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Inside the Digital Revolution

Meeting & Managing Challenges Offshore

Subsea Pipeline IMR
The Pipeline Repair Busters

Interview
Wenche Nistad, GIEK

Brownfield
Tyra Pieces Falling Into Place

VOL. 45 / NO. 5

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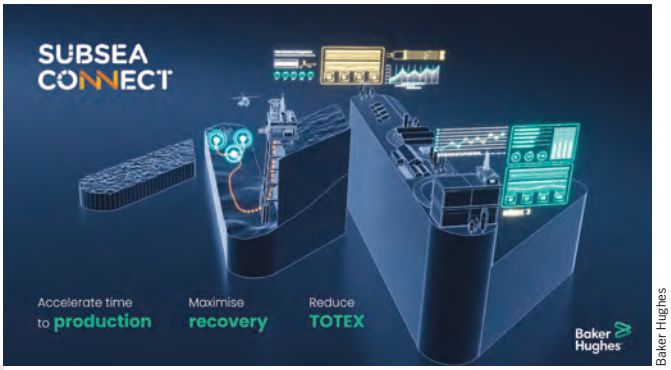
FEATURES

Pipeline Repair and Subsea Intervention (PRSI) Pool

ON THE COVER: **Image Source: ABS**

FEATURES



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BY THE NUMBERS

RIGS

Worldwide

Rig Type	Available	Contracted	Total	Utilization
Drillship	19	53	72	74%
Jackup	135	310	445	70%
Semisub	15	62	77	81%

Africa

Rig Type	Available	Contracted	Total	Utilization
Drillship	1	8	9	89%
Jackup	19	16	35	46%
Semisub		1	1	100%

Asia

Rig Type	Available	Contracted	Total	Utilization
Drillship	5	5	10	50%
Jackup	41	104	145	72%
Semisub	7	15	22	68%

Europe

Rig Type	Available	Contracted	Total	Utilization
Drillship	4	3	7	43%
Jackup	22	25	47	53%
Semisub	5	22	27	81%

Latin America & the Caribbean

Rig Type	Available	Contracted	Total	Utilization
Drillship	2	19	21	90%
Jackup	2	2	4	50%
Semisub	2	9	11	82%

Middle East

Rig Type	Available	Contracted	Total	Utilization
Jackup	24	120	144	83%
Drillship	1		1	0%

North America

Rig Type	Available	Contracted	Total	Utilization
Drillship	4	17	21	81%
Jackup	23	34	57	60%
Semisub	1	5	6	83%

Oceania

Rig Type	Available	Contracted	Total	Utilization
Drillship		1	1	100%
Jackup		2	2	100%
Semisub		5	5	100%

Russia & Caspian

Rig Type	Available	Contracted	Total	Utilization
Jackup	4	7	11	64%
Semisub		5	5	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 October 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	19	10
Shallow water	85	66	74	50	80	18
Ultra-deepwater	19	16	12	17	17	4
Grand Total	**129**	**94**	**102**	**83**	**116**	**32**

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

Offshore Undeveloped Recoverable Reserves

Water Depth	Number of fields	Recoverable reserves gas mboe	Recoverable reserves liquids mbl
Deepwater	556	41,887	21,171
Shallow water	3,214	411,902	143,638
Ultra-deepwater	327	40,995	26,705
Grand Total	**4,097**	**494,784**	**191,515**

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	Remaining reserves gas mboe	Remaining reserves liquids mbl
Africa	615	20,153	13,105
Asia	859	17,398	8,313
Europe	776	13,057	14,256
Latin America and the Caribbean	197	6,604	37,490
Middle East	124	89,552	147,745
North America	561	3,267	15,091
Oceania	87	12,001	1,502
Russia and the Caspian	58	12,502	13,969
Grand Total	**3,277**	**174,543**	**251,470**

Onstream and under development.

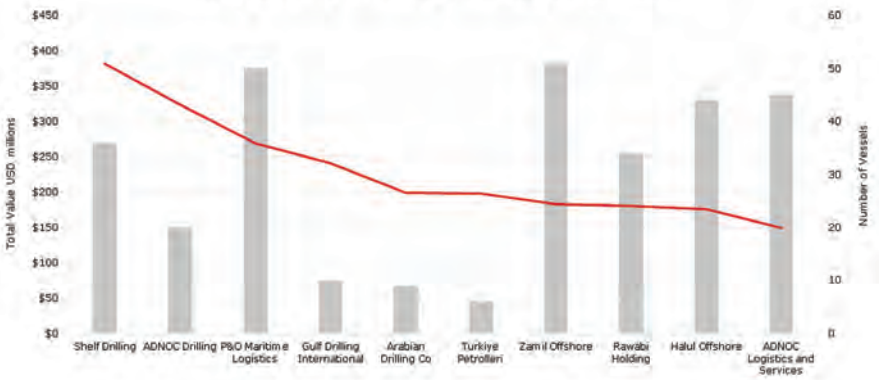
The portion of commercially recoverable 2P reserves yet to be recovered from the reservoir.

Source: Wood Mackenzie Lens Direct

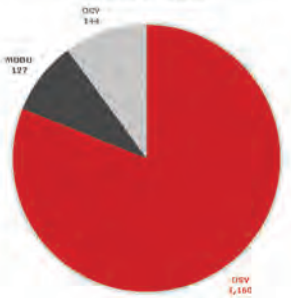
REGION IN FOCUS
MIDDLE EAST

Data & Statistics powered by VesselsValue September 2020

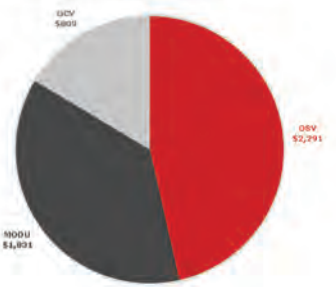
Top Middle Eastern Owner Companies



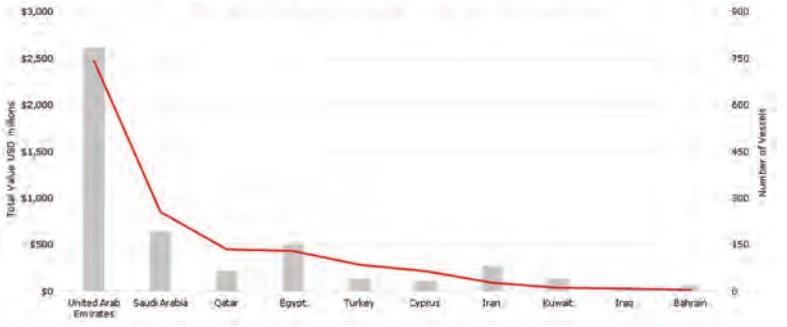
Middle Eastern Offshore Fleet
Number of Vessels



Middle Eastern Offshore Fleet
Total Value USD millions



Top Middle Eastern Owner Countries



Middle Eastern Operating Offshore Fleet Utilizations

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Mulligan


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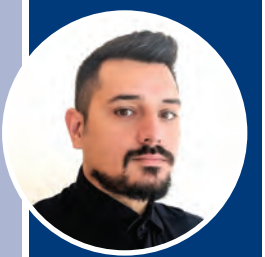
Pallanich


Paschoa


Shea


Tomic


Tremblay

GO DIGITAL ... NOW

There are, of course, no certainties in todays offshore energy world, as a good many of you reading these pages in print or online are likely emerging from, in the midst of, or heading toward a period of great uncertainty. The wrath of COVID-19 has exacerbated an already beaten down offshore oil and gas market, and while conditions in the market can pivot on a dime, (without overstating the obvious) COVID-19 will eventually pass, the world will still need energy – both traditional fossil fuel and renewable from the offshore sector – and the digitalization trend that has been creeping into various sectors of the business will come roaring through the door, full force, as companies effectively reinvent the business model of making money in the offshore energy sector.

As we enter month number eight of working remotely from our offices in New York City, the dearth of travel and meeting clients and colleagues one-on-one, face-to-face has forced us in our small corner of the energy business to improvise and amend our traditional game plan.

Prior to the March 2020 COVID-19 lockdown, I had never heard of ZOOM and when someone requested a 'video chat' I'd gracefully opt for the audio-only version unless it was a business mandate.

That, and many other 'usual ways of doing business' was flipped on its ear with COVID-19, and my work day generally consists of a minimum of four ZOOM interviews across the offshore energy, subsea, maritime, port and logistics space, interviews that have taken me into the homes and apartments, and even onboard quite a few boats of business leaders across the sector, around the world.

One such interview was with **Wenche Nistad**, CEO of the Norwegian Export Credit Guarantee Agency (GIEK) in Oslo, for a discussion on how GIEK is quickly growing it's book of business in the offshore wind sector. Nistad pulls no punches in here assessment when she says: *"The money has disappeared; nobody wants to invest in oil and gas anymore; it's all about renewable energy."* You can read the story on how GIEK is helping to facilitate the further spread of Norwegian offshore technology around the world, starting on page 16; or you can watch the full video at bit.ly/3nMlekW.

Next stop was Houston and a lengthy interview with **Alex Seinuah**, the Global Growth Initiatives Leader – Services & Offshore at Baker Hughes and the leader of Baker Hughes' Growth Initiatives Hub. The Baker Hughes name, of course, needs no introduction to this audience, but Seinuah was forthcoming on the organization's mission to develop and deliver the digital platform that will serve as the hub for energy companies to optimize offshore oil and gas field performance, cradle to grave. Seinuah and his team are leaving no stone unturned, and starting on page 20 you can read up on how Baker Hughes looks at digital, specifically for production optimization, condition monitoring, remote support, smart IMR and asset integrity, helping it to baseline assets and develop fields.

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AT THE FOREFRONT OF CHANGE: DIGITIZING RISK-BASED INTEG

By Matthew Tremblay

Industries are adapting to an increasingly digitalized landscape. The Floating Production Storage and Offloading (FPSO) industry is no different. As concerted efforts are made to improve project economics Matt Tremblay, ABS Senior Vice President, Global Offshore, discusses how digitalization can increase safety, reduce costs, and build robust technical and operational capabilities.

No one could have predicted what a challenging year 2020 would become. Offshore production activity fluctuated dramatically with changing market economics and a global pandemic, the fall out of heightened geopolitical tensions, not to mention new IMO regulations introduced at the beginning of this year.

On the horizon, however, is positive news. Markets are beginning to evolve, and an example of this is Brazil, where both Petrobras and international oil companies are again active. Increased activity is also taking place in the North Sea, and in Australia. New entrants are making strong headway in regions such as Mexico, where Petroleum Reform is opening offshore exploration and production to foreign companies.

EVOLVING FPSOS THROUGH THE INFLUENCE OF DIGITALIZATION

With these positive developments, the Floating Production Storage and Offloading (FPSO) markets and the assets themselves, continue to evolve.

With the largest fleet of classed FPSOs, ABS has supported their development in both size and complexity. At its core, an FPSO is simply a production, storage, and offloading system. While the basic design concept hasn't fundamentally changed, what is evolving are the technologies, systems, and tools available for an FPSO to optimize its design and operation.

Influencing this change are the fundamentals of how asset management can be applied to achieve leaner, cost-effective operations and reliable exploration activities. There is a primary focus on improving maintenance scheduling and performance, reducing human factor involvement, and increasing the lifetime use of the FPSO asset, safely. The importance

GRITY MANAGEMENT OF FPSOs

Source: ABS

of digitalization is increasingly becoming a priority on the boardroom agenda of many operators, particularly with industry-wide initiatives toward net-zero carbon.

MANAGING COMPLEX ASSETS

Managing the integrity of an FPSO poses a particular set of challenges, and integrity management is still often managed using outdated, labor-intensive spreadsheets or other basic systems.

However, mindsets are changing with increasing awareness on how data can be leveraged to help provide real-time answers to common maintenance, operations and performance questions.

One of the benefits of digitalization is the increase in performance and productivity that can be achieved with a minute-by-minute visibility of how an FPSO is operating. Giving an owner-operator the opportunity to clearly track the change in asset condition over time, from construction through to late-life, helps make more informed decisions, supported by more reliable data, making the industry safer.

Considering the challenges of FPSO operations, fewer, more focused inspections that reduce the need for tanks or equipment to be physically examined while maintaining safety standards, represent a compelling proposition. As does an optimized maintenance system to improve uptime and increase reliability. Combine this, and you have a simpler way to manage maintenance crews on board, optimize turnarounds, simplify logistics, streamline the POB, and improve operations. The end result leads to safer operations, a reduction in OPEX, and improved profitability.

The trick is how to avoid adding unacceptable risk. It's why ABS has moved to develop solutions using data science as the basis for an informed and targeted decision-making process, using predictive analytics to guide operational decisions. Examples include analysis of early corrosion detection and coating failures using machine learning and pattern identification intelligence, and real-time monitoring and transparency into how a vessel's operational profile and loading patterns are affecting its structural integrity, providing predictive alerts for detected anomalies to reduce the risk of unplanned downtime and improvement in maintenance strategies.

The goal in moving to a condition-based system is that you are letting the condition of the asset – such as the FPSO hull – tell you how often you need to inspect and maintain it. For example, consistent hull inspections showing no corrosion may allow you to increase your inspection interval.

It starts with collecting data that will be processed and analyzed. Most of this data is something we already have, such as the original design information, the engineering assessments and analysis, the inspection records, and survey results. Environmental data may be acquired from industry sources or measured onboard. Operational data such as loading patterns, production profiles, failure modes, maintenance data, are also available by manual intervention and measurement, or through sensor-based monitoring systems.

When you combine all this information with diagnostic and potentially prognostic models, can then detect health and performance anomalies in the form of impending failure or performance degradation at an early stage.

This provides valuable information for corrective and preventative actions by allowing both onboard and onshore management teams to observe the condition and status of their vessels' integrity. This information empowers operators to develop appropriate strategies for maintaining their assets, optimizing decision-making, and managing integrity and maintenance as efficiently as possible to avoid unexpected downtime and productivity loss in operations.

CREATING YOUR DATA ECOSYSTEM

With any offshore unit, and in any operation, there are different kinds of data generated. There is data generated from the operational side, such as oil and vibration testing. There is data generated from repairs, maintenance, warranty claims, CMMS data, as well as met-ocean conditions and environment data.

All these data configurations are very diverse and were traditionally kept in silos. Today, we're able to combine data sets from multiple sources together with technologies that help operators make better and more informed to-the-minute decisions. Combining multiple data sets generates big data analytics, which is the concept of using different data sources to create penetrating new insights.

Auditing your data and applying digital technology will automate the translation and data analysis process.

Digital solutions can then be used to visualize the status of that asset, and monitoring tools can be used to help you focus on the big picture. For example, combining data analytics with Artificial Intelligence (AI) can investigate the 'what if scenarios' and provide future insights, enabling operators to begin to answer not only what happened, but also what will happen.

BUILDING A DIGITAL ASSET FRAMEWORK

"Digital Twin" is a familiar term, but it is a term that is hard to define. For example, if you assessed 10 separate projects, each with their own Digital Twin, all 10 of them would give you a different description of what it is, what it does, and what it delivers.

This is not necessarily a bad thing, and in reality, no two projects will be the same, particularly in the design and operation of FPSOs where there are vast technical challenges that require numerous detailed process, control, safety, and flow simulations to maximize production, from subsea to offloading.

In a Digital Twin, physics-induced data are used to mirror and predict the status and life of its corresponding physical twin. This enhances the operation of an FPSO by helping to both visualize and predict the performance of that asset. As the digital twin is designed to continuously collect and process operating data from sensors and other data sources, it presents a constantly evolving picture of the FPSO's living status at all times.

While you may not need all of the potential analysis capability available today to support a new FPSO that has just been installed, it is beneficial to deliver a new FPSO with a robust condition model to allow you to begin the full lifecycle of the model alongside the physical asset. Ultimately, it allows operators to better calculate and forecast the remaining life of their asset.

Applying Digital Twin technology as part of a "Digital Asset Framework", allows for a single source of truth that can be shared with stakeholders, including owners, operators, project financiers, insurance providers, and regulators alike. Everybody can access the same reports, data, and insights in a way that makes sense through data visualization.

DIGITAL-DRIVEN BUSINESS OUTCOMES

The digital solutions applied to an FPSO impact its entire value chain, from equipment and inventory to operational efficiency, including optimization of inspections and onboard activities. Coupling these digital solutions with traditional risk-based inspection and maintenance planning techniques has shown a 10:1 return on investment opportunity over the total asset life due to optimized repair and inspection planning.

In early project CapEx planning, condition models, sensor data ingestion tools, remote inspection technology, are all aspects of what should be looked at to ensure an FPSO is future-proofed, so that in 10 years from now, an operator can apply the latest predictive analytics techniques to forecast its remaining asset life.

Where operators manage a fleet of multiple offshore units, using the right digital tools and data insight offers benchmarking that helps compare one offshore unit's performance against another in the fleet. This gives further opportunity to improve asset management activities through the efficient allocation or re-allocation of resources resulting in streamlined scheduling of fleet maintenance activities that are focused and specific.

A CONNECTED FUTURE

The transition from legacy systems to Digital Twin driven operations will be incremental, which will naturally incorporate a range of digital solutions to improve asset management and optimization.

The digital tools now entering the market allow operators to ingest, store, track, and analyze condition data in a way that was never possible before. These are technologies we are both building and implementing, focused on three primary goals; improving asset reliability, streamlining the Class process on offshore operations, and ultimately, supporting the improved profitability of the industry. Of course, this is all rooted in a framework of safety and quality spanning an end-to-end solution.

ABS has developed several innovations to support the monitoring and management of structural, machinery, and condition metrics needed for asset management and regulatory compliance.

ABS Condition Manager is just one of a suite of advanced new digital services and applications launched by ABS that offer unprecedented understanding of the status of an asset. A compartment-based, digital visualization of an asset's condition, including inspection and repair history, as well as critical area monitoring using Class and operational data, the ABS Condition Manager application is a good example of how digital technologies can empower users with insights surrounding structural health, anomaly impacts and maintenance opportunities. The ability of Condition Manager to seamlessly integrate with onboard CMMS systems can result in up to a 50% reduction in effort to prepare annual maintenance work plans.

ABS is also exploring practical applications of AI-enabled inspection capabilities in areas such as corrosion detection, machinery performance, and monitoring, through to accumulated fatigue damage on structures based on asset-specific data, and even metocean route planning.

As we continue to move deeper into a condition-based and ultimately predictive approach, we are looking towards more sophisticated AI and using additional data from onboard sensors for advanced monitoring of vessel health, from the hull structure to whole-life integrity support with 'live' operation decision support.

From the design concept, through to construction, operations, and end of life, Class is connected to the asset, and the digital tools and technology that support it are transforming the future of FPSO operations.

TRUST: THE KEYSTONE FOR DIGITAL TRANSFORMATION

By Philippe Flichy, Independent Director & Digital Transformation Advisor at Endeavor Management

The slowdown of the world economy and plummeting energy consumption have eclipsed most other industry news. Oil exporting countries are coming to terms with limiting production to sustain reasonable prices, and operators are looking for ways to improve efficiency. At the same time, the marketplace created by the pandemic is forcing companies to work differently. Telepresence and remote work have become the norm, and this directly impacts how work is organized and relationships are maintained. The new, distributed work environment requires discipline in the way teams conduct activities and demands a level of trust that surpasses anything the industry has experienced in the past.

At this inflexion point, it is important to examine the digital transformation that is guiding the evolution of the industry and better understand the critical role trust plays as companies learn to compete in a more digital world.

The first question that needs to be answered is, "What is digital transformation?" According to Microsoft CEO Satya Nadella, it is "reimagining how you bring together people, data, and processes to create value and maintain a competitive advantage in a digital-first world." Data is central to this new approach, and Nadella believes a shift in corporate culture is required to bring people, data, and processes together in a new way. The "processes" Nadella refers to are the many steps required to transform data into insights.

Oil and gas executives associate digital business transformation with operational efficiencies, cost reductions, and increased productivity. Because of the range of activities performed in an offshore environment, such improvements are only attainable via extensive use of data to perform meaningful correlations.

Operators can gather more data at higher frequency rates to rationalize activities, simplify workflows, optimize maintenance activities and improve well and reservoir management. This is possible because the cost of sensors and processing equipment going down while their capabilities are increasing.

In the trend toward broader and faster data gathering, the

Source: https://www.shutterstock.com. Philippe added the "trust stamp" on it

oil and gas industry has increased the amount of information collected and worked to make better decisions and gain insight into operations. In the current market, it is more critical than ever for companies to identify ways to economize and improve project economics. This means reassessing processes and reimagining human resource management to get the best return on investment.

First, data must be collected at a reasonable cost. This means identifying data points that can be collected reliably and consistently. Once collected, data points need to be aggregated and normalized so they can be validated. With the evolution of edge computing, data processing speed has improved exponentially. Neural Decision Processors, by Syntiant, for example, feature a processor so small that 54 chips can fit on a penny. Today, this task can be performed on site where high frequency data is available for algorithms to take advantage of the best granularity of data available. Edge processing power also makes it possible to enhance cybersecurity, leveraging machine learning to differentiate valid traffic from undesirable traffic.

Today, it is possible to temporarily store high-frequency data locally and transmit data centrally at various sample rates, depending on the level of detail required for remote analysis. High-frequency data can be used locally to perform initial validation steps while compute-intensive mining and algorithm optimization can be performed centrally. This enables companies to retain full granular data for on-demand requests and asynchronous replication by physically moving hard drives (such as Import/Export offering from Amazon Web Services) or using spare bandwidth when it is available.

The resulting improved algorithm from central processing can then be pushed back to the edge units to keep improving the data quality of the edge processing. Algorithms at the place of collection also can help correlate near-real-time data feeds to create synthetic data when a value is erroneous or missing and eliminate outliers.

An example of this approach is how offshore platforms are managing rotating equipment. Digital twins are run centrally and compared to actual measurements of the units so discrep-

ancies can be analyzed and local algorithms updated to ensure optimal performance.

Transferring data reliably and securely at the right frequency is another step in the process. The advent of "cube satellites," WiFi 6 and 5G protocol is helping lower the cost of transmission and increase available bandwidth, and more importantly for the oil and gas sector, reach remote places where telecommunication is not available.

A culture of trust must be present for these processes to be effective. Data must be normalized and accessed from various data bases, and this requires cooperation across disciplines and across companies. This means crossing the boundaries of typical departmental silos. People have to be willing to cooperate and share data and methodologies so teams can comfortably rely on data and analysis from other groups within the company.

Once data are made available to subject matter experts, they can be analyzed and correlated to be shared and transformed into actionable information or better, reliable insight. More accurate drilling data can lead to a much better completion design once reservoir and completion engineers compare notes with drillers rather than making sure their numbers look good.

For essential correlations to be discovered and valuable discernments to be extracted, data analysts and SMEs should sit together and leverage one another's expertise. In today's world of remote workers, this poses a challenge, new organizational behavior skills need to be learned.

Highly functioning teams distinguish competent companies from exceptional ones. Trust creates an atmosphere in which teams can excel and is vitally important to achieving a successful digital transformation.

Trust is based on empathy – understanding what others feel and think – which leads to kindness and respect. Trust additionally depends on clarity. A well-articulated vision and purpose help everyone on the team to align, unifying team members and improving motivation. Clear communication enables members at every level to understand how they can contribute and simplifies discussing priorities with supervisors. Trust also requires humility, the willingness to listen and recognize that someone else could have a better idea.

Groups function best when team members learn from one

another, but building trust is a challenge for today's multigenerational teams. Sharing comes naturally to Millennials and GenZ; however, older generations, for whom knowledge retention is synonymous with power, often find sharing more difficult. The first step in the process of trust-building is to establish trust at a human level. Getting to know what affects the other team members and the group dynamics creates a level of confidence that can lead to exploring options that otherwise might not have been suggested for fear of being judged. Only that level of trust can facilitate intimate sharing, with the potential to yield better results from the long hours spent digging into the data. The successful permutation of teams onshore and offshore which started in the North Sea shows how teams build trust by sharing the experience of working at a remote operation center and working on an offshore platform.

The current tumultuous times pose a challenge and an opportunity. Being forced to adopt different work conditions opens new avenues for improving productivity and the chance to elevate performance.

The coronavirus pandemic is forcing everyone to think and interact differently. The workforce is embracing tools and technologies that have been available but underutilized for at least a decade. Mastering these tools will position companies for success in the face of a resurgence of the virus or the emergence of a new global threat.

That is important because the pandemic has permanently altered the way people work. At ADIPEC 2020, the Boston Consulting Group (BCG) reported that one North Sea operation demobilized approximately 40 percent of its traditional crew from its platforms because of Covid-19. But by using wearable technology, digitized remote viewing, and remote work planning, it is possible to perform 90 percent of the plant maintenance and integrity activity that was planned.

The digital transformation that is underway will have a direct and profound impact on the way work is organized and how relationships are maintained in the future and will necessitate environments of trust in a world where telepresence and remote work are no longer anomalies but business as usual.

GIEK:

DOUBLING DOWN ON OFFSHORE WIND

Tasked to provide the financial power to help Norwegian companies export their wares to the world, **Wenche Nistad, CEO of the Norwegian Export Credit Guarantee Agency (GIEK)** pulls no punches when asked about the appetite for investment in traditional offshore oil and gas today: *"The money has disappeared; nobody wants to invest in oil and gas anymore;* ***it's all about renewable energy."*** While GIEK's guarantees to offshore wind total only about $500m today, a scant portion of its cumulative portfolio, the offshore wind portion has quadrupled in value since the end of 2019. Nistad discusses the present, and future of offshore renewable investment strategy with **Offshore Engineer**.

By Greg Trauthwein

State-owned GIEK manages an international portfolio of export-related guarantees that today totals $8.5B. Its focus has traditionally been oil and gas and shipbuilding followed by fisheries and aquaculture, it has widened its mission to include offshore wind, and more generally banks and investors participating in large international energy-infrastructure projects.

As the oil and gas downturn of 2014 has lingered beyond most every prognosticator projection, with modest climbs back above the $60 per barrel level first punctured by societal push for change and regulatory movement, then pummelled by the COVID-19 pandemic and resultant energy demand free fall, the organization has had to be nimble. To that end, GIEK has quadrupled its offshore wind portfolio to $453m since the tail end of last year, and with ample capacity and competitive rates, it is actively seeking new business worldwide as part of its mandate to bolster the participation of Norwegian exporters in a burgeoning but capital-intensive sector.

"Offshore wind is really gaining momentum and is a great example of how we can actively help Norwegian industry rechannel by opening the door to new markets for existing wind expertise and other companies looking to extend their reach into green technology," said Nistad. "(Most) offshore wind projects are huge and capital intensive."

Central to the GIEK value proposition is GIEK's core offering – AAA-rated guarantees for long-term loan financing, as well as contractual delivery guarantees that protect both buyers and suppliers in case of default. Norway can offer triple A-rated instruments, which are a key tool in reducing the cost of project financing," said Nistad. "We work together with commercial banks to share project risk, so loans will be repaid." Recent highlights including finance for contracts won by Aibel, Fred Olsen Windcarrier and Nexans Norway.

GIEK provided service delivery guarantees totaling NOK 1.3B towards the end of last year that enabled Norway's Aibel to clinch two big European contracts. In February, it stepped

in with a third guarantee package of an equal amount, this time on behalf of Fred Olsen Windcarrier for a project in Asia. Most recently it provided guarantee coverage amounting to around NOK 1.6B that helped cables specialist Nexans Norway secure a major contract with the Seagreen offshore wind farm under development off Scotland. "We have high capacity and we're ready to take on a lot more business in this sector," said Nistad. "We can provide guarantees to anyone involved in putting together a wind project, and we are very competitive compared to what is available internationally. We don't calculate an amount based on a mathematical model. The rule of thumb is basically, the more you consider buying from Norway, the more you can count on getting guarantees from GIEK," says Nistad. "And right now, offshore wind has huge potential."

While the focus was offshore wind, Nistad was quick to point out that renewable energy of every stripe has been the domain of Norwegians for many years, a culture that historically is respectful and in tune with its natural surrounds. Hydro and solar power have been staples for years, and the country has become a leader in the manufacture of advanced battery technology to power the country's burgeoning fleet of electric ferries, with the capacity to export this technology globally, too.

Artist's impression of the cable-laying vessel *Nexans Aurora* currently under construction at Norwegian yard Ulstein Verft. GIEK is helping to finance the vessel.

Source: Nexans

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WHEN IT COMES TO OFFSHORE ENERGY'S DIGITAL PATH, BAKER HUGHES TAKES IT TO THE 'NEXT LEVEL'

By Greg Trauthwein

"We are doing something amazing in Baker Hughes," said Alex Seinuah, the leader of Baker Hughes' Growth Initiatives Hub. "I call the hub a start-up business. Within the hub we look at disruptive technologies and services that we believe will deliver value to our customers. Within the hub we look at digital specifically for production optimization, condition monitoring, remote support, smart IMR and asset integrity, which helps us baseline assets and develop fields for our customers."

"Digitalization is all about leveraging digital technologies that will be an enabler and improve processes," said Seinuah. "I spent more than five years offshore, and when I was out there, you had limited connectivity. If you needed to call the beach for support, the only way to make that call was to use the phone in the company man's office; the only way to send an email was to use the company man's laptop. When you're stuck, you didn't have any way to communicate with your team on the beach for support."

Fast forward to today, and most DP rigs have good connectivity. "We can leverage that to provide remote support. We are leveraging this connectivity – WiFi, internet, satellite – to provide remote support for our assets and efforts offshore."

Baker Hughes' Subsea Connect business model looks at the offshore field holistically, designed to help accelerate time to production, maximize recovery over the life of the field and reduce their total expenditures, aiming to lower the cost of subsea projects by an average of 30%.

Subsea Connect aims to connect, horizontally and vertically, the entire subsea development process. "Within Subsea Connect we've launched engageSubsea," said Seinuah, which is a digital platform designed to provide 'unprecedented access' to real-time information on equipment status and location "This platform provides remote support and condition monitoring. At the end of the day we're leveraging all of these technologies to provide a cleaner solution for our customers."

Quantity & Quality: The Data Conundrum

Central to any digitalization initiative is, obviously, the data itself. "Data they say is the new oil, but you don't get much out of data by itself," said Seinuah. Data in and of itself has little value, a problem exacerbated by the oceans of data currently being collected and disseminated. According to Seinuah, the key is having the ability to take the data and bake it with other information to form an analysis.

"I'll take you to the top side of and FPSO and its Master Control Station (MCS)," said Seinuah. "Within that area you have a lot of information coming out – hydraulic data, electrical data, comms data – all of this is coming at you, but the question is: what are you going to do with this data?"

Within engageSubsea Seinuah said Baker Hugues have a way to connect and display the data, to run trends on the data, and ultimately to provide salient advice to the end customer on actions they can take to their financial benefit. "For example, say we've been getting this electrical signal, we've been getting it for a few weeks, and it looks like a potential problem with a pump and we need to take a look," said Seinuah. With engageSubsea Baker Hughes can help to decipher the data, leverage our condition monitoring platform and determine the kinds of information we need to be able to connect, display and run trends analyses.

While gaining actionable intelligence from data and cutting costs may seem logical enough, Seinuah noted that it's never easy as it appears, as companies in the field can be fiercely protective of their data. "On the flip side, sometimes the customer does not want to share too much data with you because of data migration issues, and because of the potential to expose production data," which ultimately could impact a

"I CALL THE BAKER HUGHES' GROWTH INITIATIVES HUB A START-UP BUSINESS. *WITHIN THE HUB WE LOOK AT DISRUPTIVE TECHNOLOGIES AND SERVICES THAT WE BELIEVE WILL DELIVER VALUE TO OUR CUSTOMERS.* ***WITHIN THE HUB WE LOOK AT DIGITAL SPECIFICALLY FOR PRODUCTION OPTIMIZATION, CONDITION MONITORING, REMOTE SUPPORT, SMART IMR AND ASSET INTEGRITY,*** *WHICH HELPS US BASELINE ASSETS AND DEVELOP FIELDS FOR OUR CUSTOMERS."*

ALEX SEINUAH
GLOBAL GROWTH INITIATIVES LEADER – SERVICES & OFFSHORE, BAKER HUGHES

Source: Baker Hughes

company's share price. "We don't need to access production data, we don't need flow rates; what we need agnostic data to, for example, see your electrical signals, your communications signals, so that we can use that to run trends and provide advice. Ultimately, it's about working with your customers to provide the right solution."

Life of Field

With the oil and gas business riding through a historic trough, oil companies of every size increasingly press to maximize the value of every field. According Seinuah, the earlier in a field's life that his Baker Hughes team can get involved is best for overall field profitability, but the Baker Hughes digitalization solution is designed to maximize efficiencies and profits no matter the stage. "You don't have to wait for a field to get old to implement a digital system."

Once a customer says it want to develop a field, Baker Hughes gets involved to gauge the scope of the field – the number of wells, the number of trees, etc. – to design and deliver a condition monitoring system, provide predictive analysis and devise a maintenance strategy early in the process. Working with the customer, Baker Hughes can help to set up a system that can, for example, project the life of equipment so that the customer can strategically plan when to replace it before it becomes obsolete. "Some are early to the game, some are late to the game, and we need to be flexible to accommodate both, whether it is a green field or a brown field," said Seinuah. As with any engineered solution, getting involved on the ground floor generally yields the best results, but the digitalization solutions proposed by Baker Hughes are not dependent on getting in at the Greenfield level. "You might have a brown field, and you want to leverage digitalization. We can do that too, but first we'll need to do a gap analysis and upgrades to get an idea of what you have and what you need."

Equipment Integrity & Flow Assurance

Ultimately, the profitability of any field is dependent on keeping equipment running, keeping product flowing in the most efficient and reasonable manner. In this regard, Baker Hughes' Integrity Management System (IMS) is geared to predictive maintenance for the field; while its flow metering is geared toward production optimization.

"In IMS platform we have Apps – hydraulic, electrical, actuator and comms apps, for example," said Seinuah. Once the effort is made to connect and display the data, "we can run trends across the entire field. With IMS we can run trends for a long period, and provide real insight, based on their real-data use model, on when an actuator, for example, should be replaced before it breaks down."

Flow measuring, on the other hand, is all about production. But it's not simply measuring real time flow, rather looking ahead and having the ability to run a 'what if' scenario to forecast production flows for the coming year(s). "This is taking it to the next level," said Seinuah.

Baker Hughes can connect its flow meter system to a reservoir model, melding data to help forecast production. In this regard it allows Baker Hughes and the customer to look at a well's current characteristics as well as its future trajectory to help advise on actions needed today to mitigate, for example, a projected sharp drop off in the reservoir in the next year.

One Size Does NOT Fit All

While Seinuah and his team are quick to discuss the merits and benefits of digitalization, he is equally swift to discuss the human element, the process to engage, discuss and discover problems and solutions with the customer, because when it comes to digitalization there is not a standard solution.

"The thing about data is you don't simply walk in and say 'I'm going to give you a digital solutions' or 'I'm going to give you the engageSubsea Platform,'" said Seinuah. The first step is a gap analysis to see the information that is being collected, to determine the information that needs to be collected, and to determine the best means to outfit the array of equipment to efficiently, accurately, gather that data. And while much of the focus traditional focuses on the equipment, he said the review is on all elements, system wide, saying it might be an issue with sensors in one case, a communications problem in another. "Sometimes when you have signals coming from the subsea equipment … you need a modem that gives us a flavor of the traffic flow, and we can analyze and tell the customer that the problem is comms, not sensors."

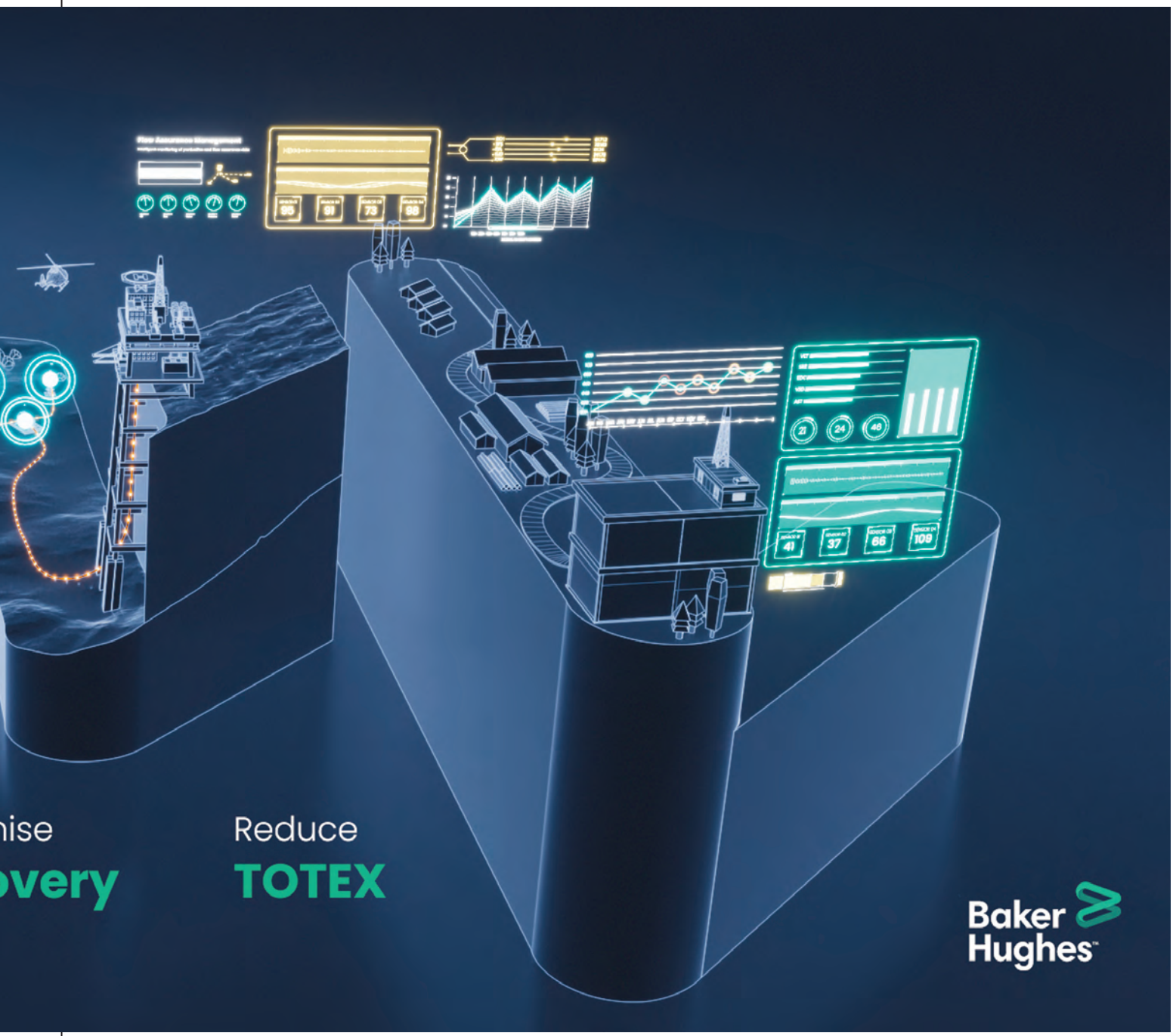
The Mantra Today: Cut Costs

It's little secret that cutting costs of offshore oil and gas production is the price of entry today for any supplier, cutting costs without sacrificing safety. Digital solutions are the key to this endeavor. "Cutting costs is a big one, and our customers are pushing us," said Seinuah. "We feel their pain, and we need to show them innovative ways to provide a service to them and meet their needs at a reasonable price."

The COVID-19 pandemic has fast-tracked multiple digitalization trends across multiple industries, and Seinuah sees this as a driver for the engageSubsea platform, which is designed to deliver the ability to tie together assets at a global level, reducing regionalized inventory holding by 50% on a typical five-well field.

In addition, it's helping to cut costly transport and personnel requirements – in some cases up to 60% – by replacing physical visits by putting 'virtual experts' on station for a fraction of the time and investment.

With a strong communication link Baker Huges can remotely 'send' an inspector out to a rig via the Engage Subsea platform, "and our Baker Hughes team can do the test for you without you moving an inch," said Seinuah, saving time, costs, and reducing the carbon footprint associated with the journey.



Source: Baker Hughes

Being ready for the worst case /

THE PIPELINE REPAIR BUSTERS

Pipeline repair isn't a frequent activity but when it is needed it's a critical activity. New tools are being developed and demonstrated to also make it safer and more efficient, and yet challenges remain, such as higher pressure, deeper water, and bi-metallic pipeline repairs. ***Elaine Maslin reports***

The world's only fully remote diverless pipeline (MIG) welding equipment spread, including the habitat, H-Frames, and remote welding tool.

Image from the Pipeline Repair and Subsea Intervention (PRSI) Pool

Pipeline repairs are not that frequent. But the consequences when they do happen can be significant. A damaged pipeline can shut in tens of millions of dollars of production – per day. Worse, it can severely weaken national energy security. When the Central Area Transmission System (CATS) pipeline in the North Sea was damaged by an anchor drag in 2007, it was responsible for the transportation of about a fifth of Britain's gas to shore.

It's a relatively infrequent issue operators have to deal with in the North Sea, despite the amount of pipeline out there: 14,000 km of pipeline connects offshore installations to beach terminals in the UK.

Alessandro Lagrotta, Senior asset integrity engineer at Intecsea, says operators have emergency pipeline repair strategies and, in the North Sea, pipeline integrity management is more about investing in avoiding rather than in a repair system, such as burying the pipeline in busy shipping areas and frequent inspection – dealing with more minor defects before bigger repairs are needed.

It's a slightly different story in the US Gulf of Mexico. There's about ~42,000 km of pipeline in the US Gulf, a region where pipeline repair is more common, largely due to the storms that rip through the area, tearing up shallow waters.

Norway's Pipeline Repair and Subsea Intervention pool

Due to the criticality of many pipeline systems, repair solutions need to be readily on hand for both regions. These solutions range from repair clamps to hugely complex diverless welding spreads. The latter has been the focus of the Norway-based Pipeline Repair and Subsea Intervention (PRSI) Pool. Formed in 1987 by Statoil and Norske Hydro, as a non-profit organization, following a request by Norwegian authorities that a repair system should be available, it's now managed by Equinor. It has 20 operator members with nearly 20,000 km of offshore pipeline. Nine of the operators do not have assets on the Norwegian Continental Shelf; their interests lay off Australia, Egypt, and Abu Dhabi.

"It's a sort of insurance policy. You don't want to spend money on these things, but the day you need it, you want it to work," says PRSI Pool Administrator Jan Olav Berge. "With the pool, we maximize experience and competence in a strong team, rather than spreading it around."

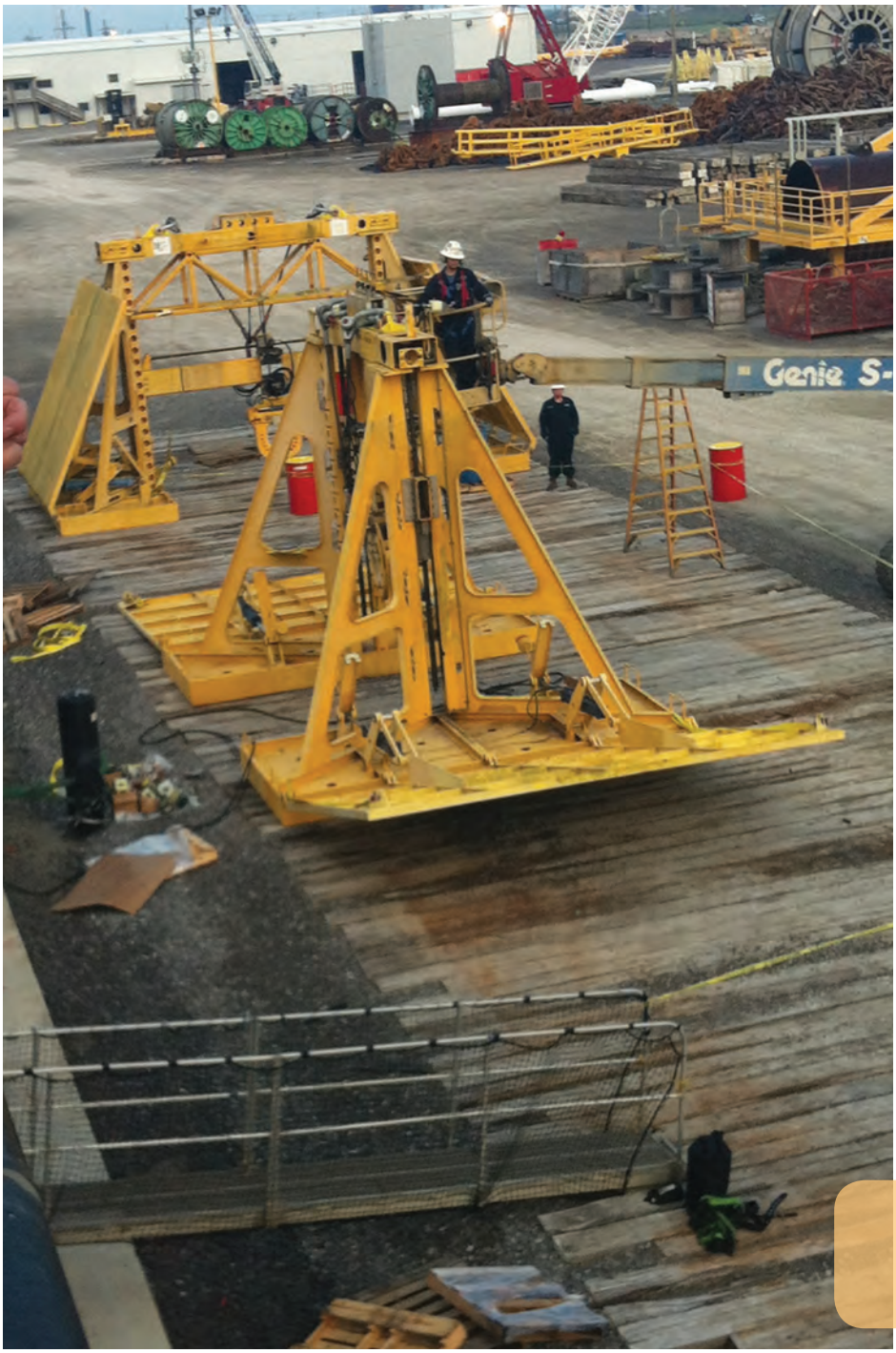
As a member of the PRSI Pool, the operators get access to what PRSI Pool Administrator Jan Olav Berge says is the world's largest spread of pipeline repair equipment, focussed on in-situ repair only (not pipelay vessel based repair, where pipeline is brought up on deck), all stored and managed at Haugesund, halfway between Stavanger and Bergen on the coast of Norway.

"It's by far the biggest pipeline repair pool in the world and it's unique as it provides both the specialized tools and specialized services to its members," says Berge. This is through

key technology providers including Sintef, Isotek, Connector Subsea Solutions, Applus RTD, and NUI, with STATS Group and TDW Offshore Services providing pipeline isolation services, and contracts and frame agreements with a Technip-DeepOcean joint venture (services) and Subsea 7 or Technip-FMC (vessel and diving services).

"It also contains some very unique equipment," says Berge. There're clamps (for small repairs), connectors, including remote installed MORGRIP connectors (10 – 30in), for replacing sections of pipe down to 1,000 meters, and hyperbaric (TIG) welding equipment contained in 100-tonne one-atmosphere habitats (for divers to work in) for 8 – 48in pipelines down to 180 m water depth (the diving limit in Norway).

There's also all the ancillary equipment needed to deploy these systems from coating and weld seam removal and cutting tools to huge hydraulic operated (with seawater and electric power from the surface) pipeline handling frames.



A pipe lifting frame at the quayside undergoing functional testing before deployment.

World's firsts in pipeline repair

Two of the latest innovations in the pool is the world's only fully remote diverless retrofit hot tap system and the pipeline (MIG) welding equipment spread. The latter was qualified in 2014 and tested down to 1,000 meters in a Norwegian fjord, after major investment to enable diverless welding – therefore allowing welded repairs in water depths deeper than 180 meters and above the pipe diameter the connectors can do (>30in). But it's only just been used for the first time, last year (2019), in a world first, on the Johan Sverdrup field for a planned tie-in of the oil export pipeline to the platform.

The system contains a complete set of tools required for a hyperbaric tie-in or repair and includes a habitat that provides a dry and inert atmosphere around the tie-in point, a gas metal arc welding (MIG) tool that includes a pre- /post-weld heat treatment system, welding consumables and a welding tip changer for long-duration welding. Pipeline joints are made through sleeve joints which are then filled in with fillet welds to make up the joints, as it was seen as

robust and easier to control than a girth weld.

"It's all remotely controlled," says Berge, thanks to a tonne of sensors and computers in the system, as well as a lot of redundancy. The technology was chosen for a 36 in pipeline tie-in at Johan Sverdrup because it was cheaper than the diver-assisted alternative, says Berge. While there were learnings and improvements found, the project went with no hiccups, he says.

Remote tap, beyond diver depth

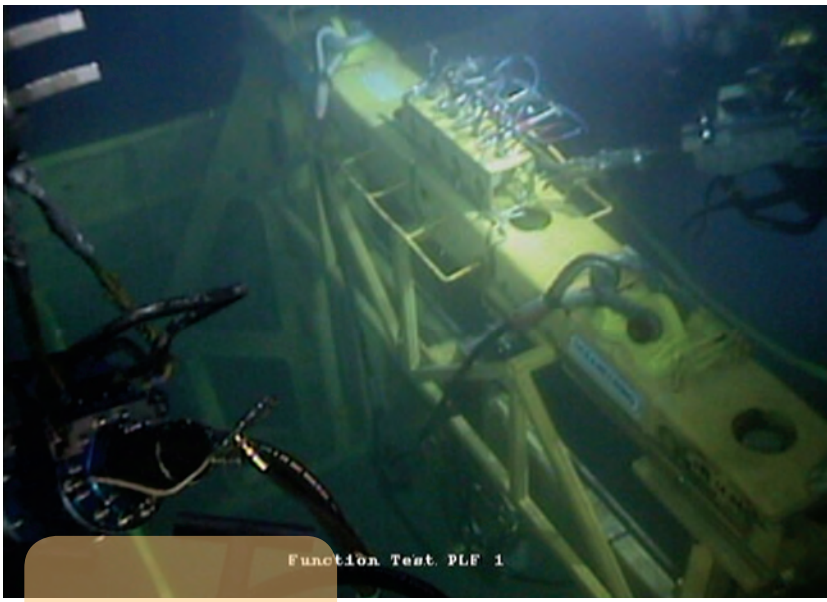
The remote hot tap system also enables subsea hot tap capability to go beyond diver depth. It was introduced and used in 2008, with installation and welding in a branch line then proven in 2012, with six hot taps now done to date, three of which were retrofit hot taps on unprepared pipelines.

In fact, much pipeline repair kit, including from system and services suppliers such as STATS Group and Oceaneering, is being used for work other than pipeline repair, notably tie-ins or pipeline rerouting. While for commercial suppliers, it's welcome revenue, for the PRSI Pool it's also to make sure the kit and those who have to deploy it in an emergency are capable.

In fact, about 80% of the pool-related activity is non-emergencies, says Berge. Using it helps reduce the overheads of keeping and maintaining it.

"The whole strategy is to use the equipment and the people and procedures in planned work because it is the best way of insurance you have an operational system ready on the day that you need it," says Berge.

There are, however, limitations to the existing system, notably water depth, but also materials. Berge says the welding process has been used at simulating pressures at 4,000 meters. The challenge is about housing it for that depth, which

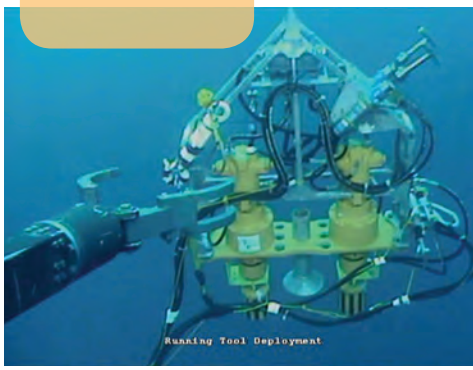


The controls at the top of the hydraulically/ ROV operated pipe lifting frame.

Image from DW RUPE

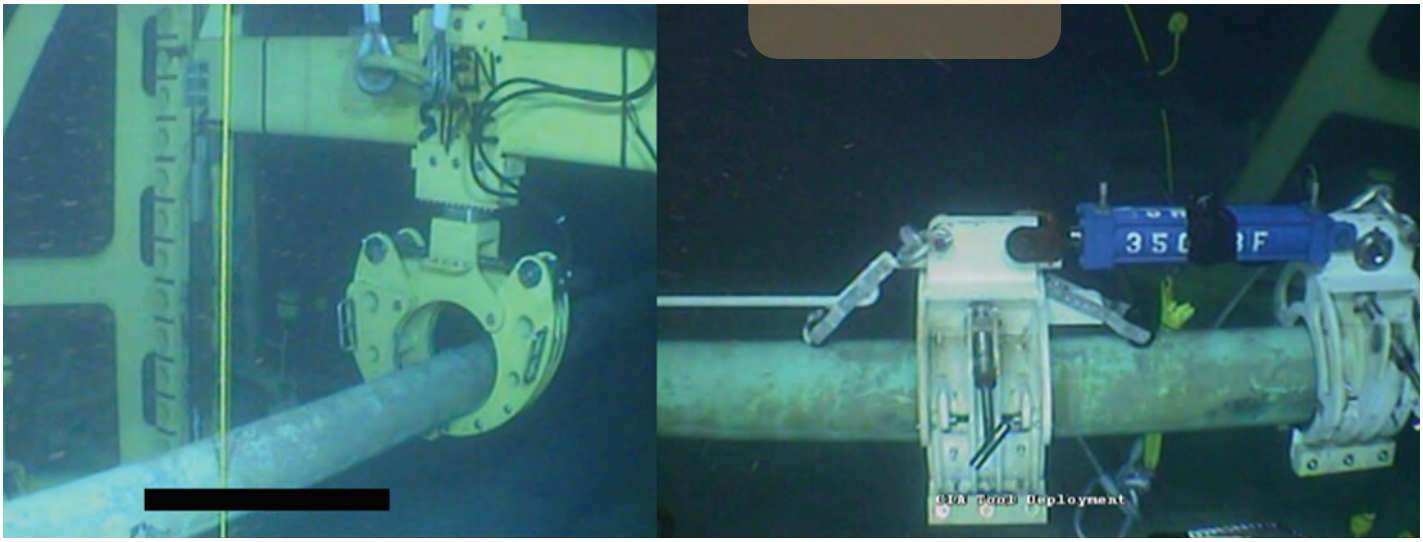
The repair clamp running tool.

Image from DW RUPE



A pipe lifting frame holding a pipeline up ready for a repair (left) and a positioning tool to enable correct positioning of the repair.

Image from DW RUPE



will cost money – and the current PRSI Pool members doesn't have a need for welding at that depth. A bigger need is dealing with bi-metallic materials, found in clad or lined pipelines.

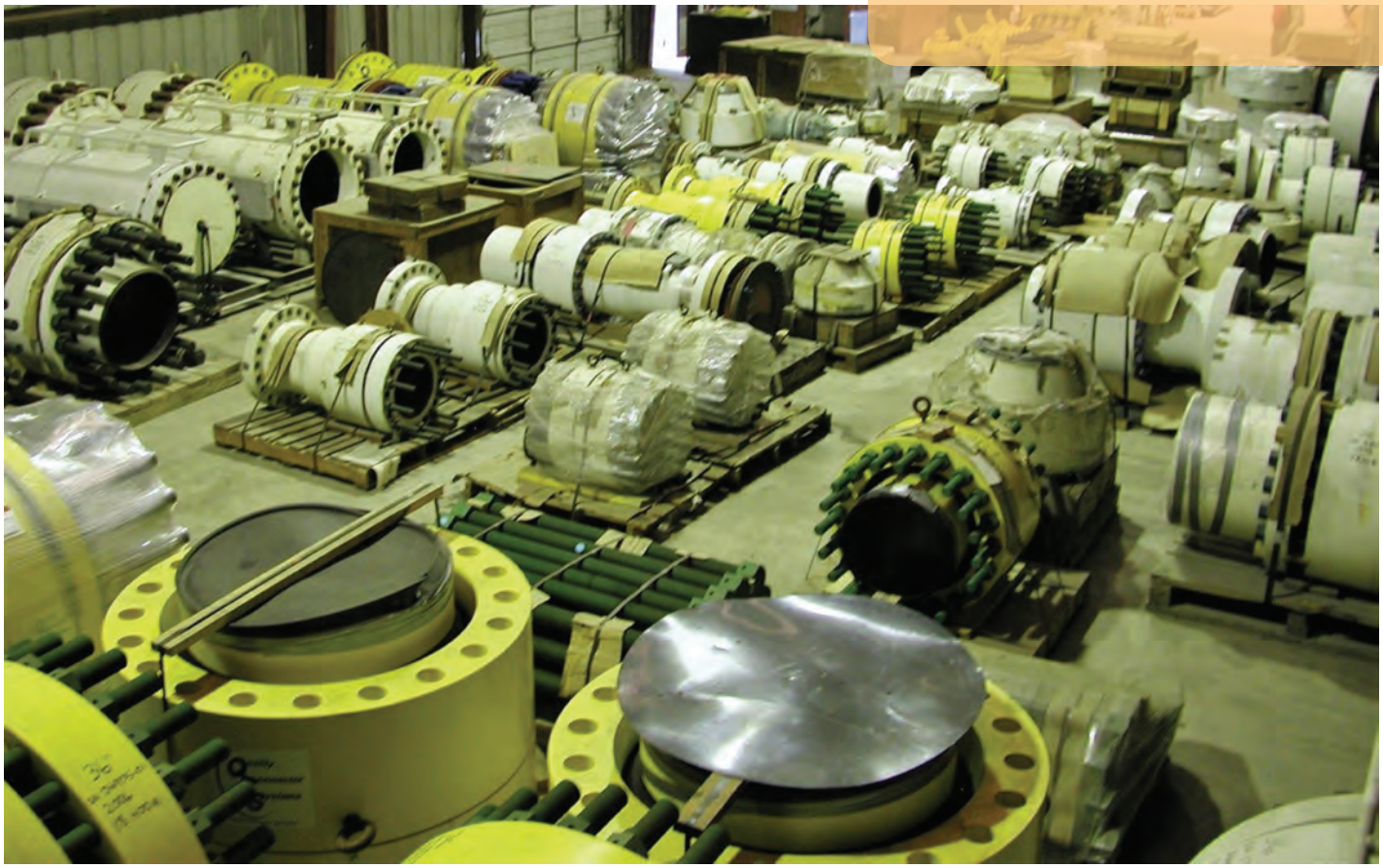
"There's no qualified system in place to repair in-situ and that's a big gap. We are to launch a project where such repairs can be done by welding in the future," says Berge.

A Response to Underwater Pipeline Emergencies

RUPE and DW RUPE are the US-based equivalents to Norway's PRS. RUPE, standing for Response to Underwater Pipeline Emergencies, has been running for 42 years providing ANSI 900 class diver assisted repair clamps and spoolpiece connector systems. DW Rupe, its deepwater equivalent, has been running for 13 years. Both are project managed by Stress Engineering Services (SES) out of Houston.

RUPE, founded in 1978, has 35 co-owners covering more than 8,570 km of 6 – 36in pipeline around the world.

It currently has 21 clamps, 44 connectors, and 45 misalignment ball flanges in stock. As an indication of tool usage within a 25 year period, RUPE has delivered 57 repair clamps, for <1m repairs, and 26 connector assemblies for pipe section replacements, including misalignment ball flanges, with the busy periods usually coinciding with hurricanes. For example, 2005 (hurricanes Katrina and Rita) saw a need for 13 tools, while



The RUPE clamp and connector tooling is stored and cared for by Stress Engineering Services.

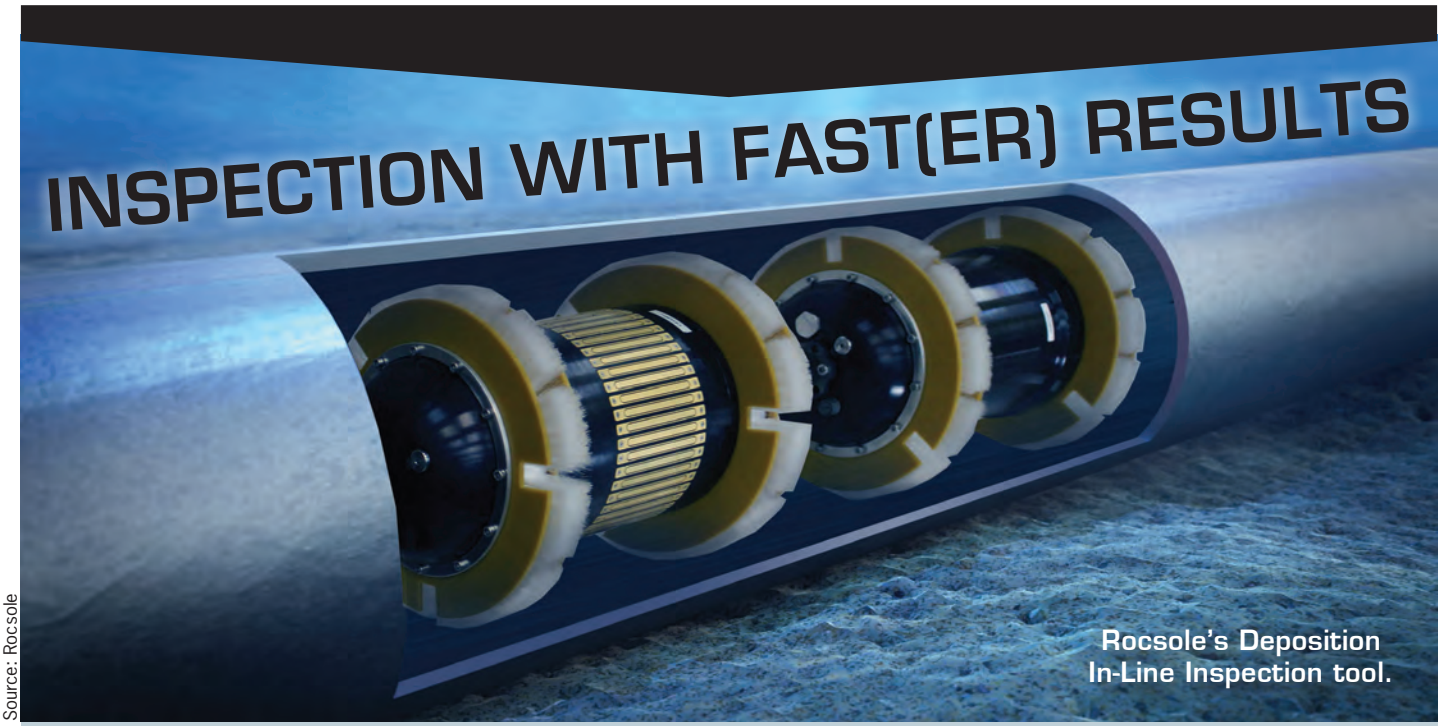
Images from RUPE

some years just two might be needed. If a tool isn't in stock with a manufacturer it can take 4 – 11 months to deliver, says Melissa Gould, RUPE Project Manager, offering a significant benefit to members wanting to get their production back online.

High consequence repairs

Deepwater repairs are less common but are high consequence, says DW RUPE Project Manager Armando Rebello. DW RUPE has four co-owners and covers 10 – 24in pipe down to 3,000 m in both Australia and the US Gulf of Mexico. Its tooling comprises of ROV assisted connectors and clamps for long and short repairs, respectively, and ancillary equipment including ROV-operated pipe lift frames (the diver assisted systems use lift bags or ship cranes instead) and pipe cutting, fusion bond epoxy, and weld seam removal as well as pipeline end preparation tools.

The largest pieces of equipment can be disassembled in order to be air freighted to anywhere in the world, in an emergency. While this can be costly – requiring use of a large Antonov freighter aircraft – it means mobilization and repair can be done far faster than by ocean freight. "The whole exercise is about logistics: having the tools ready and getting them where they're needed," says Rebello, which is why sometimes smaller lift frames can also be mobilized and don't need disassembly for transport.



Source: Rocsole

Rocsole's Deposition In-Line Inspection tool.

Finland's Rocsole is hoping to provide operators with better, faster insight into their pipelines through a new compact inline sensor and a large dose of data analytics. Its inspection tool uses electrical tomography and digital signal processing to measure conductivity and permeability values within a pipeline. These are then analyzed to determine the content – fluid and solid – of pipelines or vessels, such as separators.

The technology has had the backing of Shell, who are trialling the Deposition In-Line Inspection (DILI) in a 12 in. water pipeline in Brunei in October to detect wax deposits. Planned this December, Rocsole also has a trial set up with Equinor, to inspect the 115 km-long Oseberg pipeline 28 in. export pipeline as well as further testing in its own flow loop. **Mika Tienhaara**, the company's CEO, says that through the company's data analytics, results are also available 300x faster than available today. This can reduce maintenance requirements because an operator knows the condition inside the pipeline within minutes following an inspection, he said. Current technologies can take up to several weeks, which is unhelpful if you have a maintenance routine based on inspecting the pipeline every two weeks, he said.

If an issue is detected, machine learning algorithms are able to indicate where in the pipeline it is, the deposit size, and type. The tool is also smaller than a standard pipeline inspection gauge, reducing the risk of it getting stuck in pipelines, says Tienhaara.

To date, the company has built 10in and 26 in. units but could build up to more than 40 in. capable systems, supplied on their own or with launching and receiving equipment.

The firm, set up in 2012, also has fixed sensors for separators, looking at emulsion layers and sand build-up monitoring, commercialized last year. Tienhaara says the technology could also be modified to run on electric wireline to monitor scale build-up in production wellbores or even as a rig-mounted sensor to provide a new way of monitoring the presence of gas in drilling mud.

Targeting HPHT repairs

Luckily, it doesn't happen too often, deepwater pipelines being less prone to external damage. They've had one call out for a clamp repair in 2010 and nothing since, so focus is on ensuring the equipment is well maintained, says Rebello. SES is also looking at new technologies, specifically around repairing high-pressure high-temperature (HPHT) pipelines and the use of coiled tubing to unblock paraffin and hydrate blocked pipelines.

The RUPE and DW RUPE systems are all ANSI class 900 and 1500, respectively, and use elastomer seals. For HPHT use, SES has assessed other seal materials and came up with graphite radial seal rings that have now been tested to 22,500 psi. For unblocking deepwater pipelines, they're working on a coiled tubing-based system, using hot tap technology to access the pipe and then a special design clamp to close the hot-tap hole once the pipe has been unblocked of wax or hydrates, etc.

Internal repair options

Another research project is called Irep. It's a remote-controlled internal repair system. It's like a pipeline inspection tool that is pumped down the pipeline to where a crack or pinhole leak is (located by a magnetic sensor mounted on an ROV standing-by near the damaged area). Once in position, it releases a sleeve that is remotely activated using a ratchet design to create a seal around the full internal circumference of the pipe. Because it does the repair from the inside, the lifting tools aren't required, vastly reducing logistics and cost, says Rebello. Another future

Source: Screenshot from an iXblue, Vallourec, Forssea Robotic video

Figure 1: Illustration of subsea pipeline inspection using barcode tags integrated into a pipeline and an ROV

Three French companies are working on a pipeline inspection solution that combines ROVs and the use of visual markers - barcodes - directly integrated on subsea pipelines.

The solution, being developed by tubular solutions firm Vallourec, smart robotics and visual positioning start-up Forssea Robotic, and subsea positioning and inertial navigation firm iXblue, promises to drive down the costs of subsea pipeline inspections.

According to the companies involved, the solution would remove the need for surface vessels, traditionally used in pipeline inspection projects.

Usually, surface vessels with acoustic positioning are used to monitor the deployment of Autonomous Underwater Vehicles (AUVs) or Remotely Operated Vehicles (ROVs). The subsea vehicles then collect the required information – such as a pipeline's general aspect and route, anode consumption, free span, burial, and crossing areas – using observation sensors.

The project relies on barcodes placed on installed pipes, resulting in many passive positioning references logged with their own coordinates during the laying operation, which will remain accessible throughout the field's life.

These markers would be used as navigation support for subsea drones equipped with Forssea cameras and iXblue's inertial navigation systems that relay the pipelines' locations to the operators, thus removing the need for acoustic positioning systems and costly mother vessels.

Per the project participants, the markers are resistant to marine growth and erosion. Thus they will remain visible to divers and subsea drones throughout the project's lifespan,

"This technology had already proven itself on large structures in the field," said Jean-Guillaume Besse, Vallourec R&D project leader. "Back in January of this year, we did a first sea trial on much smaller surfaces – down to pipes of 6" in diameter – in the South of France. The tests were a success, proving that these markers, combined with iXblue's and Forssea's expertise, can be used to provide accurate subsea positioning without the need for acoustic systems."

The world's only fully remote welding tool.

Image from the Pipeline Repair and Subsea Intervention (PRSI) Pool

step for DW RUPE could be creating a strategically located global emergency response organization, suggests Rebello.

Friction stir welding

Another internal pipeline repair/refurbishment technology using a robotic crawler able to perform hydraulic friction stir welding work is being developed by a consortium led by Forth Engineering in the UK, alongside The Welding Institute, J4IC, Innvotek, and London South Bank University, with funding from Innovate UK. The crawler would need no external power or welding consumables to perform the friction stir welding which causes no sparks, internally on areas of metal loss or cracks. The robot will generate electricity from the liquid flow in the pipeline via a variable pitch turbine driving a generator, which will supply power to a hydraulic pump and a battery which drives the magnetic tracks.

Forth Engineering has successfully trialled the FSWBot hydraulic system (walking and crawling) using automated controls. Forth says it has also completed 90% of its work on the FSWBot fuselage, which is on course to be finished in October. Collaboration between Forth and LSBU on the control elements is also ongoing and due to be completed in January 2021, with FSWbot trials expected in January/early February next year.

Brownfield Development – Tyra pieces falling

Sleipnir Installing Jackets at Tyra

INTO PLACE

Source: Noreco

By Bartolomej Tomic

Tyra – Denmark's largest gas and condensate field and main gas processing hub – was, a few years ago, on the verge of being decommissioned, which would have, according to report back then, wiped thousands of jobs.

The field located 225km west of Esbjerg, consisting of two main centers Tyra East and Tyra West and five satellite platforms, had been in production since 1984, and the offshore facilities were approaching end of life, and the seabed subsidence had threatened the integrity of the sinking platforms, too.

Maersk Oil, the then operator, had spent millions of dollars reinforcing the Tyra structures over the years. However, it in January 2017, said the facilities were no longer safe for work, having sunk five meters deep over the years, and warned it would shut down the field for good on October 1, 2018, shoud no viable economic solution for the development of the field be found.

The shutdown would have meant not just the end for Tyra, but also for the satellite fields and would have discouraged future drilling attempts nearby, leaving potentially discoverable resources stranded below the seabed.

Luckily, just a few months after the shutdown warning, an agreement was reached with the Danish government, paving the way for a full redevelopment plan and life extension for the Tyra project, as well as setting the ground for future exploration nearby.

Maersk Oil operated the field at the time, on behalf the Danish Underground Consortium, with other partners being Shell, Chevron, and the state-owned Nordsøfonden.

The full redevelopment of the field was approved by the DUC partners in December 2017, calling for partial removal of old infrastructure and installation of new jackets and topsides.

More specifically, the redevelopment calls for removal and decommissioning of the prior Tyra platforms, reuse, and 10-13 meters extension of the current jackets at six platforms that will have new topsides and a totally new process platform and a new accommodation platform.

With the investment estimated at more than $3.3 billion, the Tyra redevelopment became the largest investment ever in the Danish North Sea.

So, Where are we now?

Fast forward to 2020. The DUC consortium membership has changed so much that the only company that was there in 2017 when the agreement for the redevelopment was reached is Nordsøfonden.

Maersk Oil was bought from Maersk by France's Total in a deal estimated at $7.45 billion, struck in 2017 and completed in March 2018. In September of the same year, the French oil major bought out Chevron's Danish business, increasing its operatorship in the DUC from 31.2% to 43.2%. In October 2018, Shell agreed to sell its Danish upstream business to Norwegian Energy Company (Noreco) in a deal valuing Shell's assets at around $1.9 billion.

Noreco's Chairman Riulf Rustad told Reuters at the time that the two companies had been negotiating the deal since January 2017, the month when Maersk warned about the potential shutdown.

No, Really ... Where are we now?

OK, the previous passage was still talking about a relatively distant past as compared to "now."

Now, in 2020, the Tyra site has been a busy one, and we know this thanks to Noreco, which has become an unofficial PR for the project this year, regularly sharing updates on the redevelopment milestones.

The summer saw the Dutch heavy-lifting expertise and technology – humongous vessels owned by Heerema Marine Contracts and Allseas – in action.

Heerema Marine Contractors had won the contracts for heavy-lifting work on the Tyra redevelopment with the Sleipnir semi-submersible crane vessel back in 2017, while the giant crane ship was still under construction in Singapore.

The scope awarded to HMC under two contracts included offshore lifting services in the Tyra East and West complexes related to the replacement of the wellhead and riser platform topsides, as well as the transportation and installation contract for the processing & accommodation platform.

The Sleipnir, named after Odin's eight-legged stallion as it has four vertical columns on each side of the vessel, was delivered in 2019, embarking upon a globetrotting tour, first working in the Mediterranean Sea, then in Trinidad, before arriving to the North Sea with a packed calendar.

The LNG-powered semi-submersible crane vessel, equipped with a pair of revolving cranes that can lift 20,000 tonnes in tandem, in July 2020 completed the first phase of the Tyra decommissioning when the topsides, including wellhead and riser platforms, were removed.

The second phase of the decommissioning campaign consisted of two main lifts of the two integrated accommodation

Source: Noreco

and processing platforms at Tyra East and Tyra West.

Allseas' giant catamaran Pioneering Spirit was employed for this part of the campaign, removing both topsides in single lifts.

The 14,000 tonne TEA topsides and 7,800 tonne TWA topsides were removed with the vessel's motion-compensated topsides lift system. For the smaller, lighter structures, the vessel's new aft-mounted 5000 t crane was deployed.

The two topsides will be dismantled at the recycling yard M.A.R.S. in Frederikshavn, and more than 95 percent of the old platforms are expected to be recycled.

"The recycling of old Tyra is to date the largest offshore recycling project carried out in Denmark, "Noreco said in August.

The Pioneering Spirit is not done with decom work yet, as the vessel will return to the field in 2021 and 2022, to remove the TWA jacket in 2021 and the TEA jacket in 2022.

The removed topsides will be replaced by one new processing platform and one new accommodation platform. The four wellhead platforms and two riser platforms will have their jackets extended by 10-13 meters.

The part with jackets brings us back to the eight-legged stallion, the Sleipnir, but unlike the previous trip that was all about decommissioning, this one is about installation.

Namely, the Sleipnir in September returned to the Tyra location, where it then installed two new Dragados Offshore-built jackets, which form the foundation for the new Tyra process and accommodation platforms. The two jackets were the first new jacket structures delivered and installed for the Tyra redevelopment project.

Commenting on the installation of the jackets, David B. Cook, who became CEO of Noreco in July 2020, said: "The delivery and installation of these jackets is an important achievement for the project and a true testament to our ability to consistently deliver in-line with expectations, in both a safe and predictable manner. The milestone marks a clear shift for the Tyra Redevelopment project, moving our focus onto completing the new modules. Each milestone moves us toward a state-of-the-art facility in the North Sea.

"The Tyra Redevelopment will not only improve safety and increase Noreco's production as well as operational efficiency, but also at the same time lower CO2 emissions and unit costs," Cook said.

According to info on Noreco's website, the use of new technology and modernized working processes will see Tyra's operating efficiency increase, and at the same time reduce CO2 intensity.

Total expects that the redeveloped Tyra will reduce 30% of CO2 emissions, 90% of flaring, and improve overall operational energy efficiency.

What's Next?

With the installation of new jackets, the new phase – the installation phase – started for Tyra.

The next milestones are for the new topside modules currently being built to be delivered from the yards and transported to the Danish Continental Shelf for installation.

The wellhead and riser modules are currently being built in Singapore, the accommodation module in Italy and the processing module in Indonesia.

The topsides are expected to sail away in 2021 and are slated for the installation at the Tyra in the same year, ahead of the first gas in 2022. Once online, the redeveloped Tyra will produce enough gas to power 1.5 million homes in Denmark, with production at peak expected at 60000 boepd.

Mitigating Heat & Vibration in the Engine Room

By Greg Trauthwein

While the size, shape and purpose of maritime vessels varies widely, a common concern for every shipowner is ensuring the long-life, efficient and safe operation of a vessel's biggest capital expenditure: the propulsion machinery. Heat and vibration are the two main culprits in cutting machinery life short and raising maintenance cost. **Offshore Engineer** *was in Mannheim, Germany late last year to visit Thermamax, a specialist in the design and manufacture of thermal and acoustic insulation solutions for diesel engines, spark ignited engines, exhaust aftertreatment systems and electric storage systems.*

According to Steffen Cronauer, an 18-year Thermamax veteran, the axiom that 'you get what you pay for' is particularly true in machinery insulation: "In some parts of the world, insulation mattings are used, and while they are cheaper from the beginning and can pass tests on the bench, they are not as effective in the long haul."

Thermal and acoustic insulation is the business of tmax Holding GmbH, a holding of six companies in Europe, USA and China with headquarters in Mannheim / Germany. of about 500 people working to provide engineered solutions to the automotive, on- and off-highway sectors, power sports vehicles, stationary power generation, ships, and oil platforms, both on land and at sea. For the marine industry, Thermamax is a solution provider for SOLAS-compliant insulation solutions for engine rooms. The company engineers and supplies insulation claddings for most of the leading engine and turbocharger OEMs. In addition, Thermamax is able to design, manufacture and install SOLAS-compliant retrofitting insulations also for engines that are already in service for a longer period of time and that eventually do not meet latest safety standards.

Something Old, Something New …

According to Cronauer, the number one driver for Thermamax products in the maritime and offshore sectors is safety, and in fact it was the Deepwater Horizon accident that served as an inflection point with potential customers understanding that "sheet metal insulation cladding is the better product when it comes to safety onboard, whether it is a rig or a propulsion engine for a vessel."

According to IMO SOLAS the surface temperature of modern marine engines must not exceed 220°C. In addition, engine builders are striving for better fuel efficiency, mainly by increasing the engine`s power density what typically leads to higher exhaust gas temperatures. Due to higher charge air pressures even the area of the compressor outlet of the turbocharger becomes a concern in terms of surface temperatures.

Consequently, every new engine has to be equipped with a highly efficient insulation system. "We also have to look at and consider the aftertreatment devices, as large SCR systems become more common on ships," he said. "For example the aftertreamtment system is almost as big as the engine itself. They too are hot, they too must meet SOLAS requirements."

While new engines are a central focus, the larger market opportunity comes in the retrofit sector, as there are many engines 20 years or older that could utilize an insulation retrofit, which spurred Thermamax to develop its Tmax-Retrofit. (See related story on page 38)

Thermamax Engineered Solutions

While many may not put, insulation' in the category of engineered solution, a stroll through the modern manufacting complex of Thermamax dispels that notion. It starts with the realization that the plant workers go about their business without masks, courtesy of a state-of-the-art air quality vaccum system which was installed and monitored regularly (Note: this visit was conducted pre-COVID-19).

There are many key factors to producing the bespoke engineered insulation solutions – from the latest laser cutting

Source: Thermamax

equipment to metal handling/bending machines, and, of course, the quality of the insulation materials themselves.

"The most important aspect is the grade of the material," said Cronauer. "You can buy a 20 mm material for 10 Euros or for 7 Euros, but the fact is, this highest technical requirement for our material is not temperature, it's vibration. Even the cheap stuff that you can use for the roof of your house can give you high temperature protection, but it's the vibration that is a killer with a very bad influence on the lifetime of the insulation and the machinery."

In this regard, for the marine sector Thermamax uses stainless steel and a stitched and woven insulation fabric that is designed to better withstand the pressures of heat, vibration and time.

Over the years Thermamax has continued to invest in new machinery, for example laser cutting machines that today are five times more efficient than machines were 20 years ago, but at the same price point. And the advent of CFD simulation has allowed it to ensure that not only are its insulation solutions optimized for heat and vibration characteristics, but that they are engineered for ease of assembly and maintenance by unskilled workers; to maximize material use, „so maybe we don't neet 2 mm thickness, maybe 1 mm is enough. And do we need 215 screws, or maybe only 120?"

Thermamax continually invests in R&D to test new materials, but to date stainless steel and fiber materials are still the go-to. "There is some movement (at the R&D departments that manufacture insulation material), but there hasn't been a real breakthrough. For example, a cladding design without dependent on the price of oil and their willingness to invest."

THE TMAX-RETROFIT

In the engine room temperatures are highest and reliable fire prevention is vital. As 3D details are often not available for older engines, retrofitting with SOLAS-compliant high-performance insulation systems has only been possible to a limited extent until now.

With Tmax-Retrofit, older marine engines can now also be upgraded with high-temperature insulation systems which exceed SOLAS guidelines. The all-in-one package provides all services – from the preparation of the engine's 3D profile to the thermography of the developed and installed insulation system – all from one source. "We see retrofit opportunities, as there are many old ships with old engines with old insulation systems which are rotten and do not have any fire protection properties anymore," said Steffen Cronauer.

He noted that many engine manufacturers – Thermamax's main customers – are not inspired to release a retrofit system for an engine released 25 years or older, and the decision to retrofit an insulation system requires conversation between the ship owner and the engine makers. "This is the biggest opportunity for us in the maritime sector. The offshore sector is interesting, too,

1. A 3D-Scan of the engine to ensure the best fit of the exhaust gas and turbocharger cladding. Results of the scan are used as the basis for preparing digital 3D models.

***2. Reverse Engineering:** Based on the scanned 3D profile, Thermamax develops a CAD model of the engine. For this it first generates a polygon network in STL format from the available data. This is converted into standard geometries and free-form surfaces. From these attributed surface models and own on-site photos, we can then create a CAD model in the STEP or IGES format.*

***3. Design and Simulation:** Now starts the classic design process. On the basis of a 0D/1D thermal calculation Thermamax defines material and thickness of the insulation. The detailled constrution is made in Creo, a specialized software. The result is a durable exhaust gas/turbocharger cladding which reliably lowers the maximum surface temperature below 220 °C and even below 100 °C, depending on requirements.*

***4. Manufacture:** First, Thermamax produces a prototype. Which will be test-installed on a mock-up in order to guaranty best fit later on the engine.*

The individual Tmax-Insulation Cladding is now ready to use and can be installed.

***5. Installation:** Thermamax installs the exhaust gas/turbocharger cladding – first the prototype – on your engine.*

***6. Thermography:** To ensure that the new insulation system performs as required, Thermamax performs a thermography test.*

Tmax offers

1. a SOLAS-check in order to provide a profound assessment to the vessel responsible. Regardless of whether the customer buys the insulation, if necessary, at Thermamax or renews it on his own;

2. For Tmax-Insulation cladding, the company offers a regular maintenance service during which the insulation is checked against SOLAS requirements and takes care of the production and replacement of the installation if hotspots are detected.

any fibre material. From a physics perspecitve, it is possible and it works perfectly on the test bench but the question is ... who will be the pioneer for this new design?"

But manufacturing in the marine sector is a low-volume affair for all, and Cronauer stress the importance of a skilled workforce to deliver consistent quality.

"Blue-collar workers in Germany go through an apprenticeship program that is three years long, certificate-based and teaches them how to work skillfully with metal (and other materials)."

As the maritime market moves increasingly to news fuels, hybrids and batteries, Thermamax evolves too, engineering unique solutions to address the need to manage heat and vibration. Recently Thermamax developed housings for battery modules to support electrification, beside others, for marine application. Also, on board ships electrification is becoming more and more important. Thermamax battery housings can be used for on-board energy storage systems,. Thermamax battery housings ensure effective fire protection and extend the battery range by balanced thermal management. But in regard to market guidance, Cronauer it was still too soon to tell how fast and how far these newer applications would move.

At the end of the day, the company is able to lean on the multiple markets it serves. "From the automotive side you can learn a lot of cost-efficiency, cost-engineering, secure processing," said Cronauer. "From marine we learned a lot about combining multiple materials into a single function. This is a key factor in making Thermamax a leader in providing complex solutions."

Old worn out cladding **New Tmax-Cladding**

Source: Thermamax

Seabed Drilling

Source: Acteon

South America contains some of the largest deepwater oil reserves in the world, with Brazil alone possessing over an estimated 30 billion barrel of oil equivalent (BOE). In Guyana, ExxonMobil has recently made its 18th deepwater discovery, which adds to the already estimated eight billion BOE on the Stabroek Block. These relatively remote discoveries are largely greenfields where few geotechnical data exist. To develop the infrastructure necessary to extract hydrocarbons, an in-depth understanding of the seafloor soil properties that will interact with structures is needed.

In 2019 Benthic, an Acteon company, opened its Rio de Janeiro office staffed with experienced local personnel as a deepwater geotechnical specialist contractor in the region was required. More recently, in partnership with the Federal University of Rio de Janeiro, Benthic has developed its geotechnical laboratory for standard and advanced soil testing, reporting, and geoscience research. In Brazil, Benthic is the only geotechnical survey contractor capable of conducting deepwater site investigations in up to 3,500m of water and conducting onshore laboratory testing and reporting in-country.

From the inception of Benthic's Portable Remotely Operated Drill (PROD), innovation, research and development, and continuous improvement have comprised the foundations Benthic has been firmly grounded upon.

PROD's technological advancements, engineered in a package that is portable and self-contained, represent a step-change in how offshore site investigations are conducted when compared to drillships, the historic system of choice used globally

for decades to collect samples and data offshore. Fundamentally, drillship technology has not evolved during this period as water depths of new discoveries have steadily increased. While other seabed-based drilling systems have entered the market, none have matched the widespread success that PROD has achieved.

Since 2017 Benthic has successfully executed four projects in Brazil and three projects in Guyana at future FPSO developments in water depths up to 3,100m.

A 2011 paper co-authored by Statoil (now Equinor) revealed that seabed drilling technology (PROD) is 3-5 times faster than drillships at a water depth of 1,300m with soft soil conditions. Furthermore, as water depths increase beyond 1,300m up to 3,000m, the productivity is up to seven times faster than a drillship, resulting in materials saving to the client, through fewer days in the field, and less exposure to the crew onboard.

Once on the seabed, the tool is powered and controlled by an umbilical cable from a support vessel, so it is decoupled from metocean conditions.

Thus, minimal unwanted energy is imparted at the seabed, delivering higher-quality samples and data than ship-mounted systems relying on heave compensation. Benthic's Hydraulically Tethered Piston Corer (HTPC) exploits ambient hydrostatic pressures to deliver optimal sample quality and maximize recovery.

Independent testing has demonstrated that PROD recovers quality samples of sensitive sediments from the mudline, with minimal fabric disturbance as required. These samples, complemented with cone penetrometer testing (CPT) data, allows the engineer to optimize the design of bottom-founded structures, which often reduces fabrication and installation costs.

The technology is inherently safe by design, and this is why clients often specify and prefer seabed drilling technology for their deepwater programs. Deployed on an umbilical and controlled remotely by computer, offshore personnel interaction with equipment and tooling is minimized.

As a result, PROD has achieved an outstanding safety record with no lost time incidents (LTI) in over 1.5 million manhours worked. Also, the device has a lower environmental impact than traditional geotechnical drilling methods because of the usage of biodegradable hydraulic and environmentally considerate drilling fluids.

While still maintaining focus on deepwater projects, Benthic is also taking the necessary strides to expand capabilities in shallow water, focusing on the growing offshore renewables market, where PROD has not yet garnered considerable attention.

Although some may consider PROD a deepwater tool, about 25% of the projects completed have been in shallow water, in water depths less than 100m. Benthic's new 4,000m depth-rate PROD system is currently under construction and expected to be delivered and in operation early 2021. It expects to produce a drilling system that is at least equally competitive with drillships in shallow water environments where geologies are commonly more complex and difficult to drill.

The innovative TRAC PROD system, designed specifically to address difficult to access nearshore areas, worked successfully for multiple clients in nearshore Mozambique two years ago. Benthic's engineering team integrated tracks commonly found on subsea trenchers with PROD for this bespoke solution. After being deployed, TRAC PROD tracks up to 2,000m away from the vessel and operates submerged in water or open air, conducting operations in areas not feasible by other geotechnical contractors.

CLOUD COMPUTING – *The Next Big Bang for Seismic*

By Bill Shea, CEO, Sharp Reflections

It is premature to analyze or try to predict what the final impact of Covid-19 will be on the wider seismic ecosystem at this early point in the crisis. However, we can make some educated guesses. Ongoing projects that are generating new data will continue, unless pre-commitments are cancelled. Some new projects that are "ready to sail", such as PGS' new Geostreamer X multi-azimuth marine seismic survey in the North Sea, will also go forward. Most upcoming projects still in the planning stage will be postponed or otherwise delayed. This is the result of a natural reigning in of spend that happens when shock waves hit the sector.

Disruption a driver for change

The seismic sector was poised for some change ahead of Covid-19, with seismic vendors announcing plans to migrate a percentage of their data processing to the cloud in 2020. This was the start of a new but incremental approach, which would take years to drive real change in terms of how seismic data is processed and delivered to oil companies.

Covid-19 has already disrupted normal workflows and processes. With companies across the globe embracing remote working out of necessity, it is clear that we are not going back to how things were before. Covid-19 has created a vacuum, creating opportunities for new processes and technologies to show their value. Disruption can be an impetus for change, and a natural result is that the seismic sector will use this time to restructure and evaluate to ensure its long-term survival.

Future proofing the seismic market

The oil and gas sector is often slow to adopt new habits. Remote access to technical computing is a relatively new trend. After Covid-19, the transition will have to happen quicker. Today, seismic delivery is a slow approach requiring the vendors to transmit large data files to oil companies, which in turn need to be manually uploaded to the company's expensive inhouse data storage infrastructure. For pre-stack data sets, this is still done using physical media. It can still take weeks (or months) for a new order to reach the interpreters workstation – delaying the analysis work.

Huge public clouds, such as Amazon Web Services and Microsoft Azure, will almost certainly disrupt seismic delivery. New field data will go directly to cloud computers for processing, allowing large-scale data projects to be shared instantly from vendor to company, effectively jump starting the interpretation program. Provided data analysis also transitions to cloud-based software, real advantages exist for the seismic customer. This requires widescale adoption of cloud technology by both oil companies and vendors.

Why is cloud the likely trend of Covid-19?

Covid-19 has resulted in companies across all sectors and countries taking stock of current processes, with most forced to quickly implement new ones to keep their business afloat. Issues, such as computing system capabilities and the security of online conferencing platforms, widely became shared concerns at the start of lockdown, with IT departments put on the backfoot. This created a vacuum needing to be filled. New technologies entered common parlance and became the overnight solution to many companies' remote working needs.

Investing in more flexible and elastic computing infrastructure no longer seems like something that can wait until current systems are obsolete. This is likely to result in faster adoption of cloud computing following Covid-19, and there are a number of drivers which will help this:

Increasingly complex algorithms and higher volumes of data

The volume of seismic data available is growing exponentially, and there are increasingly complex imaging algorithms, such as Reverse-Time Migration (RTM) and Full-Waveform Inversion (FWI), to cope with these bigger data loads. The seismic vendors are improving their offering to oil companies. However, these algorithms require high-scale computing infrastructure by the oil companies to work at their most efficient level.

With the current situation putting pressure on oil companies to reduce spending, new seismic purchases or full-scale reprocessing projects are likely to be cut for the short-term. However, E&P companies still need to honor license commitments and progress seismic work programs during the

downturn. This makes pre-stack data conditioning and interpretation, to extract fresh insights from existing data libraries, a low-cost workstream. The value is especially high for multi-client datasets, which are not always processed to the standard required for quantitative interpretation. Cloud computing allows for larger pre-stack data sets to be processed in a shorter space of time compared to normal computer infrastructure.

The use of pre-stack data allows users to leverage 100% of their existing seismic data library. By undertaking in-house reprocessing and seismic inversion on existing data via the cloud, operators can mature prospects and optimize drilling locations during a downturn. This activity could be looked on favorably by governments as a low-cost, efficient workstream.

Remote working

Covid-19 has shown companies that having a remote workforce is possible. Public clouds offer a new way to work. Transitioning to cloud-based computers, will remove a degree of business uncertainty. It will guarantee companies, and their respective boards and investors, that the systems they have in place can support an army of remote workers should another large-scale incident occur in the future. This level of insurance will mean companies are more likely to adopt the cloud transition with a big bang, rather than via a slow evolutionary process.

Often, the attitude was that one would learn new skills when they had the time to do it. Coronavirus has presented the sector with that time to drive big changes forward now.

Cost savings

Existing computing infrastructures are a sunk cost for oil companies. Maintaining existing computer systems requires budget every year and, at some point, oil companies will also need to invest in high-performance computer software to improve efficiency. If the new system is not embraced in one go, companies will be forced to support two systems – the new one and the legacy one. This will drive up costs. Further to this, regardless of when the new system is implemented, staff will require training, and the expense of installing new processes will need to be made. While there is an appetite for embracing new technologies now, companies would do well to make use of this.

New architectures, new technologies

Embracing cloud can further facilitate growth and other innovations, such as machine learning and artificial intelligence, to become embedded within the company. Expanding elastic computing infrastructure and the cloud, allows companies to explore the potential that newer innovations can have and ensures the company is set up for when these technologies become the norm.

Legacy applications that are retained will need to be rewritten from scratch to take advantage of client-server computing capabilities. This will create opportunities for new entrants in the geoscience computing market.

Collaboration

Regardless of whether staff are working from home or the office, collaboration with partners and external third parties is a requirement of the seismic sector. When data is stored on a public cloud, data can be shared quickly and easily among partners with equal access possible for all involved in the project.

With data security an executive-level concern, companies need to know that, when employees are working on a project with a partner, the system is secure. The cloud is a natural collaboration tool and easily facilitates the safe and secure sharing of data by allowing the analysis of data to be undertaken where the data is stored.

The current climate

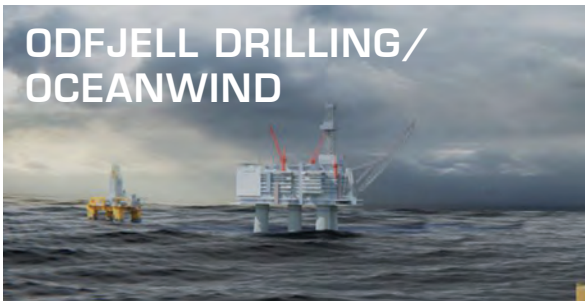
As we are entering the next phase of Covid-19, it is helpful to look at what has happened in the seismic sector. While there have been casualties of the crisis, not all projects have been shut down. Some, more innovative oil companies, are still pursuing transformation initiatives with cloud vendors. Employees across the board are open to exploring new work methods and technologies, and are keen to learn. With Rystad Energy stating there has been 'a clear growth in cost-saving remote work technologies' during this time. This is the natural reaction to a sector that has already acted fast to embrace webinars and other online learning platforms to replace the traditional conference circuit, for now.

The Rystad Energy report provided further hope that this time is one of re-evaluating priorities, stating that:

"Given the limited options of low-hanging cost savings in the current downturn, operators and suppliers are looking towards digital technologies to realize cost efficiencies."

However, with the above opportunities to a develop a more agile and modern sector, there comes with them a humbling thought. This is not a temporary blip and it will last, at least, until there is a vaccine. What can be done is to implement clever changes into business models now, so that they are setup to cope with challenges such as this one, and others, into the future.

It will take 1-2 years to know fully the extent of Covid-19, but one thing is certain. Those companies that acted fast to adapt to the changing landscape will be better equipped to thrive over the years to come.



WARTSILA
HY UPGRADE

The Wärtsilä hybrid system is designed and integrated to optimize the overall operation of the vessel. The system ensures fuel savings and reduced maintenance costs, in addition to substantial reductions in emissions.

At the center of this is the Wartsila Energy Management System (EMS). This controls the energy flows between the different power sources and connects to the onboard navigation system, enabling an entirely new level of onboard interaction.

By increasing the power redundancy, the system allows the engine to operate closer to its optimum design point where it has the highest efficiency and least emissions. The solution reduces operating costs, optimizes energy efficiency, and increases safety while meeting stringent environmental regulations.

To save space, the hybrid solution can be retrofitted to vessels either above or below deck.

MAERSK SUPPLY SERVICE/ORSTED POWER BUOYS
COLD-IRONING @ SEA

Danish offshore vessel firm Maersk Supply Service and its compatriot offshore wind developer Ørsted, are testing an innovative charging buoy that can bring green electricity to offshore wind farm service vessels and potentially to a wide range of maritime vessels.

The buoy could be used to charge the smaller battery- or hybrid-electrical vessels and to supply power to larger vessels, enabling them to turn off their engines when laying idle. By substituting fossil-based fuels with green electricity, virtually all emissions would be eliminated while the buoy is in use.

The prototype buoy has been developed by Maersk Supply Service while Ørsted is responsible for the buoy's integration with the electrical grid at the offshore wind farm. The charging buoy will be tested in the second half of 2021, where it will supply overnight power to one of Ørsted's service vessels.

Ørsted plans to make any intellectual property generated in designing the integration of the buoy into the offshore wind asset publicly available to maximize the uptake potential of this carbon reduction innovation across the offshore wind sector.

SAFT
PLUG-AND-PLAY NICKEL BATTERY UPGRADE

Battery company Saft has launched a new range of nickel batteries so that offshore operators can cut maintenance. The Compact range is designed as a drop-in replacement for existing lead-acid backup batteries. Unlike other nickel batteries, they have the same charging arrangements and fit easily inside the same footprint as lead-acid batteries.

Offshore operators will benefit from the nickel batteries' 20-year life and zero maintenance requirements. This compares with lead-acid's life of seven years with regular testing. The batteries are designed for essential control systems and other critical equipment in remote and hard-to-access installations.

PARAT HALVORSEN

Source: Marintek/ABB

ODFJELL DRILLING/ OCEANWIND

ZERO-EMISSION OFFSHORE DRILLING POWERED BY FLOATING WIND TURBINES?

Norwegian offshore drilling contractor Odfjell Drilling has invested in Oceanwind, a developer of harsh environment floating wind turbines, which is planned to enable zero-emission offshore drilling. "Developing solutions to connect our rigs to offshore wind installations is one possible road to zero emission drilling. With ownership in Oceanwind, we are well-positioned to make it a reality," says Per Lund, EVP Technology & Sustainability of Odfjell Drilling.

PARAT HALVORSEN

FLEXIBLE POWER

A new multi-fuel Combined Steam Boiler from Norwegian supplier PARAT Halvorsen adds Shore Power to power source optimization options to maximize flexibility for seagoing and offshore assets. The compact unit's flexible configuration can also cut emissions, provide additional electrical back-up during vessel operation, and enable vessels to use more sustainable and emission-free shore power where it is available in port. The MCS boiler, with smoke tubes, is available in vertical or horizontal configurations, in 400V, 440V or 690V versions. Operators of existing vessels with combined boilers systems can also upgrade to the PARAT ECS Electrical Circulation Steam boiler.

ABB

POWERING THE LARGEST DIAMOND MINING SHIP

The power system package on board the world's largest diamond recovery vessel includes ABB's solution for operational continuity for specialised offshore ships. The new vessel is due delivery in 2022 to De Beers venture Demarine Namibia from Romania's Damen Shipyards Mangalia.

In addition to power generation, distribution and variable speed drive propulsion systems, ABB's solution includes a large online double-conversion marine uninterruptible power supply (MUPS) to support vital control processes, cutting the risk of critical power loss and downtime. ABB's MUPS ensures power backup for the of the subsea-crawler and processing plant.

FLASC

NON BATTERY BASED ENERGY STORAGE

Start-up FLASC B.V. is pioneering the development of non-battery based energy storage solutions for the offshore sector. FLASC's patented Hydro-Pneumatic Energy Storage (HPES) concept combines pressurised seawater with compressed air to create an efficient, large-scale energy storage device that can be applied across a wide range of offshore applications. The company has recently teamed up with Subsea 7 to bring the tech further, targeting a number of use-cases: from conventional grid-connected wind farm applications to decarbonisation initiatives in the offshore oil and gas sector.


Walker


Nipper


Jackson


Borg


Whalen


Gould


Agnevall


Maris


Huntsman


Kavafyan


Durrant


Cook


Oytan


Gillespie


Kent


Gumbs


Cooke


Pieton

Lundin Energy, a Swedish energy company with offshore oil and gas operations in Norway, appointed **Nick Walker** as President and CEO, effective on January 1, 2021, following **Alex Schneiter's** decision to step down.

Ørsted elected **Mads Nipper** as its new CEO, effective January 1, 2020. He takes over from **Henrik Poulsen**, who recently announced the decision to step down. Nipper joins from his position as CEO and President of Grundfos.

Offshore drilling contractor Seadrill appointed **Stuart Jackson** as its new CEO, replacing **Anton Dibowitz**. Jackson previously served as the CFO of the company, having joined in July 2019.

Swedish power company Vattenfall named **Anna Borg** as its new President and CEO after Magnus Hall in July said he would leave the company. Borg has served as the offshore wind developer's CFO since 2017.

Wärtsilä appointed **Håkan Agnevall** as its next president and CEO. Agnevall, who currently president of Volvo's bus division, will start in his role no later than in April 2021, succeeding **Jaakko Eskola**, who will continue with the company as a senior advisor and executive until he retires on June 30, 2021, after 22 years with the group.

Tony Durrant, CEO of UK-based Premier Oil, will step down from the group at year-end, as Premier Oil has agreed to merge with Chrysaor. **Linda Z. Cook**, currently CEO of Chrysaor's largest shareholder, Harbour, will be CEO of the combined company.

Margareth Øvrum, EVP of Equinor's Development and Production Brazil business, joined the oilfield services firm TechnipFMC's Board of Directors 2020.

Philippe Kavafyan, CEO of offshore wind turbine maker MHI Vestas Offshore Wind, will chair Europe's wind energy association, WindEurope.

Vineyard Wind, a company with plans to construct offshore wind farms in the U.S., has appointed **Sy Oytan** as Deputy Chief Executive Officer.

Norwegian offshore installation services company Ocean Installer has appointed **Robert (Bob) Gillespie**, a former DOF Subsea U.K. boss, as managing director of its U.K. business.

ARO Drilling, a Saudi-focused offshore drilling joint venture between Valaris and Saudi Aramco, appointed **Derek John Kent** as new CEO. Kent has served as V.P. Middle East, Africa & Asia Pacific at Valaris.

Andrew F. Gould, former Chairman and Chief Executive Officer of Schlumberger, has joined the board of directors of offshore engineering services firm McDermott.

Offshore helicopter operator Bristow appointed **Jennifer Whalen** as Senior Vice President and Chief Financial Officer.

Jon Huntsman Jr., the former U.S. Ambassador to Russia and the former Governor of Utah, has been re-elected to Chevron's board of directors.

UK-based oil and gas company Hurricane Energy appointed **Antony Maris** as Chief Executive Officer ("CEO") designate and executive director.
Maris' appointment follows the resignation of Hurricane Energy's long-standing **CEO Robert Trice**, announced back in June when **Kimberly Smith** took the interim CEO role.

Greg Gumbs will be the new President and CEO of Bosch Rexroth North America when **Paul Cooke** retires in December after 38 years with the company.

TechnipFMC named **Arnaud Pieton** President and CEO-elect of Technip Energies, unit after previous CEO Catherine MacGregor left to work Engie. TechnipFMC also appointed **Jonathan Landes** to the role of President, Subsea.

OE OFFSHORE ENGINEER

2021 EDITORIAL CALENDAR

JANUARY - FEBRUARY

FEATURE
Floating Production Outlook

DEPARTMENTS

Renewable Energy
Offshore Wind Installation & Supply Vessels

EPIC
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Downhole Data: Sensors, Fiber Optic & Wired Pipe

Regional Report
Asia & Australia

Subsea
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Product
Coatings & Corrosion Technologies

Regional Report
Offshore Mediterranean

EVENTS & BONUS DISTRIBUTION
- Subsea Expo: Aberdeen, Scotland
- 7th International LNG Conference:Madrid, Spain
- Australasian Oil & Gas, Perth, Australia
- Offshore Mediterranean Conference, Italy

MARCH - APRIL

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Special Report
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Production Optimization: Projects & Technologies

Special Report
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NOVEMBER - DECEMBER

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Offshore Outlook 2021

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

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Processing & Separation

Drilling and Completions
Completions Technologies

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Brazil

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Cyber Security

Product
Subsea Technologies

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OFFSHORE SUPPORT VESSELS MARKET GROWTH RATE BY REGION, 2020-2025

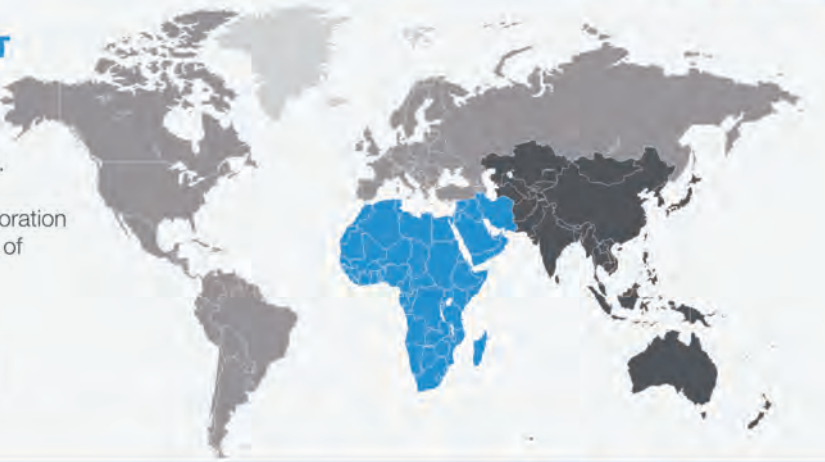
The market for offshore support vessels is expected to grow at a CAGR of approximately 6.50% from 2020 – 2025.

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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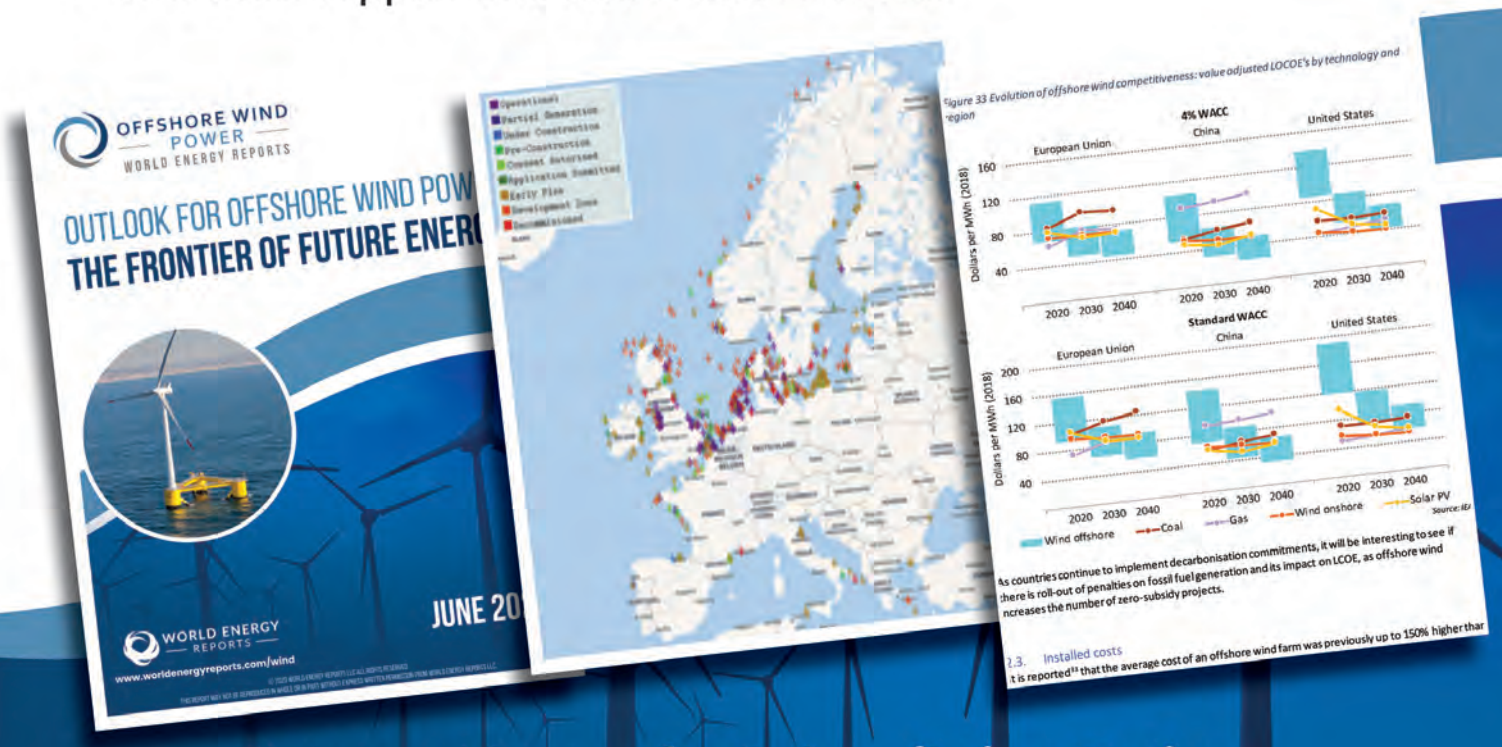

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