OE OFFSHORE ENGINEER

THE FUTURE OF OFFSHORE ENERGY & TECHNOLOGY

SEPTEMBER/OCTOBER 2024 | OEDIGITAL.COM | VOL. 49, NO. 5

DIGITALIZATION

The Baker Hughes subsea digital ecosystem

O Canada!
Offshore Newfoundland & Labrador

Hammer Time
Menck Unveils Massive 6250KJ Pile Driver

Floating Future
In Offshore Renewables

N-O-S
Unique CTV Debuts

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Assistant Commandant for Prevention Policy (CG-5P)
U.S. Coast Guard

Dain Detillier
Executive VP LNG Operations
Harvey Gulf International Marine, LLC

Angeliki Zisimatou
Director, Cybersecurity
American Bureau of Shipping

Philip Bannerman
VP Sales Americas
Marlink

Moderator
Greg Trauthwein
Editor & Publisher
Maritime Reporter & Engineering News

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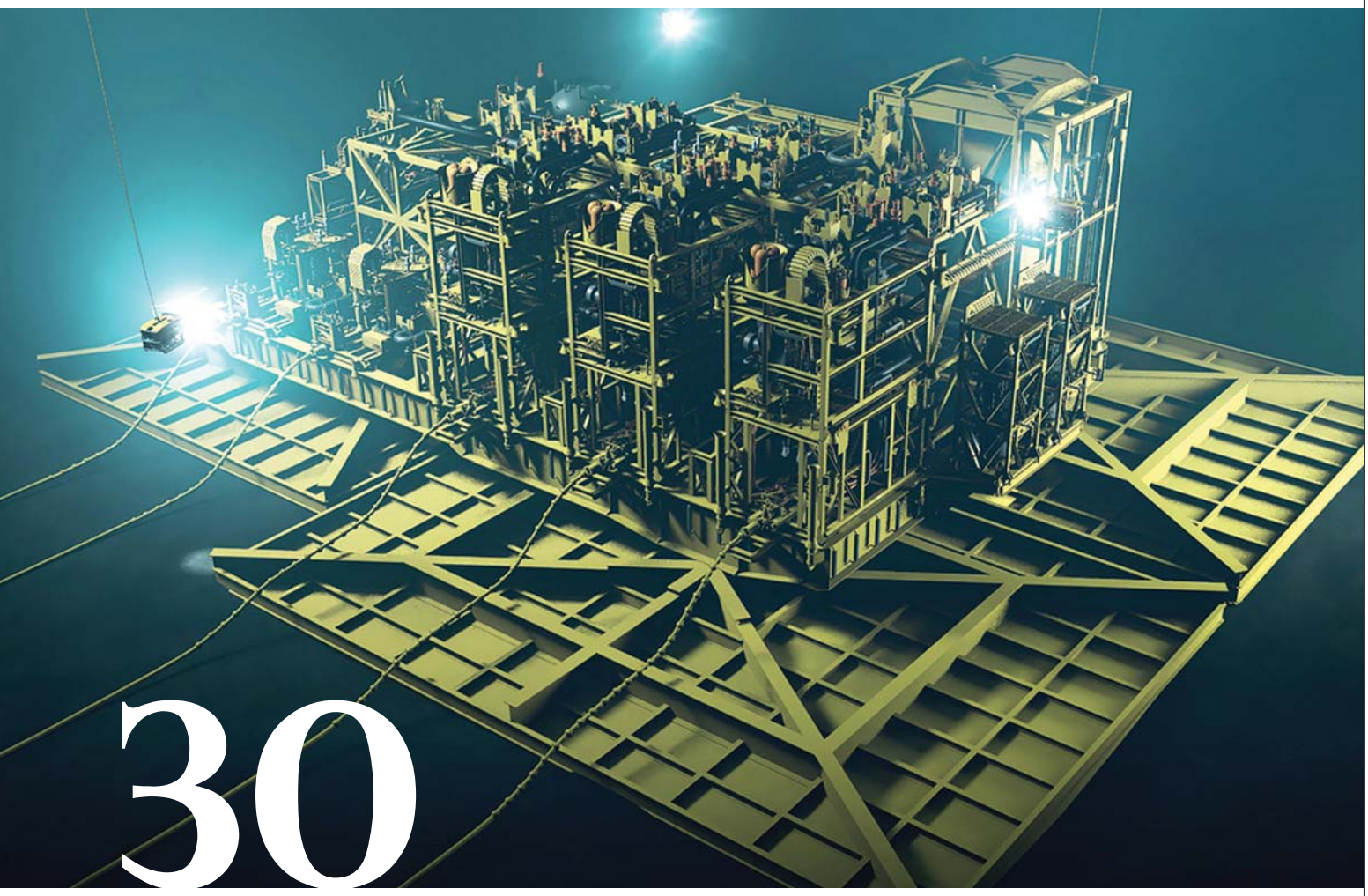

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DEPARTMENTS

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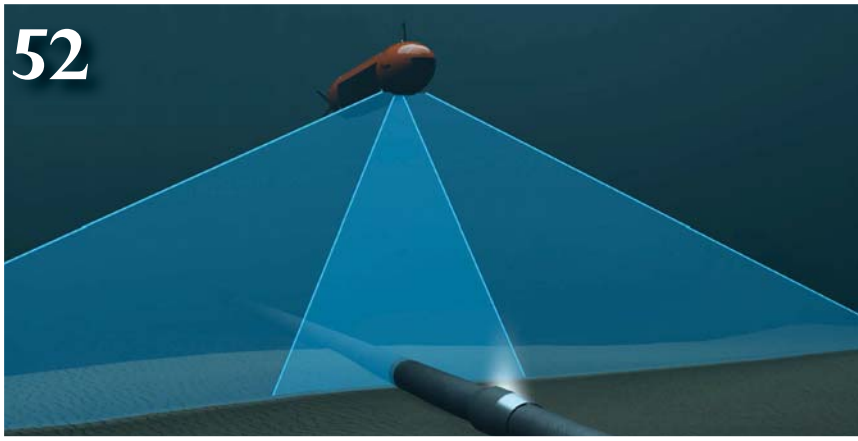
N-O-S



Argeo

Rune Havn

Welcome to the September / October edition of ***Offshore Engineer*** and our focus on Digitalization. "Digitalization" has, in many respects, become one of this overused industry buzzwords, jargon that means 100 different things to 100 different people. With that we set our editor in Australia, Wendy Laursen, on the path of discovery, to dig deeper into the companies that are 'walking the walk' in terms of leveraging digital solutions. And she found a treasure trove. In July, ADNOC and e& announced a project to build a 5G network that will relay information from sensors embedded in more than 12,000 wells and pipelines to autonomous control rooms. It is due to be completed in 2025 and expected to generate $1.5 billion in value during its first five years of operation. Siemens Energy is working on new concepts to make subsea digital systems smarter using its Subsea DigiGRID control, safety and digital twin systems. These are just two of multiple real-world case studies driving the digital trend in offshore energy today.

In this edition we're pleased to welcome back a long-tenured colleague Joe Keefe. Joe was editor of sister-publication ***Marine News*** for many years, and we were able to cajole him back with a trek to Sweden in August for an up close and personal ride onboard Northern Offshore Services (N-O-S) unique I-Class Crew Transfer Vessel (CTV), powered by the first commercial application of Volvo Penta's IPS Professional Platform. As Joe writes, "in the cutting-edge IMPRESSER, N-O-S designed a flexible, future-proof CTV that will adapt to and accommodate new technologies and energy solutions over the next 25 years, all of which is targeted to exceed the needs of their most important cargo: the offshore engineers that they serve." While much is written about the plethora of new and emerging technologies that power the offshore energy business ahead, perhaps more should be dedicated to the technologies that are designed to enhance and protect the lives and well-being of the people that continue to work in and around some of the most challenging industrial conditions on the planet.

Last but certainly not least, read up on the new Menck hammer, a 6250KJ pile driving system that can only be best described by a German engineer offering the following illustrative analogy, saying that the new hammer – when it enters ethe market in 2027 – delivers a blow "which is the equivalent of a Porsche hitting a wall at 190 mph!"

"We are approaching the limit that mankind can build right now," said Fabian Hippe, Marine Foundations Sales Director, Acteon, "as with the 6000 we have maximized the weight of the ram that we can build."

Though the Menck hammers were originally designed for [and still used in] the offshore oil and gas market, the MHU 6000W is designed to meet the growing demands of the offshore renewable sector, opening up new possibilities for offshore wind projects by handling larger and heavier piles in increasingly challenging environments.

Check out the 2025 Media Kit via the QR Code Below

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Kjetil Aamodt is a mechanical engineer with 40+ years of experience from the energy sector on the Norwegian Continental shelf. He is the inventor of the AOGV and has worked for IK Group and now Izomax since 2007.

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Joseph Keefe contributes to New Wave Media titles as needed. Previously the Editor of three maritime b-to-b periodicals, including *MarineNews*, his work has appeared in more than 20 industry publications. He is a graduate of the Massachusetts Maritime Academy and a licensed mariner.

Wendy Laursen has 20 years of experience as a journalist. In that time, she has written news and features for a range of maritime, engineering and science publications. She has completed a Master of Science research degree in marine ecology as well as diplomas in journalism, communication and subediting.

Johan Mattsson (PhD) is currently chief Physicist in Argeo. He develops electromagnetic technology for underwater applications using vehicles like AUVs and ROVs.

Hamna Ghias Sheikh is a MPhil International Relations Scholar, Research Officer based in Lahore, Pakistan. She writes columns on international affairs, Pakistan affairs and geopolitics.


Laursen


Mattsson


Sheikh

AST Networks White Paper:

Driving Digital Transformation in the Offshore Engineering Sector with Hybrid Connectivity Solutions

Introduction

The offshore engineering sector is at the heart of global infrastructure, supporting industries such as oil and gas, renewable energy, and maritime operations. These complex remote environments have traditionally relied on manual processes and isolated communication systems. However, the advent of digital technologies is revolutionising the sector, enabling significant improvements in efficiency, safety, and cost-effectiveness.

This transformation hinges on robust connectivity solutions, as offshore environments often pose significant challenges for communication infrastructure. The integration of hybrid connectivity solutions – combining satellite, cellular, and traditional networks – offers unprecedented opportunities for offshore engineers to fully embrace digitalisation. AST Networks, a global leader in satellite and hybrid communication solutions, is uniquely positioned to drive this shift, ensuring offshore engineers have the critical connectivity needed to unlock the full potential of data transformation.

Digital Transformation in Offshore Engineering

Digital Transformation refers to the integration of digital technologies into all areas of business, fundamentally changing how companies operate and deliver value to their customers. In the offshore engineering sector, this process is crucial for addressing challenges such as:

Remote Operations

Offshore platforms and vessels operate in remote, often harsh environments, where communication and data exchange are critical for real-time decision-making

Data collection and analysis

Modern engineering projects generate vast amounts of data from sensors, drones, and IoT devices, requiring reliable connectivity for transmission and analysis.

Operational efficiency

Digital tools, such as predictive maintenance and automation, can significantly improve operational efficiency and reduce downtime.

The Role of Hybrid Connectivity in Offshore Digitalisation

Offshore environments present unique connectivity challenges due to their remote locations, unpredictable weather, and harsh conditions. Traditional connectivity solutions, such as satellite communications, have played a crucial role in bridging the gap, but the demand for higher bandwidth, lower latency, and more resilient connections has driven the need for hybrid connectivity solutions.

Hybrid Connectivity Defined

Hybrid connectivity refers to the use of multiple communication networks, such as satellite, cellular, and terrestrial networks, providing seamless, reliable, and high-speed connections. By combining these technologies, offshore engineers can ensure constant connectivity, even in the most remote or challenging conditions. Hybrid solutions offer:

Redundancy and Resilience

Offshore operations cannot afford downtime. Hybrid networks provide a failover mechanism, ensuring that if one network (e.g., satellite) becomes unavailable due to weather conditions or technical issues, another (e.g., cellular or terrestrial) can take over seamlessly.

Bandwidth Flexibility

As offshore operations adopt more digital tools - such as IoT, AI-driven data analysis, and cloud-based systems - the demand for higher bandwidth grows. Hybrid networks can dynamically switch between different connection types to optimise bandwidth availability based on the task at hand.

Cost Efficiency

Hybrid solutions can reduce communication costs by allowing engineers to use more cost-effective networks, like terrestrial or cellular, when available, and only rely on satellite when absolutely necessary.

Applications of Hybrid Connectivity in Offshore Engineering

The potential application of hybrid connectivity in the offshore sector are vast. AST Networks provides solutions tailored to specific operational requirements, allowing engineers to fully leverage digital tools and practices in their day-to-day work.

Real-Time Data Transmission and Monitoring

Offshore platforms are equipped with thousands of sensors monitoring everything from structural integrity to environmental conditions. These sensors generate massive amounts of data, which must be transmitted in real-time, regardless of weather or network conditions.

This is particularly important for predictive maintenance, where early detection of equipment failure can prevent costly downtime. For example, by integrating IoT sensors with hybrid networks, engineers can monitor the health of critical equipment remotely and receive alerts if anomalies are detected. This allows for timely interventions and reduces the risk of unplanned outages.

Enhanced Collaboration and Remote Expertise

In offshore engineering, collaboration between onshore and offshore teams is vital. However, geographic separation has often been a barrier to real-time communication. With hybrid connectivity, offshore teams can engage in high-quality video conferencing, share data instantly, and access cloud-based applications.

AST Networks' solutions make it possible for engineers to connect to experts and supervisors located onshore, even during challenging sea conditions. This not only enhances decision-making, but also allows for real-time problem-solving, which can be critical in high-stakes environments such as oil rigs or wind farms.

Autonomous and Remote Operations

As offshore operations become more automated, the need for continuous, reliable connectivity becomes even more essential. Unmanned platforms, autonomous underwater vehicles (AUVs), and drones are increasingly used for monitoring, inspection, and maintenance tasks. These autonomous systems rely on constant data streams to operate effectively.

With hybrid connectivity, engineers can monitor and control these systems from remote locations, ensuring operational continuity, even when direct human oversight is limited. By leveraging multiple connectivity solutions, AST Networks ensures that autonomous systems remain online and fully functional, even if one communication method should fail.

Improving Safety and Compliance

Safety is paramount in the offshore engineering sector, and hybrid connectivity plays a critical role in enabling real-time monitoring of safety systems, ensuring that vital alarms and alerts are communicated instantly to the relevant personnel. This is particularly important for emergency response scenarios, where rapid communication can be the difference between a controlled situation and disaster.

Moreover, regulatory compliance often requires the continuous transmission of data, such as environmental impact reports or safety audits, to government authorities or corporate headquarters. Hybrid connectivity ensures this data is reliably delivered, supporting compliance efforts and reducing the risk of penalties.

Challenges of Hybrid Connectivity and How AST Networks Overcomes Them

While hybrid connectivity offers numerous advantages, it also presents challenges. These include the need to manage multiple networks seamlessly, ensuring network security, and optimising network performance in varying conditions. AST Networks has developed a suite of solutions designed to address these challenges head-on.

Intelligent Network Management

AST Networks' advanced management systems automatically switch between networks based on real-time conditions, ensuring that offshore teams always have access to the best available connection.

Network Security

Offshore engineering environments are increasingly becoming targets for cyberattacks. AST Networks provides robust encryption and cybersecurity solutions to ensure that all communications are protected, regardless of the network in use.

Customised Solutions

Every offshore environment is unique, with specific needs for bandwidth, latency, and uptime. AST Networks works closely with clients to design custom hybrid solutions that meet the precise needs of each operation, ensuring optimal performance.

Conclusion

The offshore engineering sector is on the cusp of a digital revolution, with hybrid connectivity playing a pivotal role in enabling this transformation. From real-time data transmission and remote collaboration to autonomous operations and enhanced safety, hybrid networks provide the backbone for offshore engineers to fully embrace digitalisation.

AST Networks, with its industry-leading expertise in hybrid connectivity, is committed to supporting offshore engineering companies as they navigate this digital transformation journey. By ensuring robust, reliable, and flexible connectivity solutions, AST Networks is empowering the sector to unlock new levels of efficiency, safety, and innovation.

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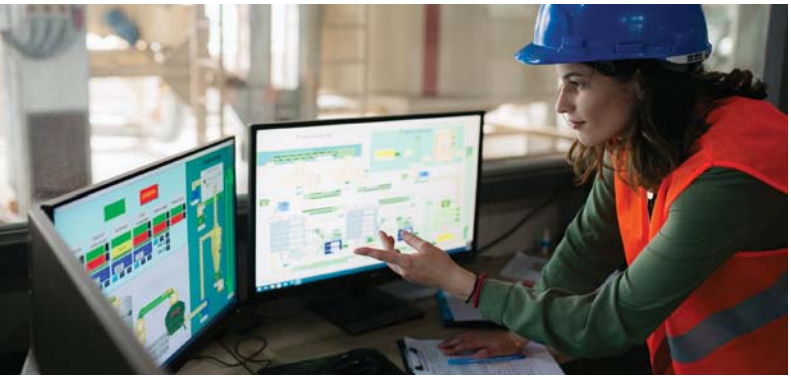
Maximize Wind Turbine Efficiency with Advanced Technologies

Operators of wind turbines are constantly looking to maximize both power output and profitability. Any tool that can reduce turbine maintenance requirements and improve reliability is incredibly useful. With a focus on creating solutions for customer problems, Regal Rexnord™ has employed Industrial Internet of Things (IIoT) technology to provide smart monitoring of wind turbine braking systems, which improves turbine reliability while simultaneously increasing uptime.



Credit: Getty Images

In simple terms, wind turbine profitability is directly tied to its ability to generate power. Any unplanned breakdowns not only incur significant maintenance costs, but also decrease revenue streams due to lost energy output. In most cases, however, maintenance or repair can be challenging. Offshore wind turbines are often located 1-2 hours off land by boat, making them more challenging to reach. Additionally, critical systems such as the brakes are inside the nacelle at the top of the tower, which can be upwards of 300-500 feet high. As a result, equipment is hard to access, and often must be serviced at height. These challenges can increase the time and cost of maintenance, especially in emergency breakdown situations, further compromising power output and profitability. Reducing maintenance requirements and increasing reliability is therefore key for these installations.

Svendborg Brakes™ IIoT Gateway

Svendborg Brakes™ Universal Control Case (UCCase/m)

Breeze Through Maintenance with Smart Solutions

To help operators of offshore wind turbines, Regal Rexnord provides 24/7 smart monitoring solutions that combine IIoT and data mining technologies to improve turbine uptime. A suite of sensors monitoring the braking system provides data on a variety of parameters such as system pressure, brake pad wear, brake position, brake piston, brake fluid levels, and temperature. This data is then uploaded to the cloud, where big data analytics is carried out to provide accurate diagnosis on the condition of key components, and crucially, to predict any potential reliability risks well in advance of failure. This means operators can eliminate unforeseen breakdowns and their costly repercussions. Moreover, data insights can inform a long-term preventative maintenance strategy, ensuring that specific brake components can be highlighted for repair or replacement at the optimum time.

Svendborg Brakes™, a Regal Rexnord brand, has solutions installed in over 200,000 wind turbines globally and Regal Rexnord IIoT solutions can be installed on any existing or new Svendborg Brakes system for permanent condition monitoring. The hardware required consists of an in-house developed Svendborg Brakes Gateway working in collaboration with a high security cloud gateway for a secure connection to the cloud.

If a non-permanent condition monitoring solution is needed, such as for commissioning or troubleshooting, the Universal Control (UC) Case, developed by Svendborg Brakes, provides this functionality for wind turbine brake systems. Contained in a compact, lightweight case, the UC Case can remotely access data from wind turbines and enable direct online intervention from technicians to aid maintenance work. Easily operated by a technician with general training, the UC Case uploads data to the Cloud or manually downloads to USB memory to allow offsite in-depth analysis of the braking system. Importantly for wind turbine operators, the UC Case has the ability to deliver significant cost savings when compared to the expense of transporting a technician to the installation. Furthermore, it offers a distinct advantage in terms of time, adding further value. This tool is suitable for use on all Svendborg braking systems.

Ensuring Reliability in Turbine Operations

By combining condition monitoring, IIoT technology, and in-depth data analysis to provide real-time insights and predictions, Regal Rexnord delivers the dual benefits of reducing turbine maintenance requirements while eliminating unforeseen breakdowns. For offshore wind turbine operators, this means that turbine uptime and reliability can be improved simultaneously. This not only delivers an increase in profitability due to maximized power generation, but also a maintenance cost advantage. Maximizing the benefits of green power generation relies on making environmentally friendly technologies such as offshore wind turbines as reliable and profitable as possible. With advances in IIoT technology, operators now have the tools to capitalize, keeping turbines running for longer, all while reducing downtime.

As the wind industry navigates through immediate challenges and long-term growth opportunities, Regal Rexnord's decades of industry expertise, deep application knowledge, and rigorous testing delivers solutions that minimize risk and maximize value. Their focus is on driving profitability for OEMs and ensuring reliable operations for offshore wind farm owners. Regal Rexnord provides complete solutions for the Wind industry, from design and manufacturing to installation and continuous support.

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Creating a Better Tomorrow

Impending Shortage of Jackups within Ageing Asia Pacific Fleet

While utilization for marketed jackup rigs is at a healthy 100% in the Asia Pacific (APAC) region, it is an ageing fleet that will ultimately be unable to fulfil operator age requirements.

By Paul Ezekiel, Senior Rig Expert, Westwood Global Energy Group

Westwood's RigLogix records 39 marketed jackups in APAC. This number excludes two units under construction in Singapore, five National Oil Company (NOC) units operating in Vietnam, and two cold-stacked units in Labuan. The current age breakdown shows 16 units in the 1-10-year age bracket, 18 units aged 11-20 years, and three units aged 21-41 years. The two units operating in Australia are 18.6 and 25.8 years old respectively.

Operators generally stipulate rigs to be no more than 15 years old as part of their technical requirements. By 2030, only 20 units or less will be available that meet these criteria. This includes an additional Borr Drilling unit due for delivery at the end of this year, with the assumption that it does not leave the area. Expanding outside of APAC, the average age of the global marketed jackup fleet is 20 years.

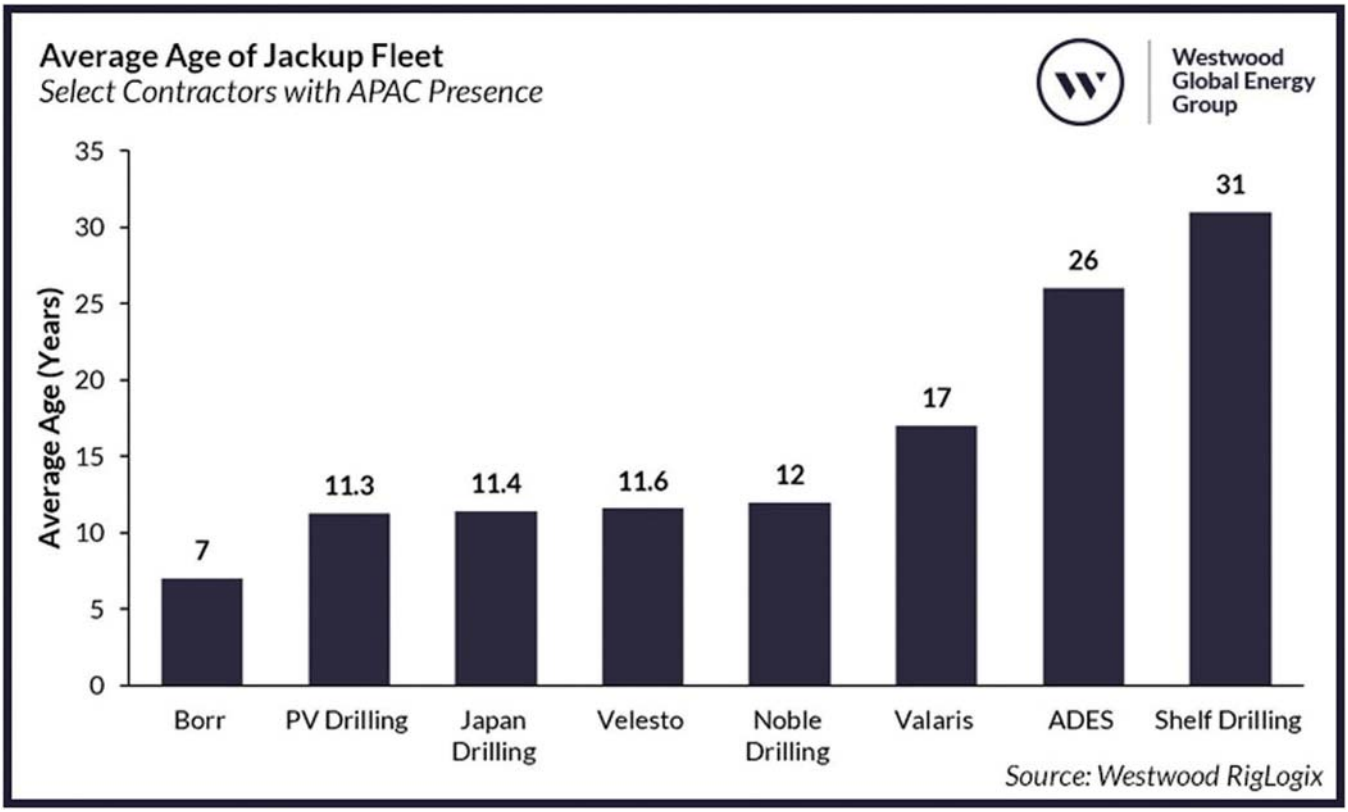
An interesting observation is that while ageing jackups are mobilising into the region, newer units have ended up in Saudi Arabia and continue to leave for other regions. Since the beginning of the year, Shelf Drilling Perseverance, Valaris 247, Emerald Driller, Topaz Driller, Admarine 502, COSL Seeker and Baltic have entered the APAC region. The youngest of these "new entrants" is 11.4 years and the oldest is 40.7 years. At the end of the year the newbuild Vali will be leaving the area. It is worth noting that APAC includes Australia, but excludes China, Japan and Korea. The latter two have a transient fleet of rigs that operate there when needed, then generally demobilise back to Southeast Asia.

Adapting to Prevent a Jack-up Shortage

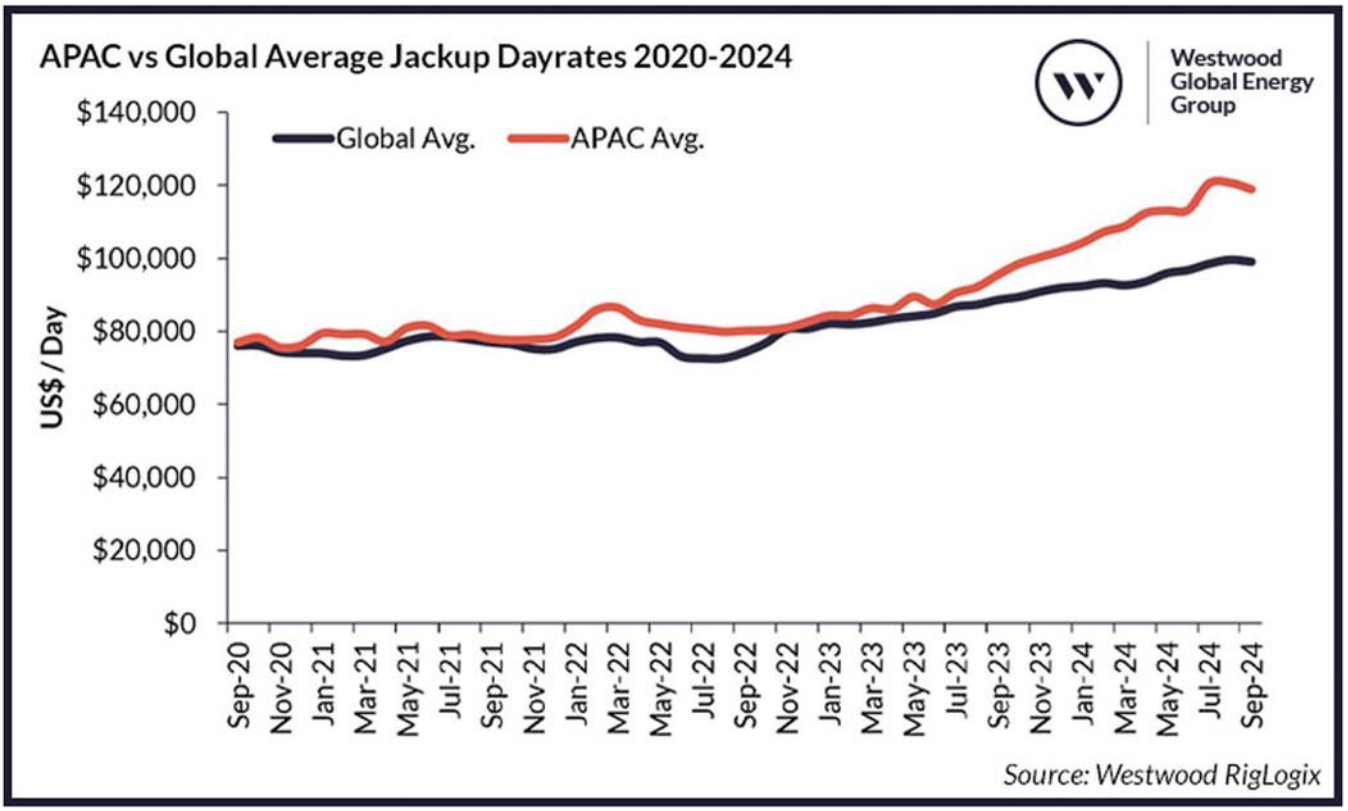
Here are four possible solutions to the impending problem of a shortage of jackups. Firstly, operators could amend the age requirements, to ease supply in the near term. Inspections would need to be more regular, and a more stringent maintenance regime may need to be put in place to keep the rigs in good operational conditions.

Secondly, operators taking equity in the rigs could help reduce contractor costs, and in turn pay lower dayrates since not subject to market fluctuations and availability. The operator-contractor relationship must become more of a partnership as opposed to the current customer/service provider. One key factor is the sharing of responsibilities in a manner befitting of the term "partnership".

The third possible solution is to build new units. At this point in time, newbuild costs still appear to be prohibitive. Contractors seem to concur that current dayrates cannot support the cost. In its most recent presentation, Borr Drilling said: "Newbuild economics would require



Average Age of Jackup Fleet for Select Contractors with APAC Presence.



dayrates in excess of US$200,000 for the usable asset life of 25 years". Indications from shipyards are that a new jackup could cost in the US$300 million range with a delivery runway of about 36 months.

There is much less appetite to invest in the oil and gas industry these days. Obtaining financing for such projects is a challenge as banks or financial institutions fear of reprisals from environmental groups or just do not want to be involved with oil and gas. Following the downturn of 2014 and the current focus on clean energies, shipyards have turned their efforts on other types of projects such as FPSO, FLNG and Wind Installation Vessel builds and therefore do not have the immediate capacity. Perhaps a measured approach of building one or two units, with some financing from operators (especially the big NOCs and supermajors) could offer long-term contracts to support such investments.

Finally, rigs from the Middle East could return to the APAC region. There are currently 24 jackups in Saudi Arabia less than 10 years of age. Current rates in APAC are more attractive than in the Middle East, however recent bidding trends within Southeast Asia show an easing of rates, brought on by the excess supply from the Saudi Aramco contract suspensions and the uncertainties within Malaysa (vis-à-vis) PETRONAS and PETROS negotiations.

Unless action is taken, operators will most likely find themselves short of premium jackups for drilling operations in the Asia Pacific region. There may need to be a shift from traditional contracting methods and streamlining to reduce the current cumbersome tendering processes. Waiting times for regulatory approvals could also be decreased, making the region more attractive to contractors.

© Björn Wylezich/AdobeStock

OSV 2Q Recap

Entering the Capital Distribution Phase

The OSV sector has concluded its second quarter earnings season, marking another quarter with strong profitability and favorable market conditions.

By Magnus Øye Andersen, Equity Research at Fearnley Securities

However, negative oil market sentiment, with the Brent price down by 19% since the start of July, has impacted the overall oil services market with the wider PHLX Oil Service Index trading down 4% year-to-date. The OSV sector has returned 5% year-to-date at the time of writing, led by DOF's 57% performance.

Dayrates Continued to Rise

Tidewater was the first out of the blocks this earnings season, posting results in-line with market expectations. The company increased its average achieved dayrate by USD 1,600 to $21,100, which marks the 2nd largest quarterly increase since the market recovery started in early 2022. Tidewater contracted at an average rate of $28,800 last quarter, which was down from $30,600 in the first quarter as the contracting was skewed towards lower spec vessels. Looking at the underlying figures, however, the contracted rates for large PSVs and AHTSs increased by 8% and 13% respectively.

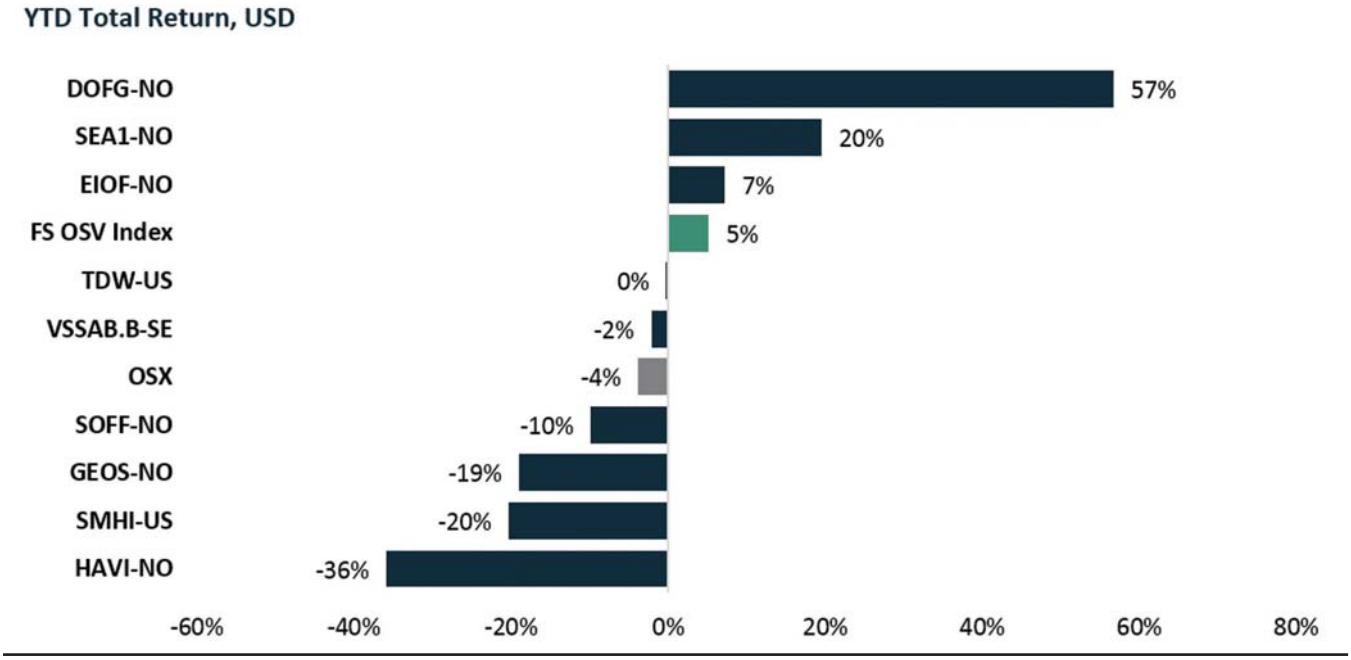
Dividends on the Menu

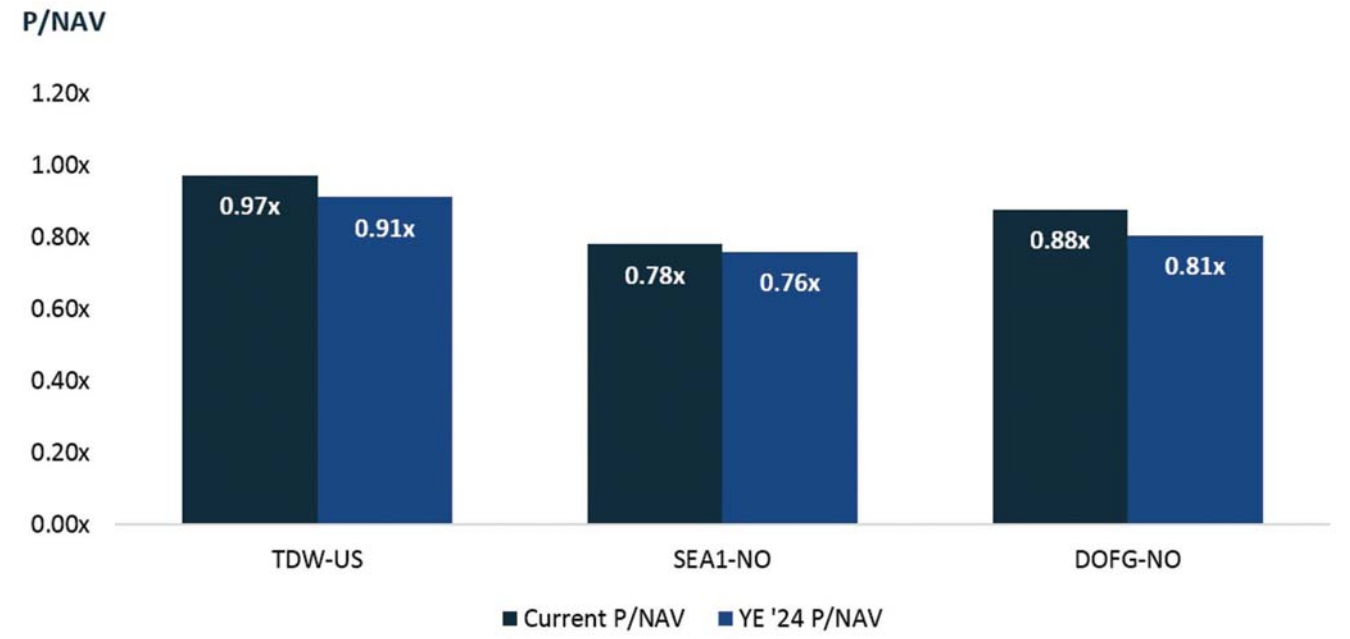
Sea1 Offshore followed up with an important milestone - the first sizable dividend distribution of the current cycle - as Sea1 Offshore announced a dividend distribution of NOK 5 per share. This equaled a 16% yield at time of announcement. We estimate that Sea1 will be able to maintain

the dividend level for 2025, increasing to NOK 6 per share in 2026. This equals a yield of 17% and 20%, respectively.

DOF followed up soon thereafter, announcing to commence quarterly distributions in the second quarter of 2025. The company expects to distribute $0.3 per share, which equals 14% annualized dividend yield. DOF will review the size of dividend on a quarterly basis and given a continued strong market the company sees the potential to increase the distributions from 2026 and onwards. Moreover, DOF hiked the lower end of its 2024 EBITDA guidance range, now guiding $500 – 520 million. This is up from $490 – 520 million from the first quarter update and $470 – 520 million from the fourth quarter last year.

Moreover, DOFG announced during the summer that the company is acquiring Maersk Supply Services for circa $1.1 billion. The transaction will be paid with $577 million in cash and 59 million new shares in DOF. Following the acquisition, DOF owns 65 vessels with an average fleet age of 10.7 years. The transaction was set at 0.8x EV/GAV, while DOF has been trading above 1x in the months prior to the transaction. Thus, impressive work from DOF in acquiring quality assets at an attractive price.





Opportunities Arise in a Volatile Oil Market

Since the start of July, the sector has been trading down 24% as the Brent spot priced has turned from $87 per barrel to $78, and even trading as low as $70 per barrel in September. With project break even prices sitting mostly well below $50 per barrel, we argue that an oil price environment above $60 per barrel should not impact project sanctioning and thus vessel demand. With the Brent price in or near the 60's however, the risk is starting to being gradually factored in by the market even though it has limited effect on earnings. This has created some very attractive opportunities with sliding share prices, as long as the oil price is not turning for worse.

Trading at 3.5x and 2.0x 2025 and 2026 EV/EBITDA we argue that the sector holds an attractive risk/reward. Moreover, on our estimates we have Tidewater, DOF, and SEA1 trading at 0.91x, 0.81x, and 0.76x year-end 2024 P/NAV, respectively. Tidewater's pricing premium in terms of earnings multiples and steel values has more or less vanished over the last few weeks, making for an attractive entry opportunity in the large-cap player. We expect Tidewater earnings to increase substantially going forward as the company is churning through its legacy contracts. Current average backlog duration sits at 1.5 years, in that time frame we expect the average dayrate to converge with the current reported contracted rate.

All-in-all we are firmly keeping our Buy recommendation on the sector, with current dayrate levels implying high profitability and enabling solid dividend potential. However, while oil market volatility has led to increased risk for OSV demand, we currently see this as a buying opportunity as pricing on earnings multiples and vessel values has become attractive. With dividends on the table, we are currently set for a stage in the cycle where capital is flowing back to shareholders, a welcoming sight to a situation which was quite the opposite just some years ago.

NL Government Forecasts a Long Run for Oil & Gas

Minister Andrew Parsons, *Industry, Energy & Technology, Newfoundland & Labrador, Canada, discusses the innovative technology cluster that has grown within and outside of his province, with insights on the technology and the importance of oil and gas.*

By Greg Trauthwein

Andrew Parsons is a member of the House of Assembly for a district called Burgeo-La Poile, but he's also the Minister of Industry, Energy and Technology in the Government of Premier Dr. Andrew Furey.

"When the Premier took over government in August of 2020, he combined the previous departments of natural resources with the economic development responsibilities of other departments, combining it all into one shop, but really also putting a focus on technology, putting that in the departmental name," said Parsons.

Today his department handles all technology, everything from mining, electricity, oil and gas, offshore, renewables, marine technology, aiming to build a base for economic development opportunities and investment attraction.

With a population just north of half a million, Newfoundland & Labrador is a small province, but its natural resources and cumulative centuries experience living and working by and on the ocean has created a unique and dynamic cluster of excellence in maritime, subsea and offshore energy.

"When you look back historically, the fishery was the backbone," said Parsons. "But that has grown over time, and now we are building on this blue economy, and the expertise has shifted."

Specifically, the discovery of oil and gas fields offshore helped to not only bolster the finances of the province, but the cumulative experience of discovering and recovering oil and gas in close proximity to iceberg alley has helped this small population create, refine and export a long list of technologies aimed at working efficiently, effectively and safely in some of the ocean's harshest conditions.

"We are home to the Hibernia gravity-based structure,

Courtesy the office of Minister Andrew Parsons

"We are home to the Hibernia gravity-based structure, which is the world's first offshore oil structure specifically designed to deal with harsh environments, including icebergs. We are known as the east coast energy capital, and we cannot overstate the importance of oil to our province."

– Honourable Andrew Parsons, Industry, Energy & Technology, Newfoundland & Labrador, Canada

Image courtesy Dr. Lesley James

Parsons noted the work of Dr. Lesley James, *the Chevron Chair of Petroleum Engineering, "is doing a lot of work with us right now on carbon capture and offshore basins, and at the same time recognizing that we have to reduce the emissions offshore. When you look at emission reduction, we are far ahead of most other oil producing nations, but that doesn't mean we can't do better when we talk about net-zero aspirations. She's played a big part of that."*

The West Hercules drilling rig moored near shore and the Horizon Arctic support vessel, taken on April 24, 2022, in Bay Bulls.

© ggw/AdobeStock

which is the world's first offshore oil structure specifically designed to deal with harsh environments, including icebergs," said Parsons. "We are known as the east coast energy capital, and we cannot overstate the importance of oil to our province. In addition, we export our [offshore oil and gas] expertise all over the world." As it moves now into aquaculture and marine biotechnology, Parsons observes: "It's amazing, for our province as small as we are, we're certainly batting above our weight when it comes to the ideas that are created here, set up here and then brought elsewhere."

Banking on Oil & Gas

Historically, while the fisheries have been the backbone of industry in Newfoundland & Labrador, with traditional fisheries and aquaculture continuing to grow.

But make no mistake, offshore energy is the muscle. Again, a commodity which has its peaks and valleys. In 2023 the Province produced about 73 million barrels, or about $8 billion in oil production. With the Terra Nova FPSO going back into production in November 2023, Parsons expects oil production to rise to around 82 million barrels this year.

Another promising development is Cenovus' nearly billion-dollar investment in constructing the West White

Rose Project now, another key plank in ensuring rising production numbers.

"When you're talking about 16% of our GDP and when you're talking about a shade over 10% of our actual government revenue, it's a big, big deal," said Parsons. "In all, we have four developed oil fields: Hibernia, Terra Nova, White Rose and Hebron. Everybody's producing again this year, [and the output is] going to go back up," helping Newfoundland & Labrador retain its spot as the number three oil and gas producer in the country behind Alberta and Saskatchewan.

"Overall, our economy this year is expected to grow, the GDP growth is expected to be about 5% this year, which is certainly music to the ears of our finance minister, Siobhan Coady," said Parsons.

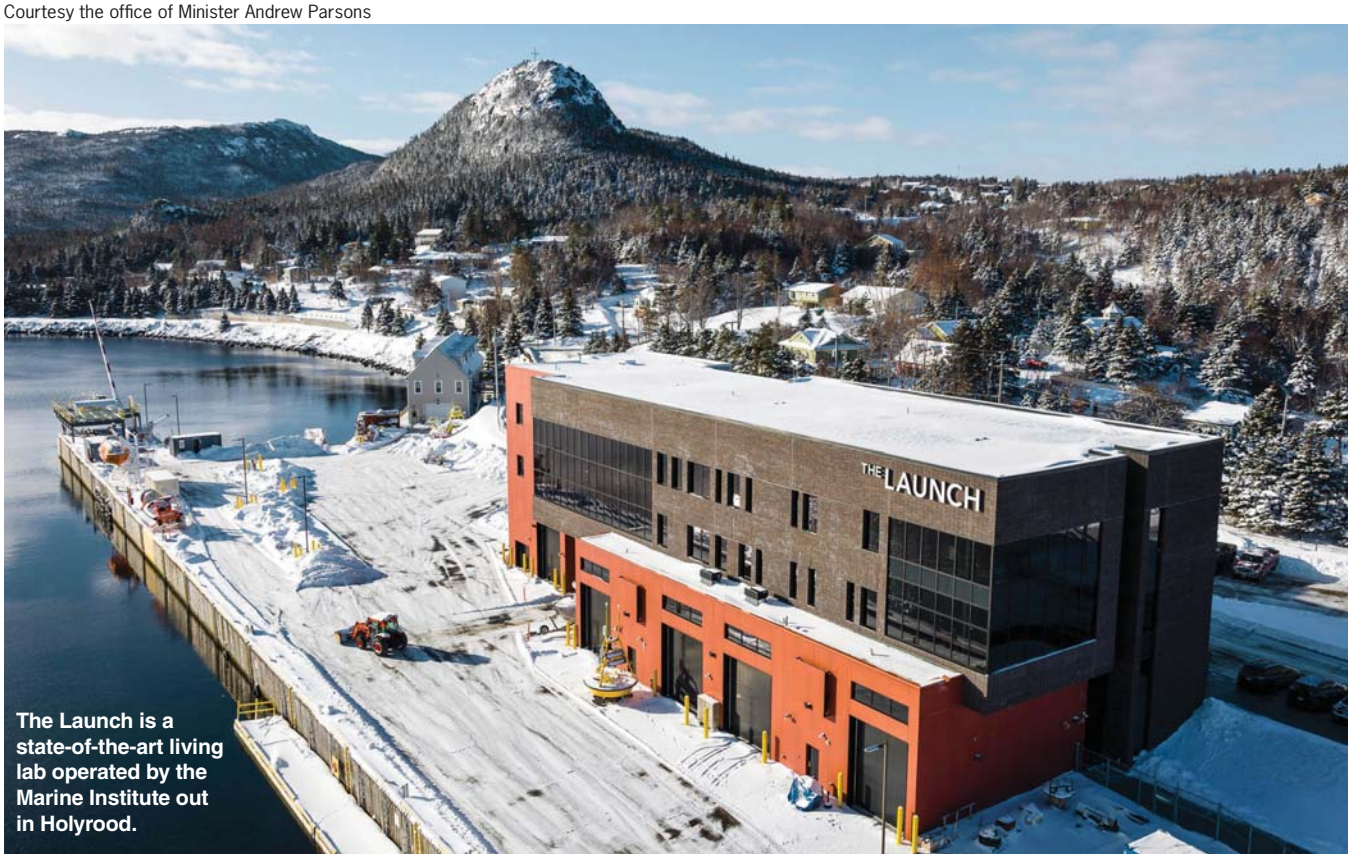
First Class Facilities

The energy business off the shores of Newfoundland & Labrador were, in fact, a driver for much of the modern facilities and local expertise that has developed in the region since the Hibernia platform first started producing in 1997.

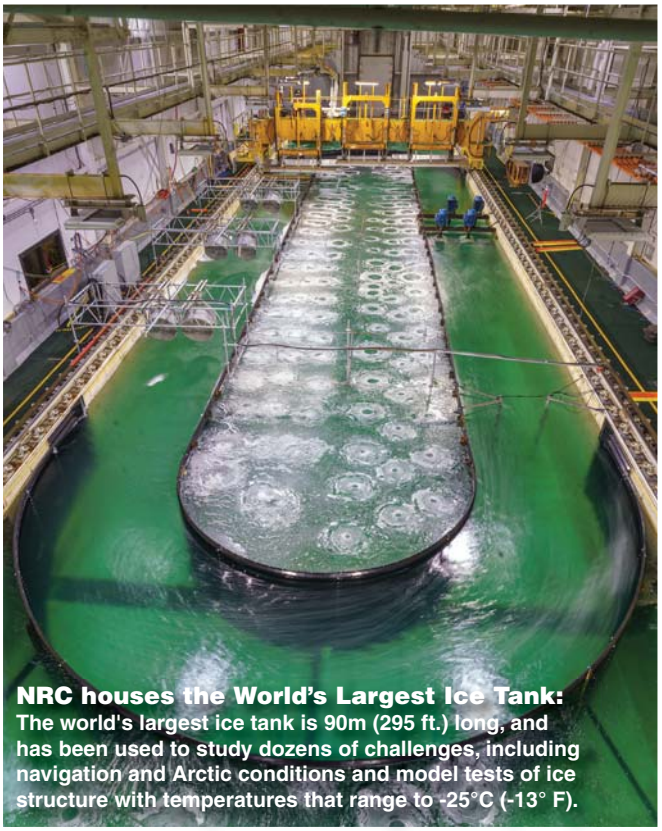
Some of the unique assets in the region that attract investors and collaborators from around the world include:

- **The Launch:** A state-of-the-art living lab operated by the Marine Institute out in Holyrood, which brings the world's harshest cold ocean environment directly to the client. Specialists in harsh ocean tech R&D, testing and demonstration.
- **The Co. Innovation Centre:** The Co. Innovation Centre is helping to address the tech needs of established companies as well as the new ones that are pursuing remote ops in energy, healthcare, mining, fisheries, transportation and more.
- **The National Research Council:** "NRC has an amazing facility in St. Johns that is one of the most advanced indoor model ocean facilities in the world," said Parsons. Among the facilities are the ability to produce multi-directional waves in extreme temperatures, at extreme sea states, able to generate wind to simulate real world marine conditions. NRC has a towing tank able to test most any vessel, including high speed vessels such as warships, to bulk carriers and patrol vessels. NRC also has "an amazing ice tank to simulate what's going on in the Arctic," able to grow ice quickly and control its properties.
- **Center for Marine Simulation:** An arm of the Marine Institute, which is a gem in itself with an amazing group of marine tech training, research and development.

Courtesy the office of Minister Andrew Parsons



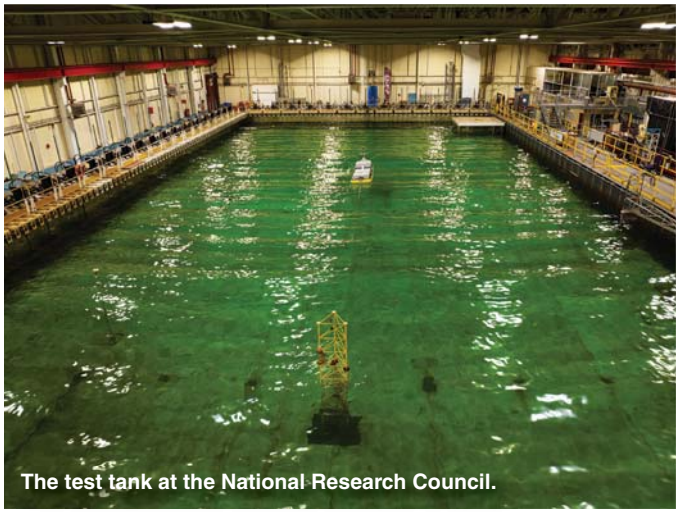
The Launch is a state-of-the-art living lab operated by the Marine Institute out in Holyrood.



NRC houses the World's Largest Ice Tank:
The world's largest ice tank is 90m (295 ft.) long, and has been used to study dozens of challenges, including navigation and Arctic conditions and model tests of ice structure with temperatures that range to -25°C (-13° F).

MARINE TECHNOLOGY TV

Watch the full interview with Minister Andrew Parsons, Industry, Energy & Technology, Newfoundland & Labrador, Canada, on **Marine Technology TV:**



The test tank at the National Research Council.

Courtesy National Research Council of Canada / Conseil national de recherches du Canada

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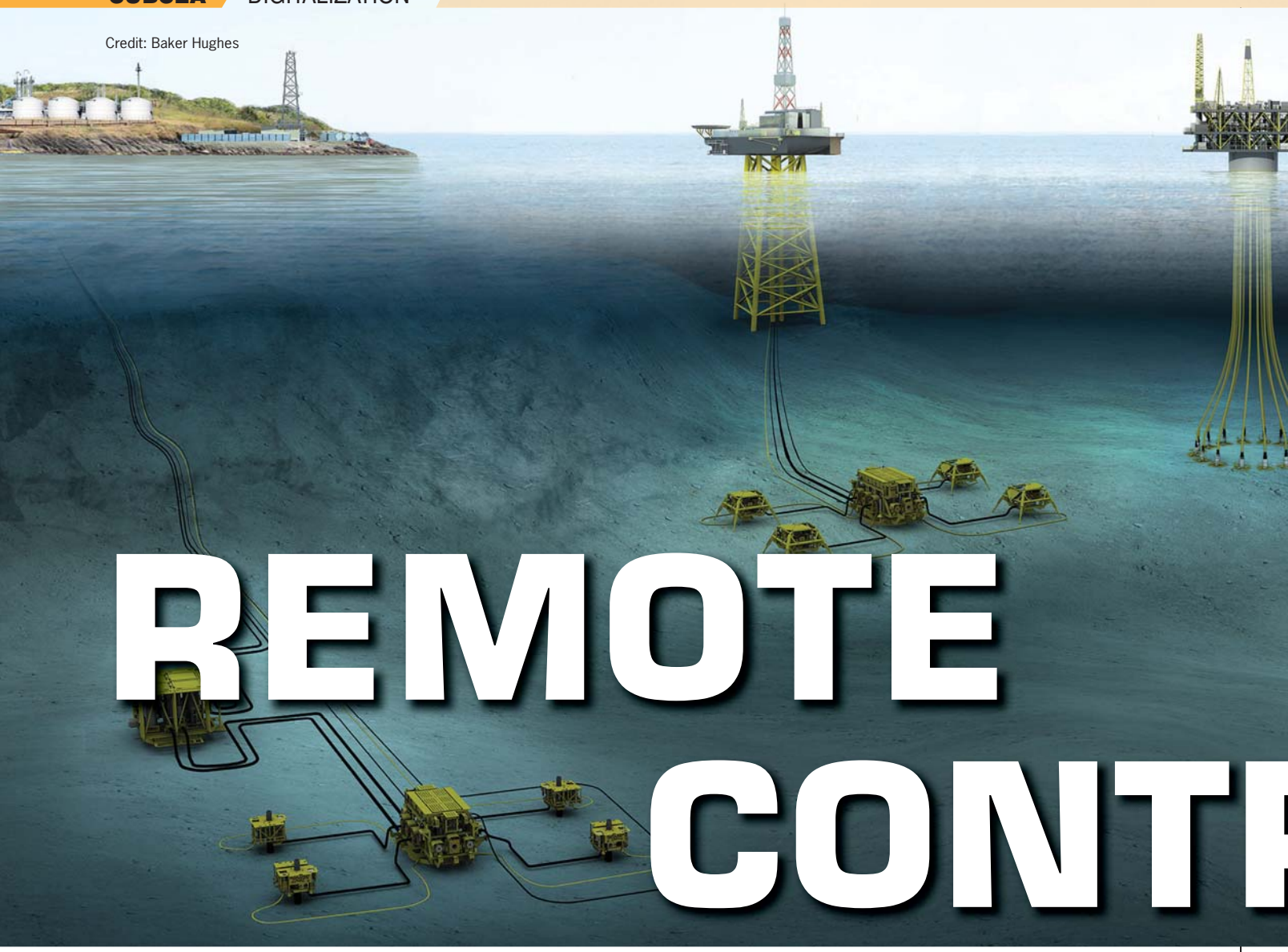
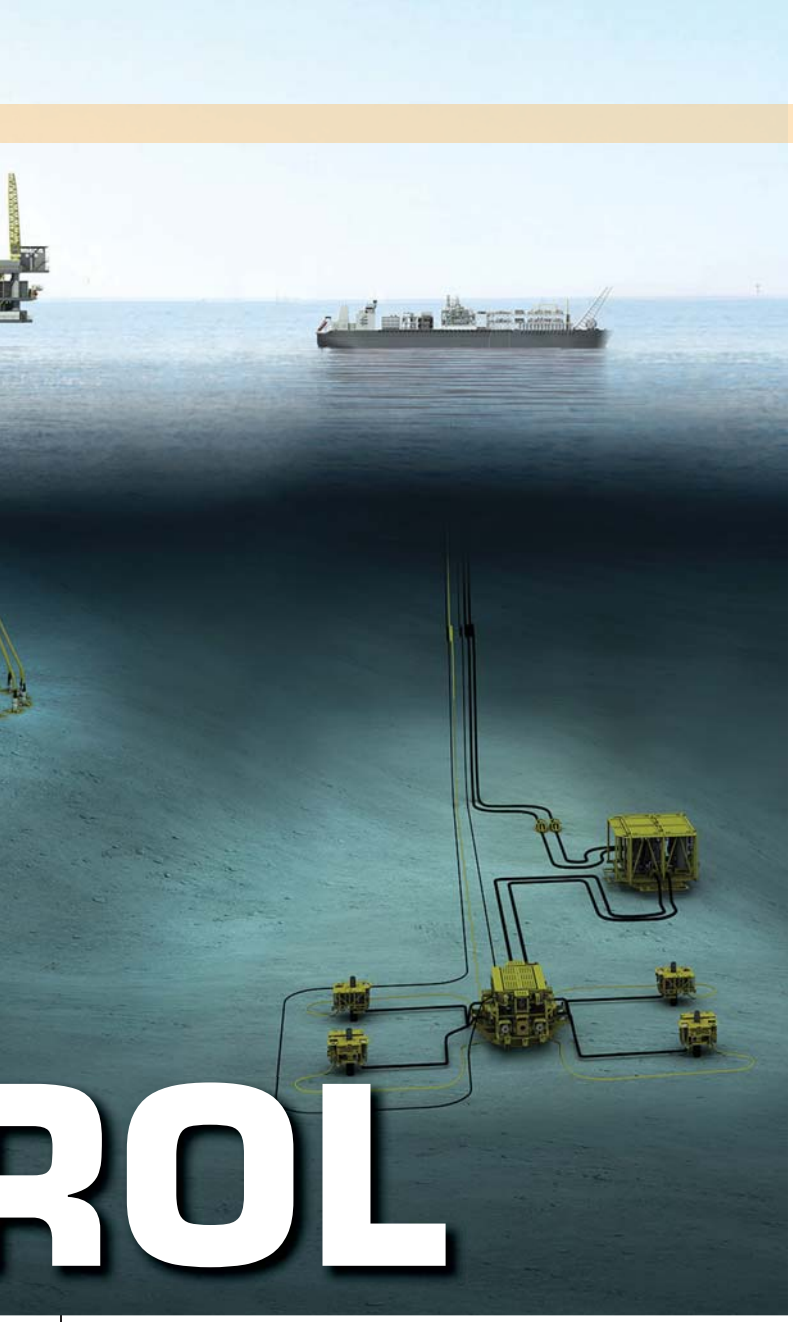


Credit: Baker Hughes

REMOTE CONTR

The more production infrastructure we push to the seabed, the more data we need to pull back up. With it comes opportunity.

By Wendy Laursen



ROL

Chevron's landmark 6,500 tons of subsea gas compression infrastructure for Jansz-Io demonstrates the scale of what is being put on the seabed, but there's a diversity of other infrastructure under development that will operate alongside traditional production systems.

This includes subsea fluid storage technology from NOV Subsea Production Systems, and TechnipFMC and Sulzer Flow Equipment's subsea CO2 pumps for new high pressure separation technology from Petrobras.

The growing number of new technologies are expected to play a pivotal role in the future of oil and gas production, advancing efficiency and environmental performance. Their digitalization will further these goals by providing remote control, optimized operations and enhanced decision-making capabilities.

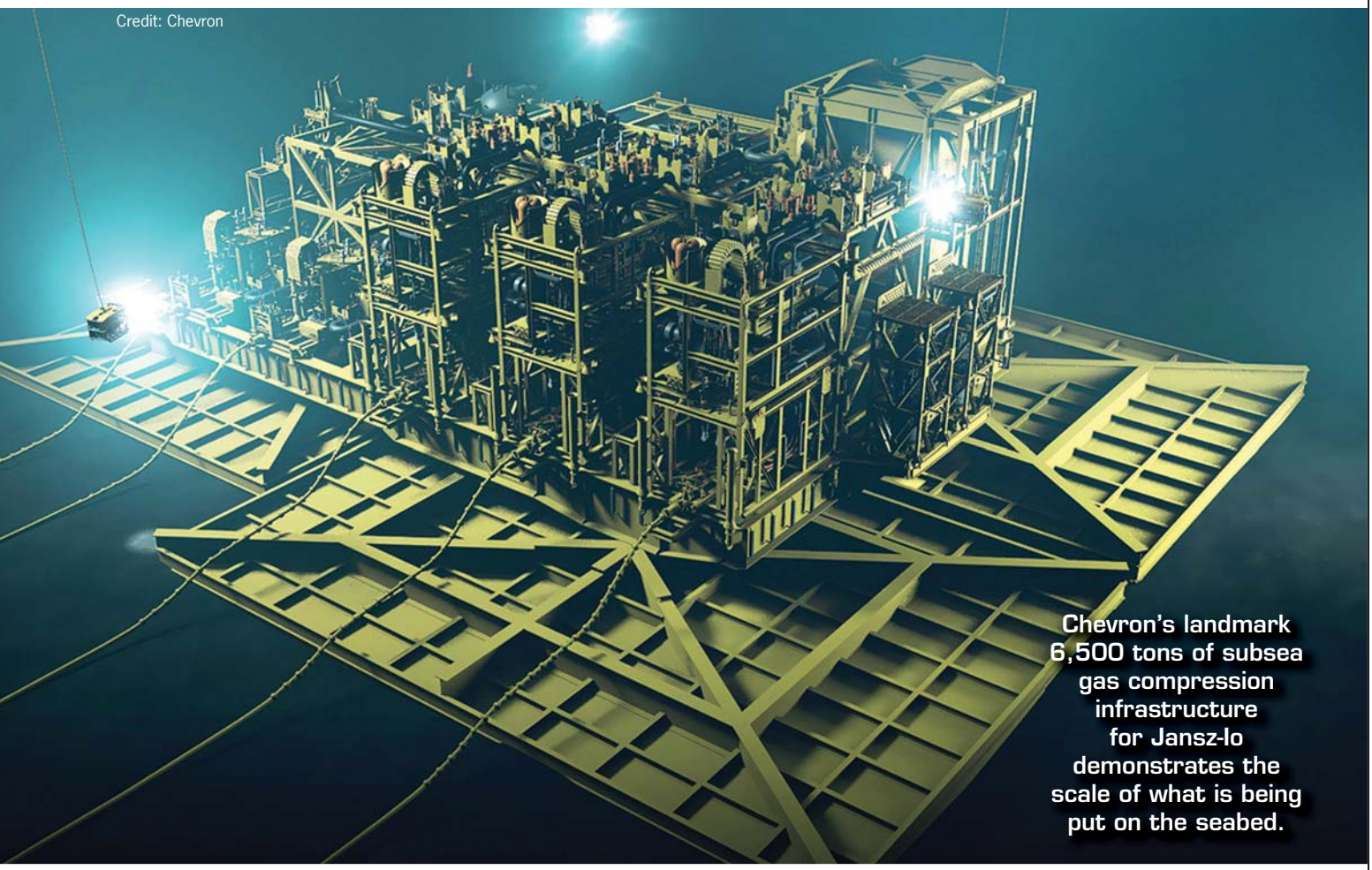
Enabling technology for that digitalization, such as subsea power and communications, continue to evolve, says Miguel Hernandez, Senior Vice President of Global Offshore at ABS, even though the subsea environment poses significant challenges. "Maintaining reliable communication links between subsea assets and onshore or offshore control systems is crucial, but connectivity issues such as bandwidth limitations and signal interference can pose challenges," says Hernandez. "Transmitting data through water, especially at great depths, is challenging due to the attenuation of signals."

The introduction of 5G technology aims to overcome these challenges and is already being developed for production systems. In July, ADNOC and e& announced a project to build a 5G network that will relay information from sensors embedded in more than 12,000 wells and pipelines to autonomous control rooms. It is due to be completed in 2025 and expected to generate $1.5 billion in value during its first five years of operation.

Also in July, ADNOC announced the deployment of RoboWell, AIQ's autonomous well-control solution into its NASR field operations. RoboWell uses cloud-based AI algorithms to autonomously operate wells that self-adjust according to changing conditions to enhance safety and efficiency and reduce the need for travel and physical interventions.

A 12-month trial project wrapped up in March that aims to support the electrification of subsea power and communications by combining wave power with subsea energy storage. The Renewables for Subsea Power project connected Mocean Energy's Blue X wave energy converter with a Halo underwater battery storage system developed by Verlume. The trial off the Scottish coast demonstrated how green technologies can be combined to provide reliable and continuous low-carbon power and communications to subsea equipment as a future alternative to umbilicals. TotalEnergies and Shell Technology recently joined the initiative to now deploy the system on live assets.

Siemens Energy is working on new concepts to make subsea digital systems smarter using its Subsea DigiGRIDTM control, safety and digital twin systems. Endre Brekke, Product Lifecycle Manager for Subsea Automation and Control, explains: "We are designing systems to be able to perform well under significant uncertainties in the system and environment for extended periods of time and without external intervention, that is, operator monitor-



Credit: Chevron

Chevron's landmark 6,500 tons of subsea gas compression infrastructure for Jansz-Io demonstrates the scale of what is being put on the seabed.

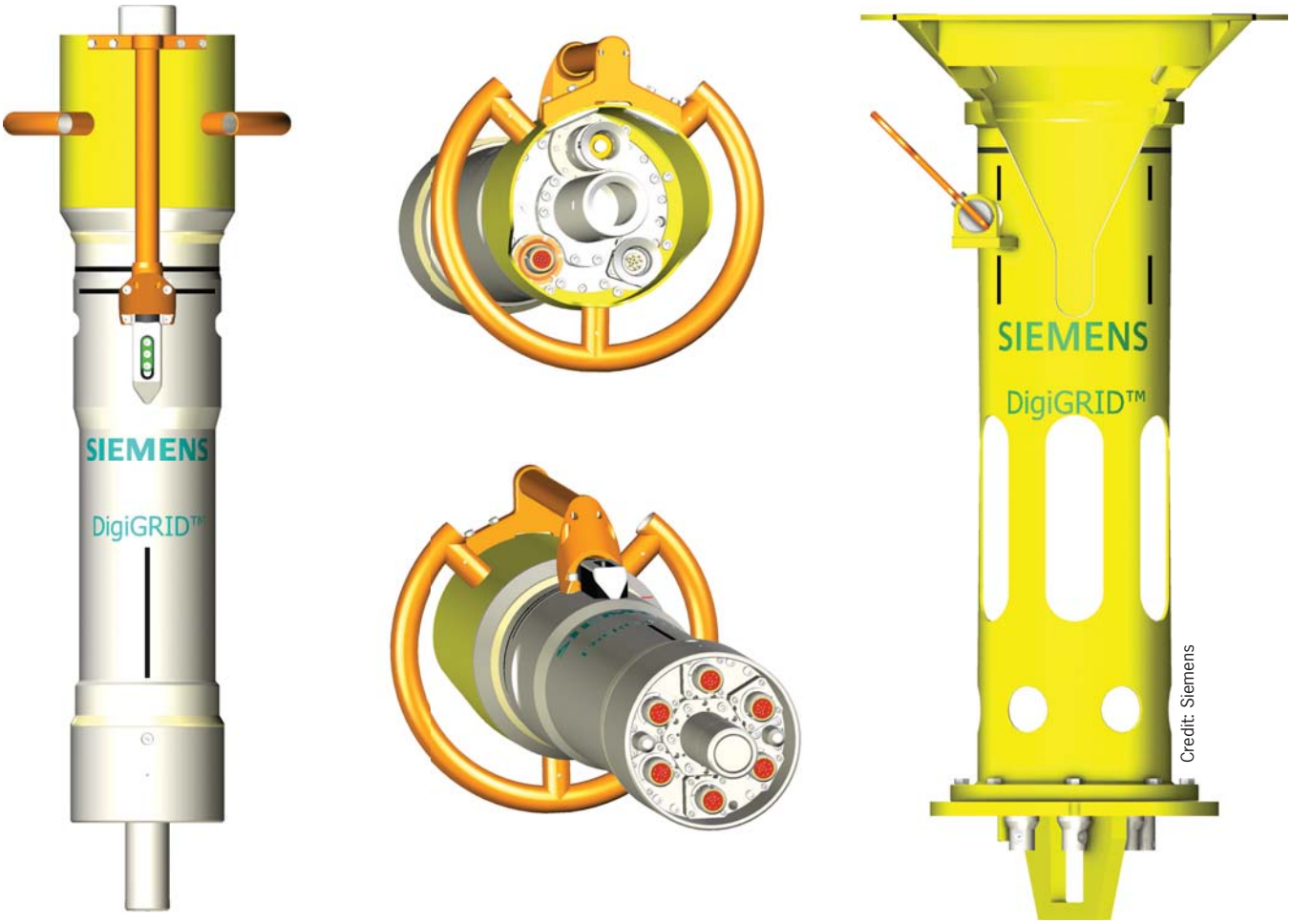
ing and control. We are also working on edge analytics and storage, building in abilities to perform analytics close to the source of the data and to store both raw data and results for an extended period of time."

Brekke says industry-standard based integration with topside systems is very important. This enables interoperability between systems from different vendors and enables use of automation standards on the seabed. "This saves CAPEX and OPEX," he says.

"This approach also enhances liberation of data for optimization of production and maintenance. This is growing even more important, and our Subsea DigiGRID system is designed to do this very efficiently. The Subsea DigiGRID can interface a topside controller on a hard real-time standard automation protocol and, at the same time, from the same hardware, stream data to a topside cloud-based digital twin using a digital twin protocol like MQTT."

OneSubsea™, an SLB joint venture, is pushing ahead with subsea electrification, a move that has the potential to increase the amount and quality of data returned topside. The company has been awarded the FEED of a 12-well, all-electric subsea production system with an IoT for the subsea trees at Equinor's Fram Sør field, offshore Norway. As part of the agreement, future engineering, procurement and construction will be directly awarded to SLB OneSubsea conditional on a final investment decision. The IoT includes three key digitalization efforts: intelligent sensors and actuators on the equipment (rather than spring-operated on/off systems), connectivity through a secure digital platform and the ability to turn data into decisions via analytics and diagnostics.

"With all these pieces now in place, we have enabled intelligent asset lifecycle performance management for our subsea production systems, including for the trees," says John Macleod, vice president of technology and strategy, SLB OneSubsea. "Looking forward, the industry needs more data to develop a deeper contextual understanding of equipment performance to safely extend the productive



Mechanical solution for stab-plate based control canister with six electrical stab-plate connectors in the bottom and two electrical and one fibre optic ROV connectors in the top. This mechanical solution can be used for all standard assemblies in the Subsea DigiGRID™ portfolio.

life of offshore assets and to enable circularity."

For Fouzi Bouillouta, Global Program Manager – EngageSubsea at Baker Hughes, maintaining equipment up-time is critical. With the growing digitalization of a growing number of subsea assets, his aim, using tools such as the company's modular engageSubsea platform, is to break down data silos, consolidate multiple data streams and bring end-to-end operational visibility and analytics. The system provides a real-time, 360-degree view of installed equipment, preventative maintenance forecasts and critical alarms.

Bouillouta doesn't see digital technology as a black-box approach to problem solving. Rather, the engageSubsea platform is a visualization tool that helps optimize how people communicate and collaborate on the processes that will maximize up-time. One standout feature is engageSubsea Remote, a module enabling remote operations for both Baker Hughes users and customer operations. With it, Baker Hughes has the capability to provide remote technical support via the use of augmented reality tools located on a platform. "This creates a lot of value, instead of sending someone offshore or having to keep someone offshore to look at problems if something happens," says Bouillouta.

"Today's business complexity necessitates a shift from a reporting culture to true transparency and collaboration in the energy industry. With asset integrity management still representing a significant portion of OPEX, the market needs a solution that leverages data and expertise to proactively manage assets and reduce costs.

"When we speak about digital technology, it sometimes sounds very complex, and expensive, but really it's all about providing a competitive view of the subsea ecosystem."

Credit: Siemens

"We are designing systems to be able to perform well under significant uncertainties in the system and environment for extended periods of time and without external intervention, that is, operator monitoring and control."

– Endre Brekke,
Product Lifecycle Manager for Subsea Automation and Control, Siemens

Credit: OneSubsea

"The industry needs more data to develop a deeper contextual understanding of equipment performance to safely extend the productive life of offshore assets and to enable circularity."

– John Macleod,
Vice President of Technology and Strategy, SLB OneSubsea

Credit: Baker Hughes

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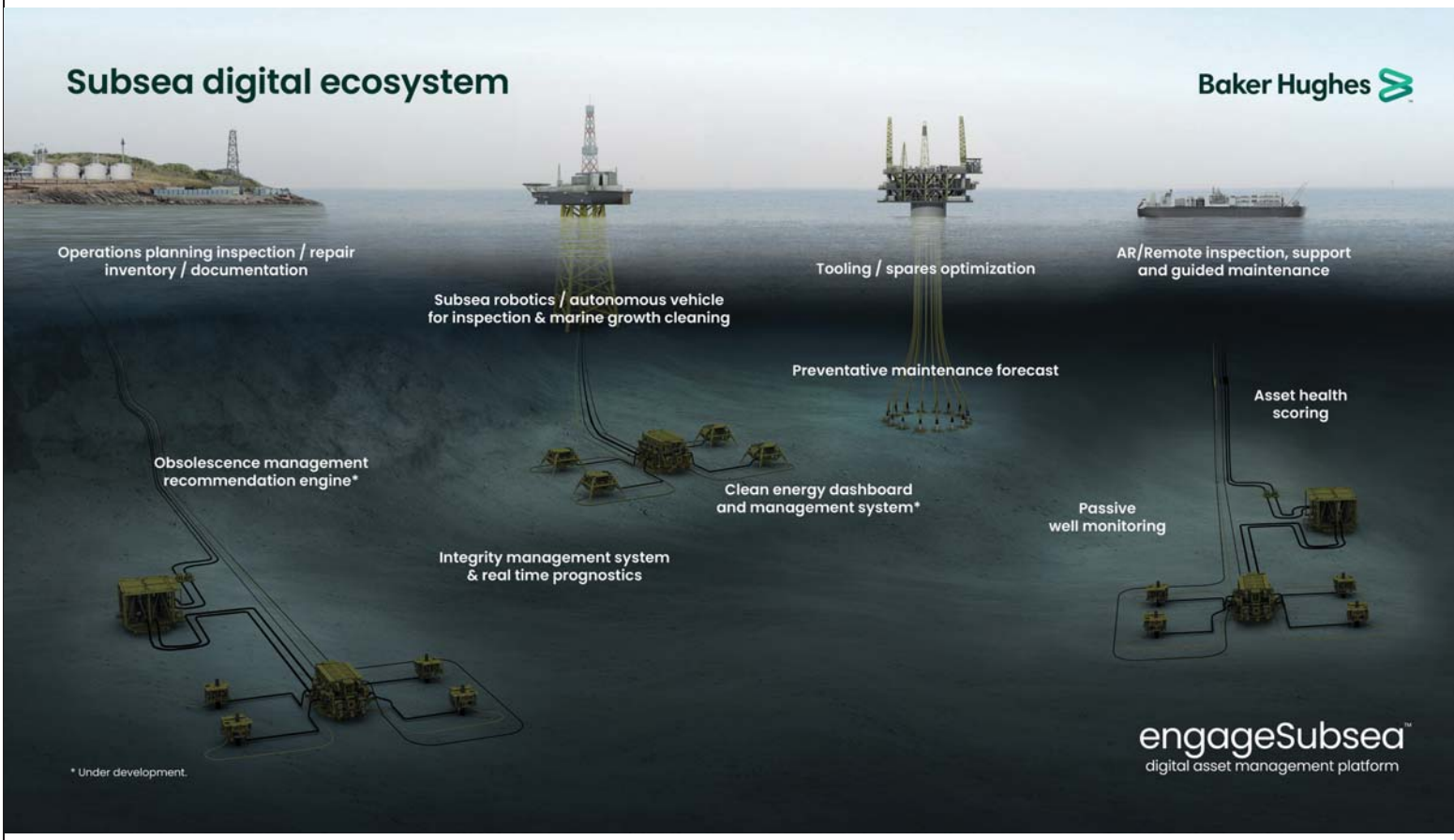


Fram Sør Will be the Tipping Point for Subsea Electrification

OneSubsea, an SLB joint venture, recently announced a contract award for its all-electric subsea production system, and John Macleod, vice president of technology and strategy at SLB OneSubsea, sees it as the onset of a tipping point.

"Large investments have been made across the industry to make this capability a reality, and we now see several projects on the horizon that use all-electric as their base case."

The first project is the recent contract award from Equinor for the front-end engineering design (FEED) of a 12-well, all-electric subsea production systems project in the Fram Sør field, offshore Norway. The solution will use SLB OneSubsea's standard subsea tree design, upgraded with a fully electrified power, control and actuation system.

"You can only go so far by optimizing component-level performance," says Macleod. "As we add to our electric capabilities toward a complete pore-to-grid solution, this will trigger further step changes in performance, enabling greater and greater system-level optimization capabilities and cost efficiencies.

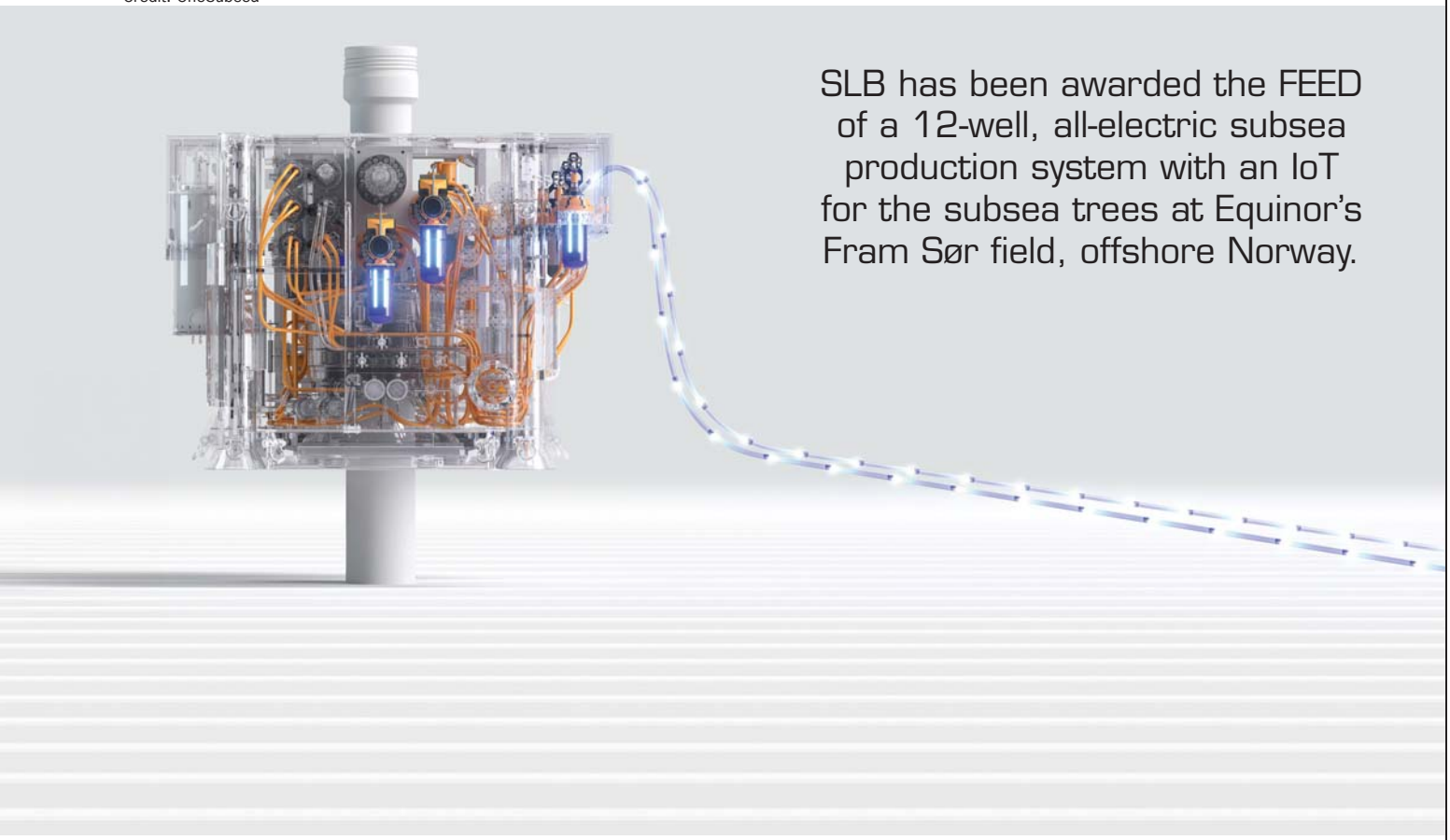
"Additionally, an all-electric approach can help to overcome some of the limitations associated with legacy offshore power and control systems. Some of the cases we have looked at for tiebacks into mature infrastructure show an all-electric approach can help to enable the viability of these tiebacks.

"It will also enable the remote control of such assets during the operational phase. The resulting reduction in project cycle time and costs and the ability to produce previously inaccessible reserves can redefine an asset's net present value for the better."

All-electric systems are well suited to local energy generation and storage which can be an additional enabler to project viability. Also, electrification leads to reduction of surface infrastructure at the host facility, coupled with the reduction of hydraulics eliminating hydraulic power units and large topside reservoir.

In the future the integration with autonomous underwater vehicles, subsea wireless and subsea power solutions will support even more reduction of infrastructure topside.

Credit: OneSubsea



SLB has been awarded the FEED of a 12-well, all-electric subsea production system with an IoT for the subsea trees at Equinor's Fram Sør field, offshore Norway.

"Electrification at a system level will drive simplification of integration with existing infrastructure, moving more to a plug-and-play model for infrastructure led (ILX) resources, for example," says Macleod.

This is especially important for tiebacks into busy facilities, where plug-and-play power and communications result in much simpler topside modifications, much lower cost and much smaller environmental footprint rebuilding topsides.

The elimination of high-pressure hydraulic systems is expected to enable operators to go further and deeper, improving production and making even marginal fields more viable.

"Electrification is in some cases the only solution to achieve technical, commercial and operationally viable solutions for long distance developments. Using traditional systems, it will be much harder and costly to achieve both acceptable safety and operational performance compared with hydraulic systems during, for instance, shutdown and pressurization of the system. Digitalization of subsea assets facilitates more opportunities for conditioning monitoring, which allows for predictive maintenance and planned interventions or the potential to avoid equipment failure altogether."

One of the key changes SLB has made is to go from a spring-operated on/off system to a battery-operated and motor controlled one, facilitating much better positional control.

"Ultimately, more control and more data enables realization of optimization that in time may lead toward more closed loop automation, as well as more cognitive workflows. This is becoming an extremely interesting area."

Macleod points out that the benefits of increased electrification and instrumentation have been recognized across many industries, and history shows that once the benefits are demonstrated at scale, adoption accelerates. "That's why we believe that the Fram Sør project could pave the way for accelerated industry-wide adoption of all-electric subsea technology, as it offers that industrial, scalable solution. It is built on a solid, proven technology platform, while offering lower cost, smaller footprint and simplified architecture. It is also a necessary piece in the overall digitalization effort of our industry."

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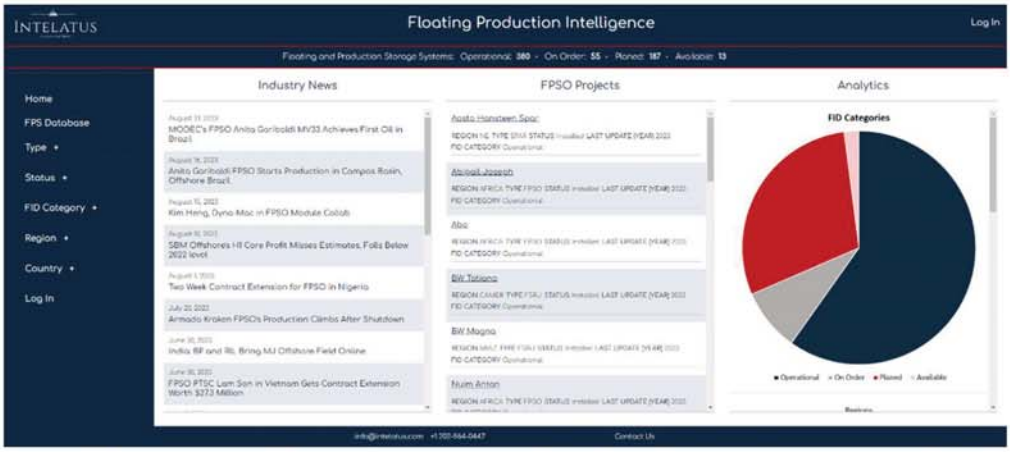
Floating Production Systems Intelligence



Introducing the **ultimate online resources for offshore energy professionals** - the Floating Production Systems Intelligence and the Floating Wind . This comprehensive database provides key technical and commercial details on all floating production systems worldwide.

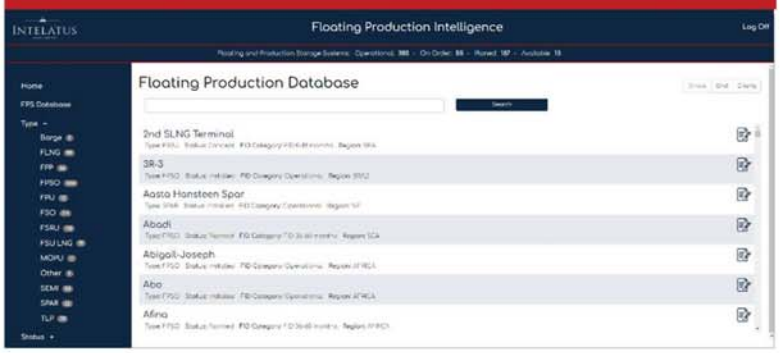
Track Progress and Production on:

Operational: 380

On Order: 55

Planed: 187

Available: 13



With over 700 floating production unit listings, the database is the most extensive compilation of FPSO, FPU, FPS and other floating production system information available.

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PRECIOUS

As global offshore markets evolve to create future, rising up to meet these challenges i Offshore Services. Offshore engineers won' but they might be the most important.

By Joseph Keefe

Credit: N-O-S

In August, Northern Offshore Services (N-O-S) unveiled its unique I-Class Crew Transfer Vessel (CTV), powered by the first commercial application of Volvo Penta's IPS Professional Platform. In the cutting-edge ***IMPRESSER***, N-O-S designed a flexible, future-proof CTV that will adapt to and accommodate new technologies and energy solutions over the next 25 years, all of which is targeted to exceed the needs of their most important cargo: the offshore engineers that they serve.

"The offshore wind industry is relatively young and has grown tremendously during the last 15 years. Since we began N-O-S in 2008, we have seen wind turbines become significantly larger, which results in more maintenance, increased downtime and more technicians at sea," said David Kristensson, N-O-S Group CEO and Owner. He adds, "These are just some of the challenges that are catalyzing innovation and driving the design and manufacture of our vessels in house to meet the customer demands of tomorrow."

Operating globally in over 90 wind farms, N-O-S vessels completed 118,000 successful cargo and/or personnel transfers in 2023 alone. The young firm has quickly become one of the world's most recognizable providers of CTV's. With 67 vessels, operating mostly in CTV markets, Donsö-based N-O-S also found the CapEx to fund 24 newbuild deliveries during the same timeframe. That would be heady stuff for most companies, but as Mr. Kristensson often says, a forwarding thinking firm "should not just sit on its hands, rather, it should stand on its toes."

The lion's share of business takes place in UK and Denmark offshore waters, but N-O-S has its eyes on a bigger prize. The wind farm market, a wild card for investors trying to figure out which way the winds are blowing, creates uncertainties that swirl everywhere; in particular, the American markets. N-O-S has nevertheless plunged ahead there, as well. Their Providence, RI-based fledgling joint venture subsidiary group, American Offshore Services (A-O-S), should have four Jones Act-qualified vessels in operation by year-end. The five-year goal is 6-10 more.

"The offshore wind industry is relatively young and has grown tremendously during the last 15 years. Since we began N-O-S in 2008, we have seen wind turbines become significantly larger, which results in more maintenance, increased downtime and more technicians at sea. These are just some of the challenges that are catalyzing innovation and driving the design and manufacture of our vessels in house to meet the customer demands of tomorrow."

– David Kristensson,
CEO and Owner of N-O-S Group

Credit: N-O-S

Two Kinds of Green: Quality Trumps Quantity

N-O-S has no intention of expanding only in terms of fleet numbers. This means focusing on converting the existing fleet to one which not only anticipates, but both satisfies and exceeds regulatory and environmental requirements, with an eye on electric and hybrid solutions. That comes at a cost. Some estimates might put the cost of the fully integrated Volvo Penta IPS propulsion system with all the bells and whistles at a 20% premium to another solution. According to N-O-S, that's just smart business.

Johan Inden, President of Volvo Penta Marine, explains why. "It is our partners who, in part, drive our innovation. We are creating something the customer doesn't need today, but will likely want tomorrow."

Looking ahead, a hybrid battery equipped IPS allows longer tours at sea. The diesel engines provide safety and speed enroute, but once on station at a windfarm, the vessel can operate on electric only. These IPS equipped vessels can operate in electric, hybrid or diesel modes. Recharging the batteries can take place underway. But if not, then it can be done using Volvo Penta's modular containerized portable battery charging units at the dock of your choice.

"Green" is a moving target. What was green previously may not qualify in the future. That creates serious risk for financiers, operators, and wind farm operators alike. N-O-S has addressed, if not embraced some of that risk. This longer-term vision will deliver what David Kristensson characterizes as "future proof" vessels – hulls that can be upgraded in terms of propulsion and environmental solutions – is just the ticket.

N-O-S looks forward to the day that greener vessels will provide better day rates. In the meantime, that involves risk – financial risk. Kristensson explains, "I would say that we have difficulties to cover our costs where we've been building greener vessels today. The economics are not there yet. So, we are building our platforms so that you

Credit: N-O-S

Credit: Joe Keefe

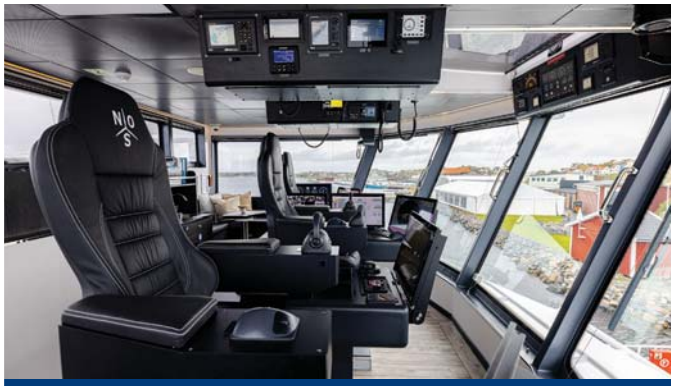
WHEN IT COMES TO UNMANNED ENGINEERING SPACE CONTROL, IT DOESN'T GET ANY MORE HIGH-TECH OR CONVENIENT THAN VOLVO PENTA'S BRIDGE MOUNTED ENGINEERING CONTROL STATION.

Credit: N-O-S

THE INNOVATIVE N-O-S IN-HOUSE DESIGNED FIVE-PIECE HIGH GRIP FENDER SYSTEM.

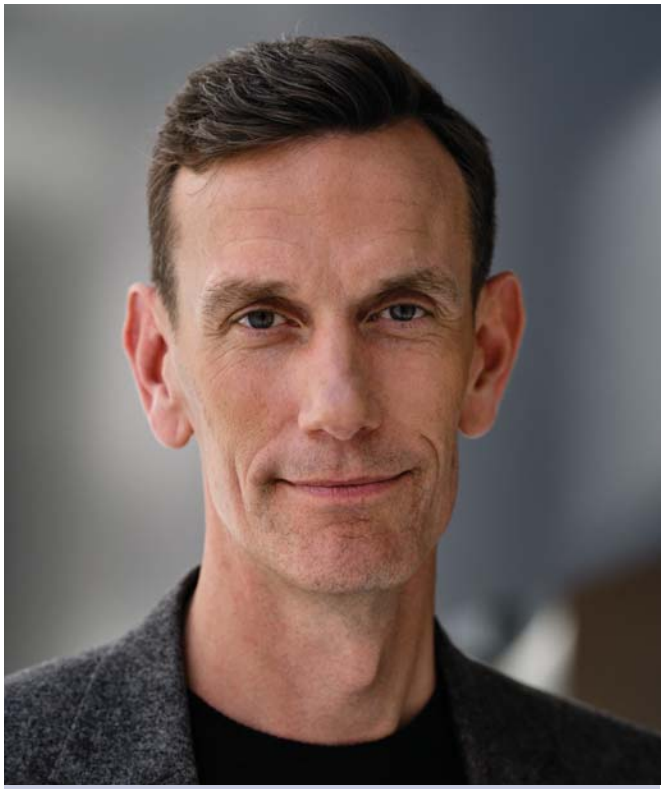
Credit: N-O-S

THE MODERN CTV BOASTS MAXIMUM COMFORT FOR THE WIND TECHNICIANS IN TRANSIT. N-O-S KNOWS THAT THESE PERSONNEL ARE THEIR MOST IMPORTANT CARGO. ON THE CTV IMPRESSER, THEY WILL ALL ARRIVE AT THE OFFSHORE WIND FARM READY TO WORK, FREE FROM MOTION SICKNESS.



Credit: N-O-S

THE BRIDGE ARRANGEMENT ON THE NEWEST N-O-S CTV. A HIGH TECH, MAXIMUM VISIBILITY WORK ENVIRONMENT THAT INCLUDES AN INDUSTRY LEADING CONTROL SEAT FOR THE CHIEF ENGINEER, AS WELL.



Credit: Volvo Penta

Johan Inden,
President of Volvo Penta Marine

can convert it later when the commercial sense or the right project might demand it. Then, you don't need to build a new vessel, you can upgrade the existing platform. Of course, there are benefits to having a green platform today, as compared to conventional vessels."

Comfort & Safety, too

As industry moves towards having permanent offshore crews on board, and moving away from dayshift work for larger fields, bigger and more capable vessels will be required. Today, there are 7,000 turbines on the water, but matching vessel size to the size of turbines is a big challenge, especially as wind moves further offshore. Newer, bigger turbines demanding bigger, more robust boats that can perform in harsher conditions, for longer periods of time. Summer work may not be a luxury any longer. It is no accident that N-O-S finds itself at the leading edge of this transition.

Offshore engineers – typically non-mariners – need to get offshore safely and in real comfort. Workers who arrive at the worksite seasick, battered by rough seas, cannot provide professional service, assuming they are in any condition to work at all. N-O-S is mindful that these personnel are their most important cargo. The modern CTV boasts maximum comfort for wind technicians in transit. On the CTV IMPRESSER, they arrive offshore ready to work, free from motion sickness. In an industry where it is a struggle to find and keep qualified technicians for challenging work environments, this operational philosophy is an attractive value-added plus for offshore energy firms.

The ongoing modernization of N-O-S tonnage takes many forms. Take their proprietary, in-house designed "high grip fender," for example. Vexed continually by the short life span of traditional, low-tech bow fendering equipment, N-O-S set out to develop their own five-piece system, which involves different materials for each segment, all of which can be replaced or serviced individually. The innovative fix allows CTVs to push at wind towers using less fuel and energy. Combining an omnidirectional propulsion system and the High Grip Fender, N-O-S operators leverage the versatile I-Class CTV to make longer, safer journeys and safely offload and onboard technicians in any sea condition.

Balancing Act: Operational Integrity & Financial Realities

It is no accident that N-O-S executives David Kristensson and Martin Landstrom are both professional mariners and bring career experience from the tanker side of the equation. Kristensson told ***OE***, "We look at things from an operational point of view. This is important to us because we have been mariners ourselves. Perhaps if you are from the capital side, your focus is more economics. We look at things more from the operational side, and this is one of the benefits of our experience, as we gain our success."

Veterans of the well-established and sometimes tedious and redundant oil major SIRE (OCIMF) inspection protocols, Kristensson and Landstrom understand the demands that these requirements imposed on the tanker sector. And, for good reason. A similar inspection scheme has evolved in the CTV sector. N-O-S executives, mindful of their roots, have embraced the concept and are determined to not only be in compliance, but to lead from the outset.

Kristensson explains, "We didn't bring safety inspections to wind, but we brought experience with how it works. We used that knowledge in our company when the wind industry started to increase the quality inspections. The

Credit: Joe Keefe

THE CHRISTENING OF THE CTV IMPRESSER WAS A JOYFUL EVENT, WELL ATTENDED BY A WIDE SPECTRUM OF INDUSTRY STAKEHOLDERS. ON THE DAIS WERE THE MANY CHILDREN OF BOTH N-O-S EXECUTIVES DAVID KRISTENSSON AND MARTIN LANDSTROM. FOLLOWING THE PLAYING OF BOTH THE SWEDISH AND DANISH NATIONAL ANTHEMS, THE MAGIC MOMENT TOOK PLACE TO THUNDEROUS APPLAUSE FROM THE JOYFUL GATHERED MASSES.

THE WELL ATTENDED CHRISTENING OF THE CTV IMPRESSER, THE LATEST N-O-S ADDITION TO ITS IMPRESSIVE 67 VESSEL FLEET.

Credit: Joe Keefe

industry has come very far, and today is very much up to date with quality inspections, and safety management systems. And, some of the [energy] customers are the same because the oil firms are starting to work in wind, as well."

Kristensson continues, "For us, it is very important to be one of the quality leaders because that is what we believe in and also, it helps us to gain work. Our customers look and both quality and performance. But, not just for us; the whole industry needs to be safer, because accidents can impact future work offshore."

The Future is Now

N-O-S envisions a 25-year lifespan for all their tonnage – whether achieved through re-power or newbuild. This means anticipating and penetrating new offshore markets – wherever they emerge, embracing new technologies that advance a greener footprint, emphasizing safety, while also creating free space on board for core operations. Eco-friendly fuels and new propulsion solutions lessen the carbon footprint of not only N-O-S, but also the industries that they serve. That's not happening tomorrow. The future is now.

Kristensson looks ahead, opining, "What has been primarily a northern Europe industry is now starting to go global. Taiwan and China were the first to start outside Europe, and now we see it taking off in the US, but may-

Credit: N-O-S

Martin Landstrom,
Director, N-O-S

be going a bit slower there than expected. The outlook in the next five years is for huge growth in the offshore wind industry. Certainly in Europe, but also globally."

Just as offshore wind can take lessons learned from oil tanker safety protocols, so too can the fledgling North American wind markets benefit from experience – and yes, mistakes – that the European markets have seen. Kristensson explains, "What can the US do today? Exactly what you are doing: looking at Europe and try to learn from our experiences. You are also starting from a higher perspective because the turbines you are starting with are already quite big, and in Europe, we started with much smaller turbines."

"It is not easy to be first in any market or endeavor. This requires close collaboration with Flag and Class," says Kristensson. As N-O-S looks ahead to a second, cutting-edge I-Class vessel, it will come bringing 'lessons learned' as they grow their nascent U.S. subsidiary, American Offshore Services. In an uncertain world and an unpredictable offshore energy environment, that's a safe bet.

"What has been primarily a northern Europe industry is now starting to go global. Taiwan and China were the first to start outside Europe, and now we see it taking off in the US, but maybe going a bit slower there than expected. The outlook in the next five years is for huge growth in the offshore wind industry. Certainly in Europe, but also globally."

– David Kristensson,
CEO and Owner of N-O-S Group

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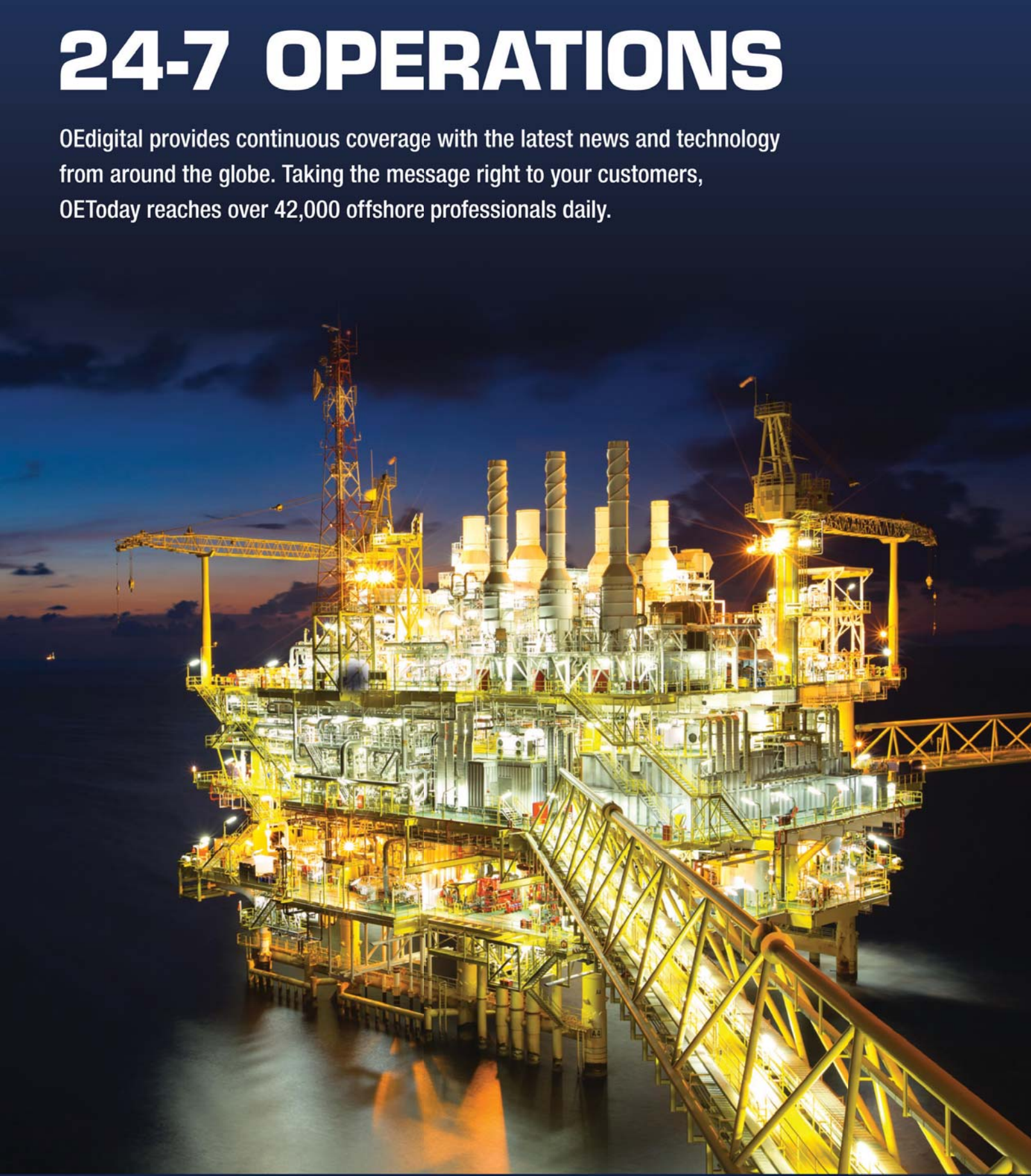

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Pakistan's Offshore Drilling History

Offshore exploration for oil and gas in Pakistan specifically in Indus Basin Offshore area has a history stretching over six decades, characterized by both ambitious efforts and significant challenges.

By Hamna Ghias Sheikh

Despite drilling nearly 18 wells, the region remains largely unexplored, with only modest natural gas discoveries in Miocene sandstones. However, each exploration attempt has contributed valuable insights, laying the groundwork for future endeavors.

The journey began in 1961 when the American Sun Oil Company conducted seismic surveys and drilled three near-shore wells. Although these early efforts, along with those of German company Wintershall in the 1970s and the U.S.-based Husky later on, did not result in commercial hydrocarbon discoveries, the geological data gathered was crucial in shaping subsequent exploration strategies.

In the 1980s, exploration efforts intensified when Pakistan's Oil and Gas Development Company Limited (OGDCL) partnered with Canadian firms to drill the PakCan-1 well. This effort, however, resulted in non-commercial gas quantities, underscoring the technical and environmental challenges inherent in the region. Similarly, the Sadaf-1 well drilled by another U.S. company in 1989 turned out to be dry, despite advanced seismic studies.

The 2000s saw renewed international interest in Pakistan's offshore potential. In 2004, French oil giant TOTAL ventured into the deep waters of the Indus Basin with the Pak-G2 well, drilling to an impressive depth of 4,750 meters. Although the well was dry, it provided critical data on the region's complex geological formations. Shell followed in 2007 with the Anne-1X well, drilling to 3,250 meters. Despite the absence of significant oil or gas discoveries, these efforts enhanced the scientific understanding of the basin's subsurface structures.

The most recent and perhaps most high-profile attempt came in 2019 when ExxonMobil, in collaboration with ENI, OGDCL, and PPL, drilled the Kekra-1 well. Located 143 miles off the coast of Pakistan and at a depth of 6,200 feet, this project was Pakistan's most ambitious offshore drilling venture. Expectations were high, with hopes that a major oil discovery could propel Pakistan into the ranks of the world's top oil producers. Unfortunately, the venture wasn't successful. However, according to experts, the critical misstep in Pakistan's offshore exploration efforts has always been giving up after just a few attempts, leaving untapped potential languishing beneath the seabed. Without proper robust strategy to present to investors, the country has struggled to attract the necessary capital and expertise in offshore exploration.

The technical and infrastructural challenges the country face today are significant, but they are not insurmountable. By failing to address these issues head-on and develop a compelling case for investment, Pakistan has inadvertently stalled progress on what could be a transformative resource for Pakistan's energy future.

An essential aspect of addressing these challenges lies in the integration of successful methodologies from other countries. Notably, Chinese Geological Surveys have proven effective in gathering vital data for offshore exploration in Pakistan. These surveys have provided valuable insights into the complex geological formations of the Indus Basin, offering a clearer understanding of the region's subsurface structures. The success of these surveys underscores the importance of leveraging international expertise and advanced technology to enhance Pakistan's exploration efforts. By building on the comprehensive data already obtained by the Chinese, Pakistan can better target promising areas for future drilling, thereby reducing the risks associated with offshore exploration.

While past offshore exploration efforts in Pakistan's Indus Basin have faced significant challenges, the potential for future success remains considerable. To unlock this potential, Pakistan must focus on fostering international collaborations that bring advanced drilling technologies and expertise to the table. At the same time, implementing policy reforms that make the country a more attractive destination for foreign investment is crucial. Encouraging innovation and research, particularly in partnership with global experts, is essential. Moreover, maintaining a strong emphasis on environmental stewardship and risk management can position Pakistan for a breakthrough in offshore exploration. With strategic alliances and a renewed commitment to leveraging cutting-edge geophysical techniques, the Indus Basin may yet yield the substantial oil and gas resources that could transform Pakistan's energy landscape.

In essence, Pakistan's journey in offshore exploration has been long and arduous, yet each setback has brought the nation closer to a potential breakthrough. By learning from past challenges and embracing future opportunities with the right mix of technology, policy, and collaboration, Pakistan can navigate the complexities of offshore exploration and realize the full potential of its energy resources.

IT'S [MENCK] HAMMER TIME!

Driven by a "massive step change in offshore wind turbine technology" premised on growth of the per unit size and output, Menck – an Acteon brand – last month unveiled what it touts as a "game-changing" MHU 6000W Wind Hammer, the largest hammer in its repertoire and a continuing a legacy of innovation since 1868 from this north Germany industrial company.

By Greg Trauthwein

Images courtesy Acteon

We recently visited with Fabian Hippe, Marine Foundations Sales Director, Acteon, for a discussion on the new pile driving unit and the markets it will serve. Hippe, based just north of Hamburg, is well-suited to discuss the company and the market evolution, as he joined Menck in 2006 and for a five-year stretch to 2021 served as its managing director.

"We are approaching the limit that mankind can build right now," said Hippe, "as with the 6000 we have maximized the weight of the ram that we can build."

Though the Menck hammers were originally designed for [and still used in] the offshore oil and gas market, the MHU 6000W is designed to meet the growing demands of the offshore renewable sector, opening up new possibilities for offshore wind projects by handling larger and heavier piles in increasingly challenging environments.

"Fifteen [or so] years ago we were talking about 2-4 MW turbines; today we're installing 15-16 MW turbines, now we're talking about 25 MW turbines. This is a massive step changes in technology," said Hippe.

Everything about the offshore renewables market is big, and while there are starts and stops in some regions, Menck and Hippe are eying massive market growth for units of this size starting in 2028. Hippe said that today Menck has committed to the forgings for the new MHU 6000W, and the plan is to have them built and available for use by the start of 2027 – aiming for 2027 to have it available.

To put the growth of renewables in perspective, Hippe said that five years ago, offshore oil and gas accounted for about 60% of Menck's revenue, the other 40% to offshore renewable energy. Today that script is flipped, and while the offshore oil and gas business has been stable, "there has been a tremendous growth in renewables," and today about 75% of Menck's revenues come from offshore renewable energy with about a quarter from oil and gas.

THE TECH BEHIND THE HAMMER

The Wind Hammer is engineered to drive larger piles in tougher environments and install longer piles in deeper waters, to enable the deployment of a future generation of monopiles with top diameters of up to nine meters. Delivering from 100 kJ to 6,250 kJ of energy to drive monopiles with diameters up to 9 m and beyond, the Wind Hammer provides unmatched power and efficiency.

When Menck was formed more than 156 years ago by "two guys who joined together to manufacture boilers," even in the first year of business they developed a steam-

powered engine to drive a pile, said Hippe.

To put the amount of power being laid down by its hammers in perspective, Fabian Hippe said the smallest unit in its arsenal today – a 100KJ, double impact hydraulic hammer – delivers a force analogous to a Porsche crashing into a wall at about 28 mph. The new hammer coming to market in 2027 is a 6250KJ system, "which is the equivalent of a Porsche hitting a wall at 190 mph!

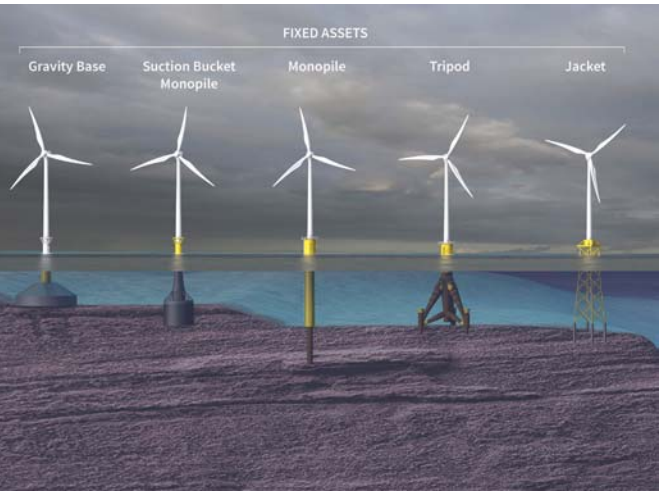
Key features of the hammer include a double-acting hydraulic drive, closed-loop control, shock absorber cartridges and comprehensive safety mechanisms. By driving a larger hammer at a lower energy, the Wind Hammer also reduces machinery wear and tear and minimizes underwater noise.

While driving impact is critical to efficient build out of offshore wind farms, so too is doing the job with a minimization of noise as 'noise pollution' is increasingly a point of contention in the world's waterways.

"We need to drive the pile, but we need to be quieter in the water column to adhere to regulations," said Hippe. He said making the equipment larger has actually had a positive effect on the noise emitted.

"Oversizing the equipment has a positive impact on noise, as you're striking with a heavier weight at a lower

> ***To put the amount of power being laid down by its hammers in perspective, Fabian Hippe said the smallest unit in its arsenal today – a 100KJ, double impact hydraulic hammer – delivers a force analogous to a Porsche crashing into a wall at about 28 mph. The new hammer coming to market in 2027 is a 6250KJ system,*** ***"which is the equivalent of a Porsche hitting a wall at 190 mph!"***



Courtesy Acteon

Courtesy Acteon

velocity and delivering the same energy."

By incorporating the Menck Noise Reduction Unit (MNRU), the Wind Hammer ensures efficient and environmentally responsible installations, reducing noise, pile fatigue and operational costs.

In addition, the MHU 6000W machinery will be connected to Menck's real-time digital and data platform, meaning the machine draws on decades of pile-driving experience and places that knowledge at the fingertips of the operator offshore, while giving full situational awareness to offshore operations and onshore engineering and equipment management real-time support.

"As the offshore renewable sector expands beyond traditional regions, we face new challenges, including unexplored natural soil deposits," said Hippe. "The MHU 6000W Wind Hammer is designed to meet these challenges head-on, delivering the power, precision and operational insights to install the ever-larger foundation structures required as wind turbine sizes continue to grow. As we venture into deeper waters and navigate changing soil conditions, this innovation is critical to ensuring we remain at the forefront of the renewable energy landscape."

All images courtesy Argeo

ARGEO LISTEN –

Electromagnetic System for High Accuracy Marine Contactless Cathodic Protection Measurements

By Johan Mattsson

Autonomous Underwater Vehicles (AUV's) have been introduced as efficient tools for subsea pipeline inspections. It has also been demonstrated that AUVs can be used to perform contactless and continuous electric field measurements of the Cathodic Protection (CP) systems along pipelines. In this article we present a newly developed and commercialized sensor system for accurate and low noise electric field measurements. We also present electric field data along a pipeline section together with analysis and estimation of anode material consumption derived from continuous electric field measurements.

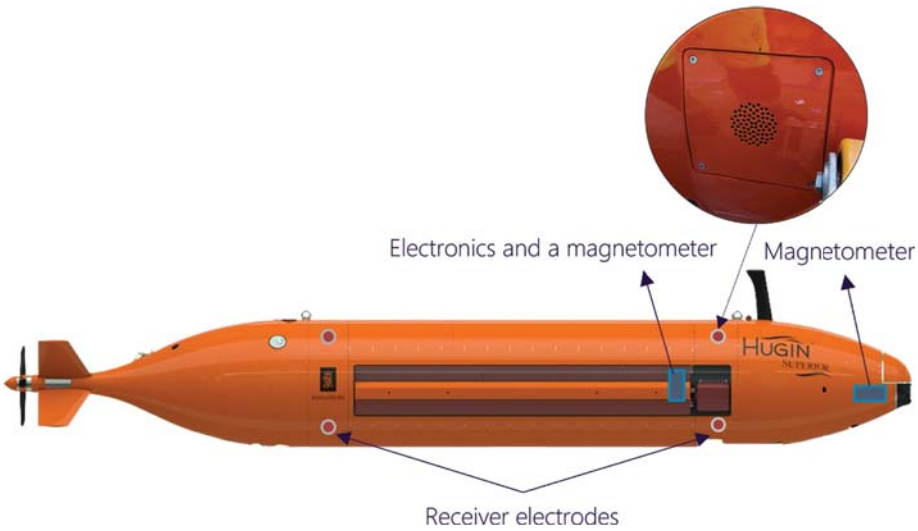


Figure 1. The AUV with the eight electrodes flush mounted with the hull.

Argeo Listen – An electromagnetic receiver system

The Argeo Listen electrode system consists of eight silver/silvercloride (Ag/AgCl) electrodes mounted in flush with the hull of an AUV. Four electrodes are located in the aft and four in the front, figure 1. The mounting in flush with the hull reduces turbulence noise and prevents damages during AUV launch and recovery. Each electrode is connected through a cable inside the AUV to the acquisition electronics mounted inside a pressure bottle. The bottle is placed inside the AUV in an area chosen with the objective to minimize electromagnetic noise. The electronics bottle, cables and electrode housings and electrodes are depth-rated down to 6,000 m.

The eight electrodes are connected into eight pairs (channels) where each channel measures an electric potential field difference. The eight pairs are chosen to span the 3D space redundantly and are used to construct the full 3D electric field. The reason for this design configuration is to achieve higher accuracy in the electric field components compared to trying to measure them directly. The eight electrode pairs also give redundancy which is useful if any or several of the electrodes should degrade during a dive. The redundancy also provides additional noise suppression.

The powering of the electronics from the onboard batteries is designed to be independent on the charging levels of the batteries as well as independent on the power consumption from other onboard payloads and instruments. This is important to achieve sufficiently low noise during measurement with low influence from the AUV platform itself. As a result, the sensor system provides highly reliable and calibrated electric field measurements, with excellent signal-to-noise ratio (SNR) in CP measurements with typical noise levels less than 0.005 μV/cm. In addition, the motion stability of the AUV platform with high accuracy navigation data enable electric field measurements of sufficiently low anode output electric currents for complete CP integrity evaluation along a pipeline.

The acquisition electronics controls the sampling, digitization, and pre-processing of the EM-data before being merged with the navigation, heading, pitch, roll and environmental data as well as with magnetometer data. Automatic quality control of the nav merged EM-data then enables short turnaround time for evaluation of the CP status.

Efficient contactless CP-measurements and analysis

A working CP-system along a pipeline generates electric currents in the seawater. In particular, electric current is going out from each anode and returns into the structure at dedicated drain points or at places where the coating has been removed or damaged into bare metal. The CP-system works as a galvanic element where the electric current in the seawater generates an electric field.

An AUV equipped with the Argeo Listen electrode sensor system continuously measures the 3D electric field at a height of 5-10 m above the pipeline in a speed of 3-4

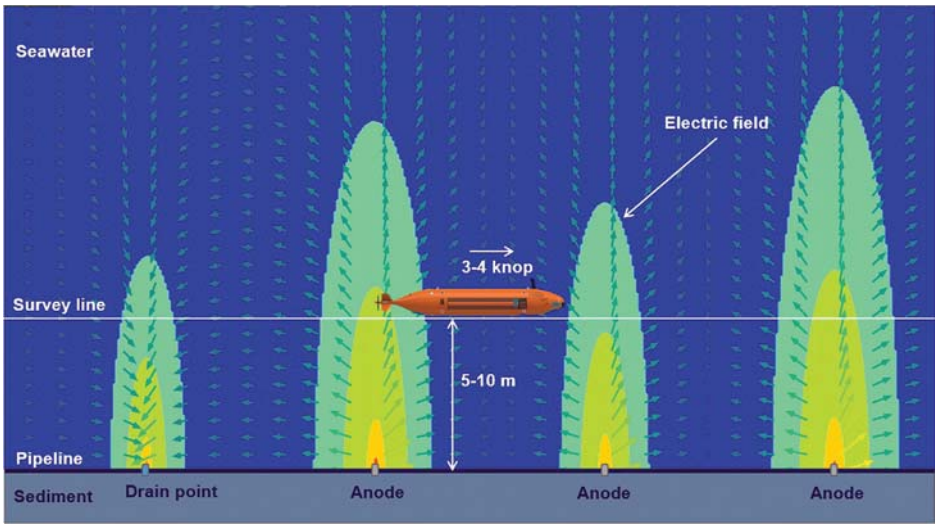


Figure 2. A typical AUV electric field measuring configuration along a pipeline.

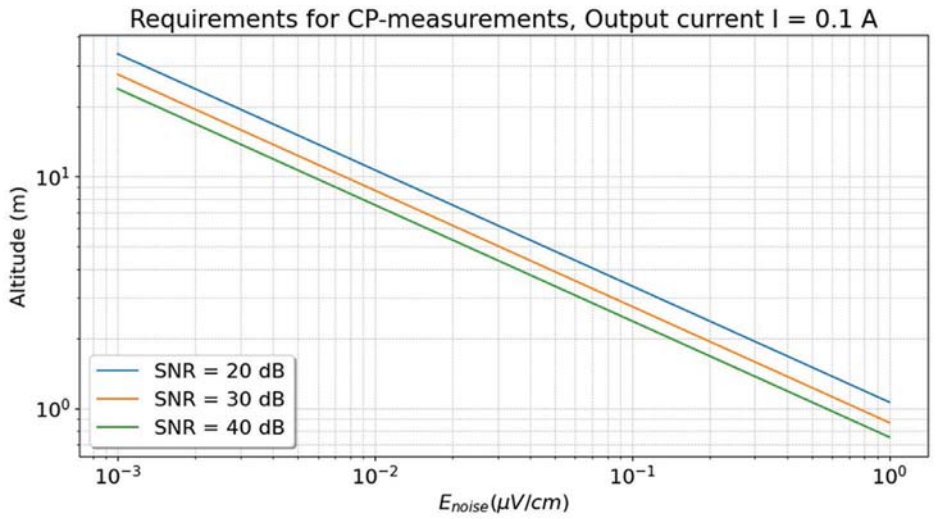


Figure 3. Noise and altitude requirements for the measured electric field data after processing given a 0.1 A anode output electric current amplitude.

knots. This is illustrated in figure 2 where the CP resulting electric field amplitude and direction are visualized as well as the AUV on a survey line on top of the pipeline (black line on the sediment).

The electric currents going out from each anode into the seawater, are obtained from solving a linear system of equations which relates the electric current going in and out from the pipeline with the measured electric field. The low electric field noise and high accuracy of navigation data results in accurate estimations of the electric currents. The pipeline with anodes can be buried or be exposed above the seafloor. The electric field measurements and output current estimations work equally well for buried pipelines. The burial depth and positions of the anodes along the pipeline are determined directly from a combination electric and magnetic data.

Once the electric currents going out and into the pipeline have been estimated, the anode material consumption rate can be calculated. In fact, the anode output current is proportional to the material loss rate. With this information together with camera pictures, the status of the CP system can be determined. Damages are revealed and the amount of consumed anode material is determined.

The accuracy i.e. the error in the consumption rate estimation is highly dependent on the SNR. Ideally, a 30 dB SNR is necessary for sufficient accuracy. This requirement determines the maximum sail line altitude above the pipeline given a typical noise level in the measured data. With the Argeo Listen system it is possible to fly the AUV 13-15 m above the pipeline and still reach an SNR of 30 dB when the output current is 0.1 A as can be seen in figure 3. However, to resolve output currents down to 0.02 A, the recommended AUV height above the pipeline is set to 5-10 m. This altitude range also allows for good multibeam echo sounder and camera/laser coverage along the pipeline.

A CP data case

The electric field data along a pipeline shows the behavior of the CP-system. The anodes generate output electric currents into the seawater if they are active. The amount of current depends on several things like the remaining material in the anode, coating of the pipeline, i.e. return points for the electric current into the pipeline etc. The sacrifi-

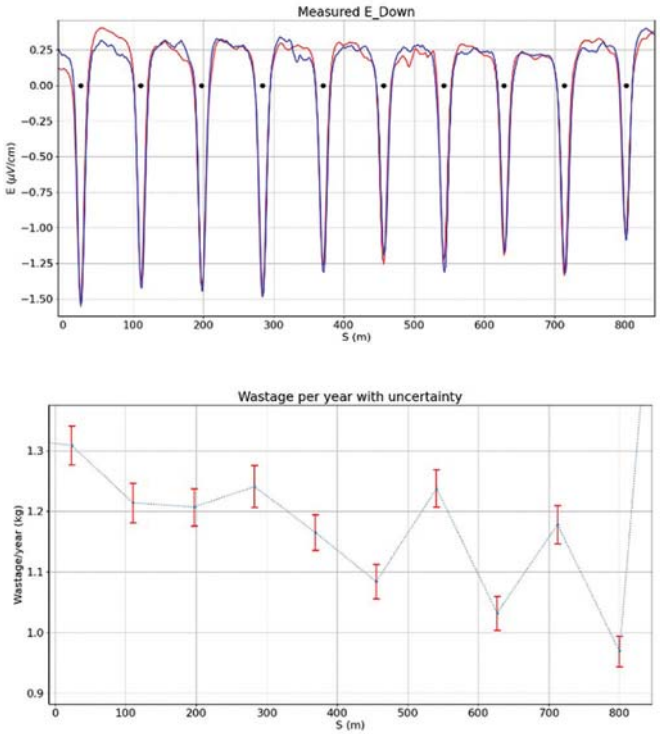


Figure 4. Vertical electric field data (top) and estimated anode material consumption rate (bottom).

cial anodes are supposed to corrode instead of the pipeline provided that electrical circuits are completed through the electrolyte, which is the seawater in this case.

When sacrificial anodes are not active, meaning no electrical current flows from them, it typically indicates that the protective coating on the pipeline is intact, preventing direct contact between the pipeline steel and the seawater. The coating acts as an insulating layer, breaking the electrical circuit necessary for corrosion to occur. Therefore, the sacrificial anodes will not corrode (or will corrode at a significantly reduced rate) because there is no pathway for the electric current to flow through the water to the pipeline.

The behavior of the electric field reveals directly where electric current is going in or out. This is most clearly seen in the E_Down component of the data. Hence, by investigating the behavior of the electric field, it can be concluded if there is any electric current going out from each anode and how the electric current is returning to the pipeline. That will tell how active the cathodic protection system is.

The AUV integrated electrode sensor system has successfully been tested on a pipeline section partly on the seafloor and partly buried. The AUV was sailing 5-6 m above the pipeline section in 3 knots speed. Multiple runs back and forth were conducted to check for repeatability and consistency in the acquired data. The vertical component of the electric field from two of the runs is shown in the top graph of figure 4. The measurements can be performed at any speed the AUV can do.

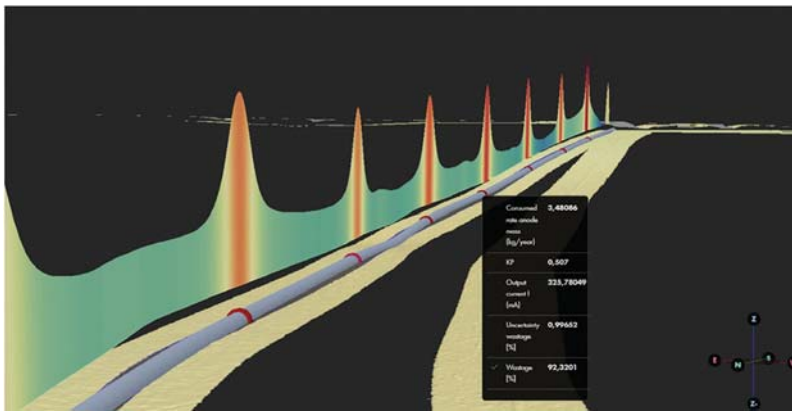


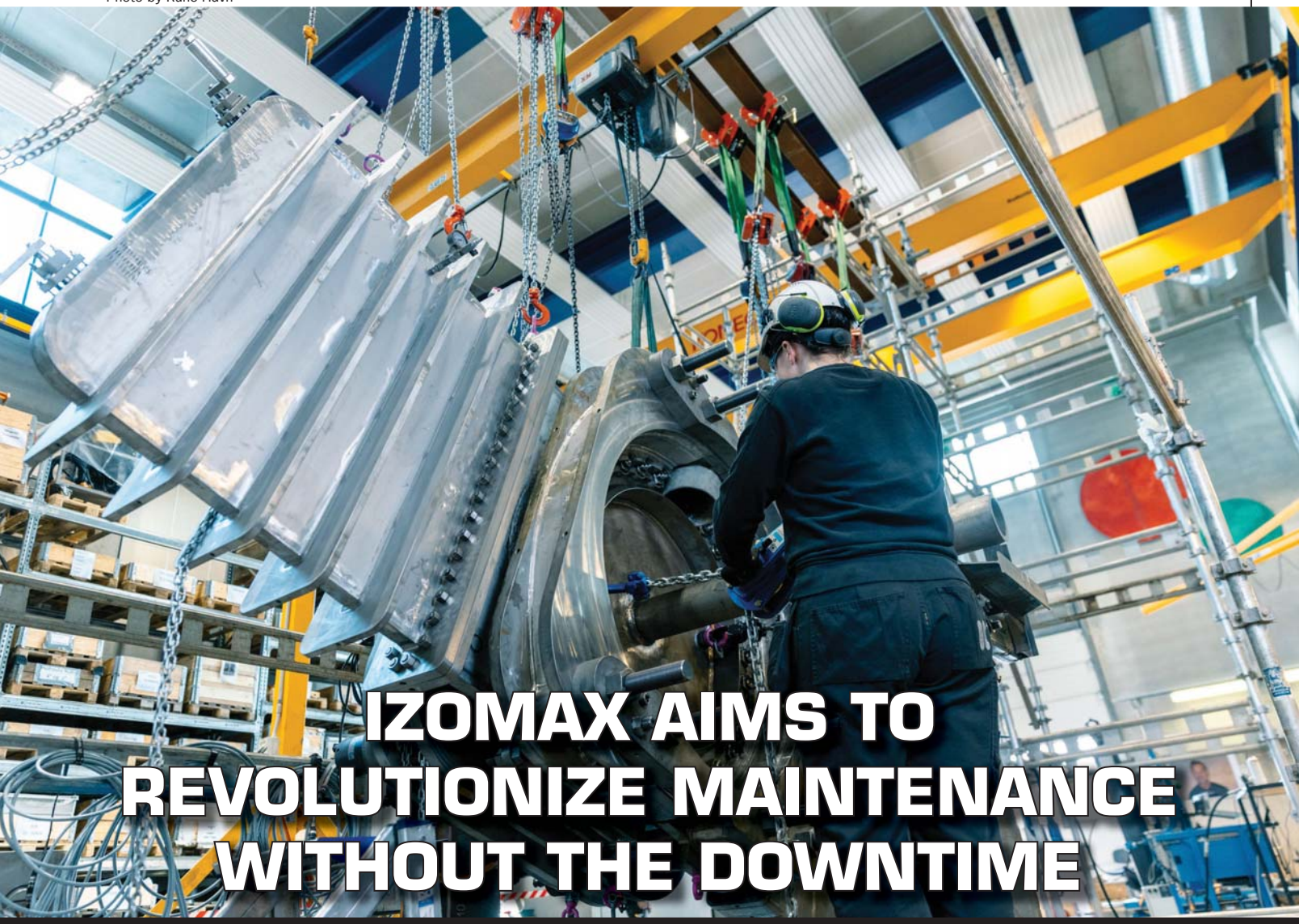
Figure 5. A pipeline on the seafloor with measured bathymetry. The anodes are color coded to show the estimated material wastage. On top of the pipeline the vertical electric field is visualized on the AUV survey line. Detailed anode information from the data analysis is shown in the black text box.

The signal-to-noise ratio in the signal peaks above the anodes, the black dots, is high (about 30 dB). The repeatability between the runs is good with low noise in the data between the peaks. This data accuracy makes it possible to determine the anode output currents with high precision and then enabling good estimations of the anode consumption rates with error bars shown in the bottom graph of figure 4.

The acquired electric field data, the resulted output currents and estimated anode material consumption rates are integrated with camera images, multibeam and synthetic aperture sonar data for a complete pipeline analysis. An example of this is shown in figure 5 where all data from a pipeline survey are merged and displayed in 3D using the Argeo Scope cloud based software. The merge of the CP measurements with other data in 3D enables fast and efficient evaluation of the complete pipeline integrity.

In summary, it can be concluded that the AUV with the implemented Argeo Listen electrode system together with accurate navigation data facilities efficient and accurate investigations of pipeline CP-systems on or below the seafloor.

Photo by Rune Havn



IZOMAX AIMS TO REVOLUTIONIZE MAINTENANCE WITHOUT THE DOWNTIME

Time was when a defunct butterfly valve could shut down an entire LNG plant for maintenance and repairs. With the patented AOGV (Add-On Gate Valve) technology gaining traction with major operators, Stavanger-based Izomax enables the execution of crucial maintenance and repair work without shutting down operations and impacting uptime and revenue.

By Johan Mattsson, Principal Engineer, Izomax

The AOGV technology has proved its capabilities over the seven years that have passed since the initial operation, on the Goliat installation in the Barents Sea. Since then, Izomax has delivered a total of 200 operations worldwide that have caught the eye of the energy sector. This summer, Izomax signed a three-year global frame agreement with Shell. The supermajor has ambitions to use AOGV to reinvent their maintenance practices and introduce predictive maintenance measures to reduce downtime and unplanned outages while maintaining revenue streams.

In this article, I will highlight two case studies proving the versatility of the AOGV system and give a short account of the R&D process.

Developing the AOGV

The research and development journey leading up to this and many similar successful case studies, was made possible with the help of friends and a small team of colleagues. I was on double duty, as both manager and engineer in the Pipe Intervention team at Stavanger-based IK Group (which later spun out Izomax). Back in the early 2000's, IK group was working both on subsea and topside piping maintenance and repairs.

Replacing a valve or intervening in a processing plant required a shutdown, isolating the problem area with the existing system valves, emptying the affected area of liquids and/or gas to make it safe and then starting work. If hot work was involved, a further set of risk management and health and safety procedures were implemented to ensure a safe working environment.

The basic idea for what would become the AOGV initiated after a facilitated HAZOP for a Hot tap and stopple with the purpose of opening a pair of flanges. We asked ourselves: What would it take to open a flange pair while a system is running? Working directly on flange pairs instead of using existing valves seemed like a better approach to isolate the problem area, rather than shutting down whole sections of piping.

The question was left unanswered at that point, but it kickstarted something in my engineering mindset; something that would keep me occupied on an off for the next years. With my experience from manufacturing pressure holding clamps for subsea use, I knew a lot about pressure containment and piping engineering that I could put to use solving the problem.

Instead of being dependent on the pre-installed valves that come with the plant, I wanted to do something radi-

Photo courtesy Izomax

Inventor of the AOGV, Kjetil Aamodt at Izomax, with the very first cardboard prototype showing the principle of the AOGV.

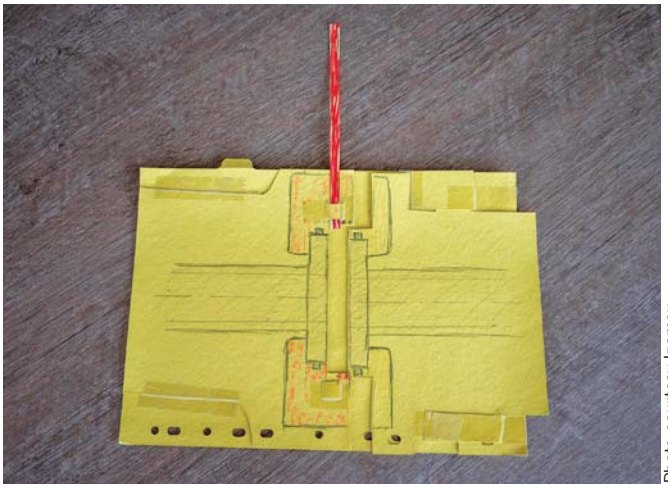


Photo courtesy Izomax

The very first cardboard prototype showing the principle of the AOGV.

Case Study 1:
Replacing a Flow Meter on a Live Butane Pipeline

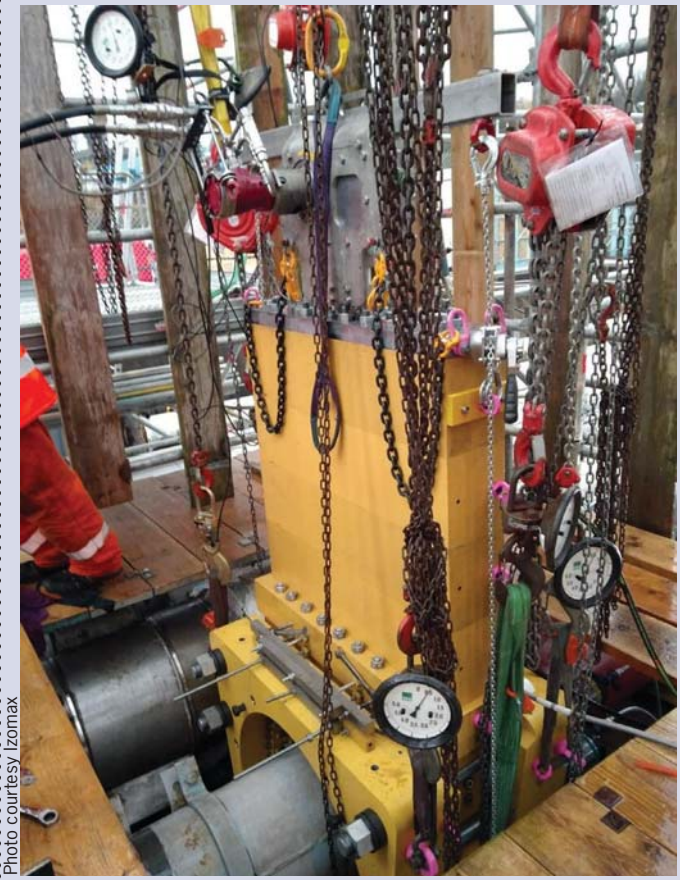


Photo courtesy Izomax

Working with the Izomax AOGV to replace a leaking flow meter on a 18-inch butane pipeline described in case study 1.

An 18-inch class 300 butane pipeline, spanning 11 km and operating at 12 bar (175 psi), had a leaking flow meter that needed to be isolated for replacement during a brief, three-week window. Pipeline design entailed that it could not be fully drained and refilled, making conventional solutions impractical. Located in a residential area, the asset owner sought to avoid the risks and costs associated with a complete pipeline replacement. There were no suitable isolation points near the defunct meter, limiting intervention options. Several alternative solutions had been deployed to attempt to solve the external leak, without success. Further complicating matters, asbestos was discovered in the gasket, requiring specialized handling, decontamination, and disposal procedures.

Izomax's patented AOGV provided a mechanical isolation solution without hot work. The tool can insert and retract a blind spade between flanges on a pressurized system, allowing for the isolation of sections for repairs and replacements. In this case, the AOGV enabled the flow meter replacement on the butane pipeline while minimizing gas freeing and keeping the main process operational.

An 18-inch ASME Class 300 AOGV was designed, engineered, and manufactured for the application. Working closely with the facility owner, we attended a HAZID on the site and hosted a Factory Acceptance Testing at our Stavanger workshop.

Identifying Asbestos within the gasket in question, Izomax engaged with specialist handlers in advance, while developing a brushing tool to safely remove any remaining debris. The performance of the AOGV was verified for high pressure services using finite element analysis and by pressure testing to 1.43 times design pressure (as per the EU Pressure Equipment Directive (PED) (2014/68/EU) and EN 13445 – Unfired Pressure Vessels prior to deployment).

A team of five Izomax AOGV specialists carried out this onshore operation, lifting the AOGV into place via a mobile crane, before scaffolding and rigging was used to assemble and deploy the system. Providing positive isolation, the AOGV mechanical isolation tool inserted an isolation spade between a flange pair and a built-in isolation valve, enabling depressurisation and gas-freeing of a very short section of the pipeline. The isolation allowed for removal and replacement of the leaking flow meter, whilst keeping the liquid butane inventory within the pipeline.

Timely completion was essential, as the terminal's butane tanks had only three weeks of production capacity. Izomax completed the operation in two weeks. The AOGV's ability to isolate the pipeline provided the only effective solution. The operation was executed without any health, safety, or environmental incidents, and no non-productive time was incurred.

No hot work was required, significantly reducing time, cost, and health, safety, security, and environmental (HSSE) risks. The asbestos in the existing gasket was safely handled and disposed of through an approved decontamination process on-site. The integrity of the system was maintained throughout, and the plant was restored to its original operating condition without complications.

By avoiding a production shutdown, the Izomax AOGV system saved the operator an estimated $15 million USD. This direct financial saving, combined with the mitigation of operational risks, made the AOGV technology the key factor in the success of the project. Without it, a much costlier and riskier alternative would have been necessary.

Photo by Rune Havn

Installing the Izomax AOGV (Add-On Gate Valve) on a test stand in the workshop.

cally different. Operating directly on the flange meant coming up with a method to separate the flange and insert a device that mechanically blocks the flow through the pipe, isolating one side of the device (and the contents in the pipe) from the other. And it was how to do that separation that eluded me for many years.

The main challenge when separating a bolt circle on a flange on a live, pressurised system is the pressure within the pipe. Depending on the pressure, the separation force pushing the sections of pipe away from each other can be hundreds of tons. To loosen the bolts on the flange, I needed to find a way to both compress the flange so bolts could be loosened, and at the same time contain gas or liquid at pressure escaping through the loosened flange seal.

I understood that the idea was a radical one and was hesitant to share the process until it was more mature. So, I spent the next years mulling this problem, on and off. Mostly while spending time at my cabin in the mountains of scenic Telemark in Norway, chopping wood and hiking.

I would be drawing sketches on scraps of paper lying around, trying to figure out a way to make the idea work, then leaving it dormant for months at the time in between. I finally figured it out one day in 2015, and I experienced physical reaction when it finally dawned on me. I remember the hairs on neck standing on end as I had this pretty intense Eureka moment! Then I grabbed some cardboard divider sheets from an old ring binder lying around and made the very first working prototype of the mechanism. With this in hand, I could approach a small circle of trusted friends and colleagues to refine the principle.

Case Study 2:

Replacing a Stuck Butterfly Valve at a Supermajor LNG Plant

Photo courtesy Izomax

Replacing a defunct butterfly valve on the 36-inch flare flare line of one of the world's largest LNG facilities, as described in case study 2.

At one of the world's largest LNG facilities, a butterfly valve on a 36-inch class 150 flare line operating had been stuck in a closed position for an extended period. The stuck valve prevented the backup flare system from being used, thus limiting the options available to undergo planned maintenance without shutting down the entire plant. The working temperature of the line could range from ambient to cryogenic in the event of a sudden slugs of liquids, and the faulty valve needed to be replaced. Solutions were required to mitigate HSSE risk associated with the valve replacement, as there were no suitable built-in isolation points close to the stuck valve. The plant operator had evaluated alternatives, concluding that few, if any, robust or cost-effective solutions were available.

The Izomax AOGV mechanical isolation tool which can set and retract a blind spade in a pair of flanges on a pressurised process system, e.g. a flare system, without hot work. The blind spade or a combination of several spades in different locations can facilitate the replacement of valves and pumps. The AOGV can also be used to take a vessel out of a closed loop temporarily for safe entry and bringing it back online, while the main process is kept in continuous operation.

A 36-inch ASME class 150 AOGV system, the largest developed to date, was designed, engineered, and manufactured for the valve replacement operation on the live flare system. The design incorporated geometrical constraints from the site, adhered to the Pressure Equipment Directive and EN 13445 standards and was verified through third-party FEM/FEA analysis. DNV assessed the tool's conformity, including design review, material evaluation, and production oversight. Pipe flexibility was also analysed to ensure the system met piping design codes.

Detailed planning was conducted in collaboration with the facility owner, including site preparations and operations. A HAZID was performed, and the customer attended a Factory Acceptance Test at Izomax's facility in Stavanger. Testing of the AOGV tool at cryogenic temperatures (-196°C) was completed, and the operation was rehearsed on a mock-up rig before shipment to the site.

During the operation, scaffolding and rigging support were provided by the site owner, and coordination among personnel in the confined space was critical. The Izomax AOGV system was installed and suspended to prevent additional load on the pipework. After leak testing, the flanges were separated for approximately 30 mm, and a blind spade was inserted for positive isolation at the upstream flange. The faulty valve was safely removed and replaced, following agreed procedures. and the system returned to normal operation. The AOGV mechanical isolation system was reinitiated, the blind spade removed, and the system brought back to normal operation. The main flare was operational throughout the entire operation.

The entire operation was completed without any HSSE incidents or downtime, to the client's satisfaction. The AOGV system solved a long-term issue that other technologies could not address due to unacceptable risk levels. Despite logistical challenges due to worksite location, the tool was delivered and operated on schedule.

The plant's system integrity was maintained throughout the process, with the flare returned to its original condition after the AOGV operation. The LNG plant was running full speed through the complete operation, no interference to the delivery of the LNG.

This project highlighted the efficiency, safety, and cost-effectiveness of the AOGV system. The ability to isolate equipment without disrupting operations makes it a valuable tool for similar industrial applications, where traditional methods pose higher risks.

Building a Pressure Chamber Around the Flange

In essence, the principle of the AOGV is to build an entire pressure chamber around the flange to contain the pressurized contents. The pressure chamber unit incorporates bolts that can compress the flange, relieving force on the original bolts so they can be loosened. A separation of a couple of centimetres then allows a mechanical blocking device like a blind spade or a spectacle blind to be inserted before re-tightening the flange. The same principle allows for a wafer butterfly valve to be replaced, as the valve is situated between pipe flanges.

To isolate a section of pipe, blind spades may need to be inserted at several points, leaving the section mechanically isolated so work can be done. Achieving smart interventions on a working process plant, requires that there are redundancy sections that can take over the operational workload. The inherent capabilities of the AOGV technology uncovers at lot more of micro redundancy with its ability to insert positive isolation in any flange pair.

Pressure is definitely one of the main challenges, but so are the dimensions of the piping involved and the complex nature of a processing plant. Plants and any sort of piping installations can be messy places, with close proximity to other piping, constraints such as walls and a general lack of space. That is why the majority of AOGVs are designed as bespoke units. A close inspection of the worksite, and even 3D scans in some instances, are the basis for designing the hardware to be produced for the specific purpose.

The main principle of the AOGV is the same for all pipe dimensions, from 2-inch pipes up to our largest AOGVs to date, the 36-inch pipes described in the second case study. But of course, complexity increases with the larger pipe diameters as the weight and size of the AOGVs involved create their own logistical and HSE challenges. The second-generation AOGV we use today has improved from the first-generation version in that we have added hydraulic compression of the flange to the unit, replacing the bolt compression we first used.

Izomax is in the maintenance and repair business, and for operators facing huge and complex maintenance and repair challenges, what matters most is to find the least costly option. The alternatives for operators are, in many cases, to shut down installations completely and bear the massive cost of revenue loss during downtime. Operators easily see the benefits of AOGV, frequently commenting that the technology has revolutionized their maintenance options.

Offering the alternative to isolate smaller areas for required maintenance, and execute planned, predictive maintenance on crucial components, the AOGV entails a cost-effective option to shutdowns. In cases where there are parallel process segments for redundancy backups, AOGV operations on one segment will not impact the overall operation of the installation.

Floating Wind Turbine to Help Cut Platform Emissions

TotalEnergies unveiled plans to install a 3 MW floating wind turbine to provide renewable power to Culzean offshore platform in the UK North Sea. The 3 MW floating wind turbine will be located 2 km west of the Culzean platform, 220 km off the eastern coast of Scotland. The turbine, expected to be fully operational by end 2025, will supply around 20% of Culzean's power requirement.

It will be installed on a modular, light semi-submersible floater hull designed by Ocergy, allowing for fast assembly and optimized costs, as part of the pilot project selected by Crown Estate Scotland's Innovation and Targeted Oil & Gas (INTOG) leasing round.

XolarSurf Offshore Solar Prototype

Developed as part of a joint effort by Saipem, Moss Maritime, and Equinor, the XolarSurf offshore floating solar prototype unit has been deployed offshore Norway where it will remain under sea trials for one year for performance and production assessment.

XolarSurf is a modularized floating solar technology developed by Moss Maritime, Saipem's Norwegian subsidiary specialized in design and engineering services for the offshore energy as well as other ocean-based sectors.

The solution can produce electricity from solar panels mounted on floaters specifically designed for marine environments.

Its design grants significant flexibility as it is formed by 'islands', each one consisting of several smaller floaters providing a safe space for the photovoltaic panels. Each floater may generate up to 35-45 kWp of installed power.

Designed to withstand waves up to 8 meters, the deployment represents the first full-scale test and a key milestone in the readiness of the product.

Offshore Nuclear for O&G Decarbonization?

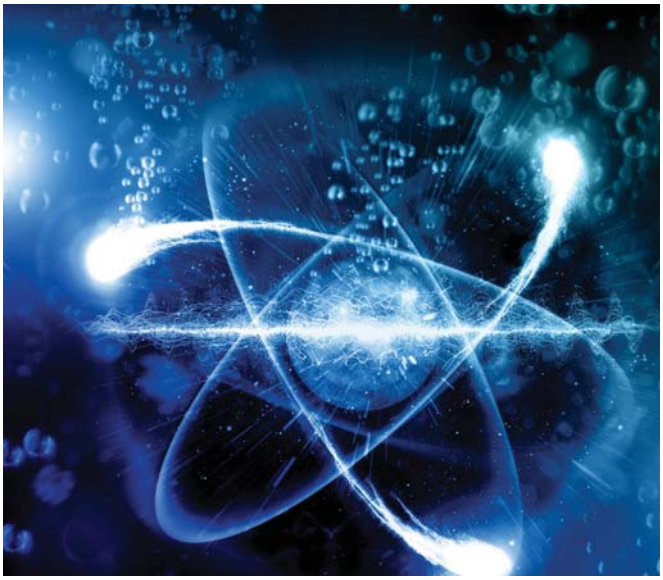
Saipem and newcleo have signed a collaboration agreement to identify solutions for the offshore application of newcleo's technology to produce nuclear energy, which could provide zero-emission electricity for oil and gas installations.

The companies will study the application of newcleo's Small Modular Lead-cooled Fast Reactor (SM-LFR) technology to provide zero-emission electricity and process heat to oil and gas offshore installations, thereby improving their sustainability performance.

The agreement also allows for the possibility of extending the use of newcleo's technology to produce zero-emission electricity through floating nuclear units, connected to the electricity grid on land or to other users.

newcleo's solution leverages passive security systems (exploiting natural forces or phenomena without requiring active mechanisms), unique in the marine environment, enabling efficiency in the use of extracted uranium.

"The production of zero-emission energy through floating offshore plants equipped with new generation compact reactors could represent a new frontier in the energy transition. With this collaboration agreement, we leverage Saipem's distinct skills in the offshore sector as well as our ability to bring



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innovation to the world of energy infrastructure, to explore new solutions that can accelerate the path towards decarbonization," said Alessandro Puliti, CEO of Saipem.

OPT's PowerBuoy

Ocean Power Technologies (OPT) recently completed the demonstration of its next-generation PowerBuoy, designed as an uninterruptable offshore power supply unit which exploits the energy of waves, sun and wind.

OPT completed more than four months of offshore testing of its next generation PowerBuoy in the Atlantic Ocean off New Jersey. The solar and wind power equipped PowerBuoy also featured OPT's AI-capable Merrows suite of solutions. The system maintained 100% data uptime and the state of charge of the batteries remained over 90% throughout the deployment, according to the U.S.-based company.

During the deployment, several intelligence, surveillance, and reconnaissance demonstrations for potential customers were completed.

OPT's PowerBuoy has been designed to act as an Uninterruptable Power Supply (UPS) which constantly recharges itself by harvesting energy from the waves, as well as wind and sun.

ZEUS Bridges the Power Generation Gap

Aker Solutions, in collaboration with Petronas and Clean Energy System, launched a pilot project featuring the Zero Emission Power Station (ZEUS), a pioneering energy solution that uses oxyfuel combustion with immediate CO2 capture and storage. The ZEUS technology employs advanced oxyfuel combustion to convert high CO2 natural gas into dispatchable power while capturing 100% of the CO2 emissions.

The CO2 is immediately injected into a reservoir for permanent storage or can be used to increase production of both oil and gas before being permanently stored.

The advantage of ZEUS technology innovation is the ability to handle the combustion at elevated pressures, enabling more compact and simplified process equipment. This could lead to significant cost savings while enhancing CO2 management capabilities. In short, ZEUS aims to deliver zero-emission, affordable and reliable power and it is positioned to be a significant bridge technology in the transition to a more sustainable energy landscape.

Jack-Up Platform Enables All-Weather Nacelle Maintenance

Knud E Hansen designed a "Jack-up on Jack-up" vessel concept for offshore wind farm maintenance.

The four-legged jack-up vessel features a 15m wide working platform that can be jacked-up to the height of a nacelle to provide a safe platform for maintenance work on the blades eliminating the need for hazardous rope access.

With a telescopic weather cover fitted on the platform, work on the blades can be done in practically all weather conditions, day or night, resulting in more working hours annually than with conventional maintenance vessels.

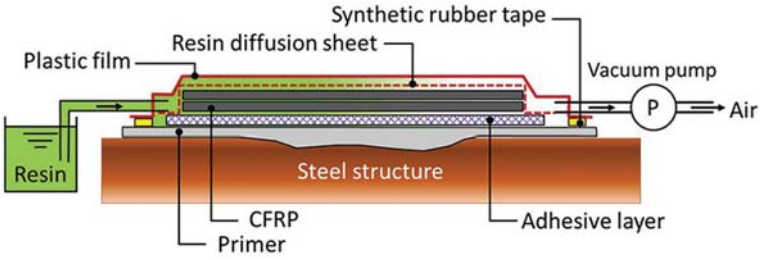
A large, air-conditioned workshop is located at the aft end of the work platform, and when the weather cover is deployed, a virtual factory hall is created around the blade, allowing all types of work to be performed on the blade, minimizing the need to remove the blades and transport them to shore for repair.

Additionally, there is the possibility of inserting an X-Y motion compensating system between the work platform and the platform carriers so the "factory hall" can remain geostationary.

A "cherry picker" mounted on a hammer head at the platform's opposite end provides the access to the nacelle. The main crane is fitted on the elevating structure, allowing for the use of a conventional pedestal-mounted crane with a boom that is approximately 30% shorter than that of a conventional wind turbine maintenance vessel, which should be able to reach the same height, providing a much better view of the blades and the nacelle from the crane driver's cabin.

Measuring 154m in length and 64.4 m in breadth, the vessel is designed for all kinds of maintenance work on wind turbines up to 20MW, including replacement and handling of nacelles weighing as much as 1,000t at a hub height of 175m, and managing blades up to 130m long. This can be done while it is jacked up in 80m water depth.

TORAY INDUSTRIES

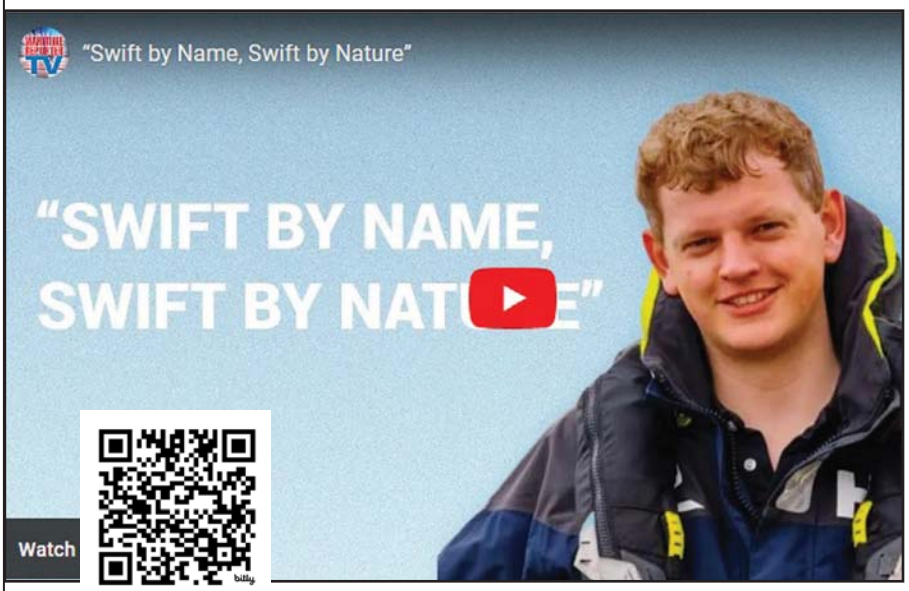


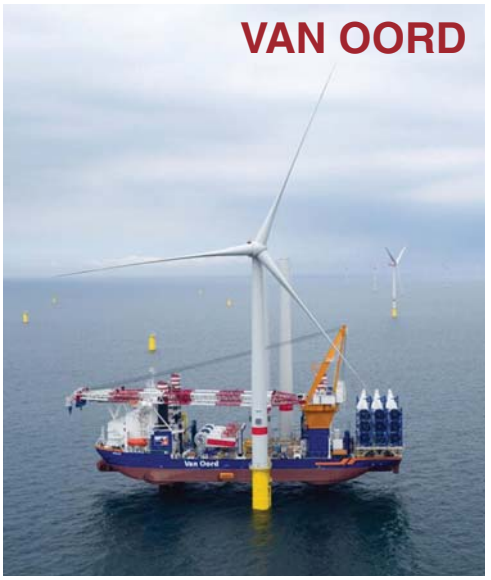
ABS Type Approval for In-Situ Carbon Fiber Composites Repair Technique

Toray Industries became the first in the world to obtain type approval from the American Bureau of Shipping (ABS) for its vacuum-assisted resin transfer molding (VaRTM) process for in-situ ship repairs. The technique entails applying carbon fiber reinforced plastic (CFRP) to corroded areas with reduced thicknesses of floating production, storage and offloading (FPSO) and floating storage and offloading (FSO) systems. ABS accounts for around half of FPSO and FSO certifications. This approval enables these certified vessels to employ the proprietary VaRTM process, reducing the time needed for engineering reviews and verifications for ship repairs.

FPSO and FSO maintenance is normally offshore using steel materials. The welding, or hot work, halts oil and gas production. Toray and MODEC, Inc., jointly developed the VaRTM repair process in 2020. It entails applying Toray's TORAYCA carbon fiber woven fabric, which offers excellent strength and elasticity, to the surfaces of existing steel structures. The next step is to cover the fabric with a film, vacuum-seal, and inject epoxy resin that then cures to complete repairs by bonding the CFRP to the steel structures.

Another advantage of this in-situ VaRTM process is that it is easier than with regular steel-based techniques to transport materials and equipment to locations and perform repairs faster and with fewer people and time. The procedure does not involve hot work, minimizing impacts on oil and gas production.





VIDEO "Swift by Name, Swift by Nature"

Zelim's founder and CEO Sam Mayall has a simple mission: make man overboard recovery at sea easier, more efficient, more predictable. In fact, he wants to make MOB recover 'boring'. To accomplish the job, Zelim debuted a comprehensive system, including the Guardian vessel and Swift in-water recovery system at SMM.

INS to Boost Wind Turbine Installation Precision

Inertial navigation systems (INS) manufacturer Exail has secured a contract to supply three Hydrins INS to Pliant Offshore, an offshore measurement specialist. The units will be integrated into Pliant Offshore's installation measurement system to improve the accuracy and efficiency of wind turbine installations. Pliant's technology is designed to provide real-time measurements of the inclination and position of structures, such as monopiles, during installation. The system uses 3D point cloud technology combined with laser sensors to measure and virtually reconstruct objects with high accuracy.

The integration of Exail Hydrins INS enhances the system performance by providing precise positioning and motion compensation, even on moving vessels. This enables the installation measurement system to take continuous measurements during the pile-driving process, guaranteeing the correct positioning and stability of wind turbines in challenging offshore conditions.

SLB Launches Carbon Storage Well Integrity Assessment Tool

SLB launched a well integrity assessment solution that helps carbon storage developers quantify the risks associated with wells at prospective storage sites with previous drilling activity.

Establishing secure storage sites is essential to enabling growth of CCUS and creating a low carbon energy ecosystem, said SLB. Many prospective carbon storage sites are located in either mature or retired oil and gas fields, and having a large number of wells at a site can increase the risk of potential leakage pathways for the stored carbon.

The company's new methodology for quantifying the probability and potential impact of carbon leakage helps customers understand the risks associated with each well, informing remediation strategies and ultimately estimating the project's long-term viability.

SLB's well integrity assessment solution incorporates advanced failure mode effect and criticality analysis (FMECA) to assess potential leakage pathways, well barrier, failure mechanisms and resulting consequences. Using advanced multi-physics 3D modeling, SLB can assess the volume and flow rates of brine and carbon leakage over time to better estimate risk.

BY THE NUMBERS

RIGS

Worldwide

Rig Type	Available	Contracted	Total	Utilization
Drillship	8	69	77	90%
Jackup	175	300	475	63%
Semisub	25	44	69	64%

Africa

Rig Type	Available	Contracted	Total	Utilization
Drillship		14	14	100%
Jackup	13	18	31	58%
Semisub	1	1	2	50%

Asia

Rig Type	Available	Contracted	Total	Utilization
Drillship	3	5	8	63%
Jackup	78	80	158	51%
Semisub	14	6	20	30%

Europe

Rig Type	Available	Contracted	Total	Utilization
Drillship	3	1	4	25%
Jackup	10	28	38	74%
Semisub	4	18	22	82%

Latin America & the Caribbean

Rig Type	Available	Contracted	Total	Utilization
Drillship		28	28	100%
Jackup	3	5	8	63%
Semisub	2	7	9	78%

Middle East

Rig Type	Available	Contracted	Total	Utilization
Jackup	35	137	172	80%
Drillship				

North America

Rig Type	Available	Contracted	Total	Utilization
Drillship	1	20	21	95%
Jackup	25	26	51	51%
Semisub	2	3	5	60%

Oceania

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

Russia & Caspian

Rig Type	Available	Contracted	Total	Utilization
Jackup	8	2	10	20%
Semisub	1	2	3	67%

Global Average Dayrates

Floaters		Jackups	
Ultradeep water	479.9	High-spec	166.0
Deepwater	254.1	Premium	127.3
Midwater	403.9	Standard	92.4

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 2024
Source: Wood Mackenzie Offshore Rig Tracker

DISCOVERIES & RESERVES

Offshore New Discoveries

Water Depth	2019	2020	2021	2022	2023	2024
Deepwater	20	13	14	22	15	16
Shallow water	88	49	60	40	61	17
Ultra-deepwater	18	12	7	22	12	3
Grand Total	**126**	**74**	**81**	**84**	**88**	**36**

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	602	50,069	24,883
Shallow water	3,274	460,406	155,829
Ultra-deepwater	346	44,411	26,786
Grand Total	**4,222**	**554,886**	**207,497**

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

Region	Number of fields	Remaining reserves gas mboe	Remaining reserves liquids mbl
Africa	586	19,418	13,761
Asia	850	16,856	7,947
Europe	750	12,406	11,728
Latin America and the Caribbean	197	7,863	40,948
Middle East	140	88,227	150,124
North America	467	2,596	13,214
Oceania	85	10,890	1,099
Russia and the Caspian	59	17,006	12,639
Grand Total	**3,134**	**175,262**	**251,460**

Onstream and under development.

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

Source: Wood Mackenzie Lens Direct

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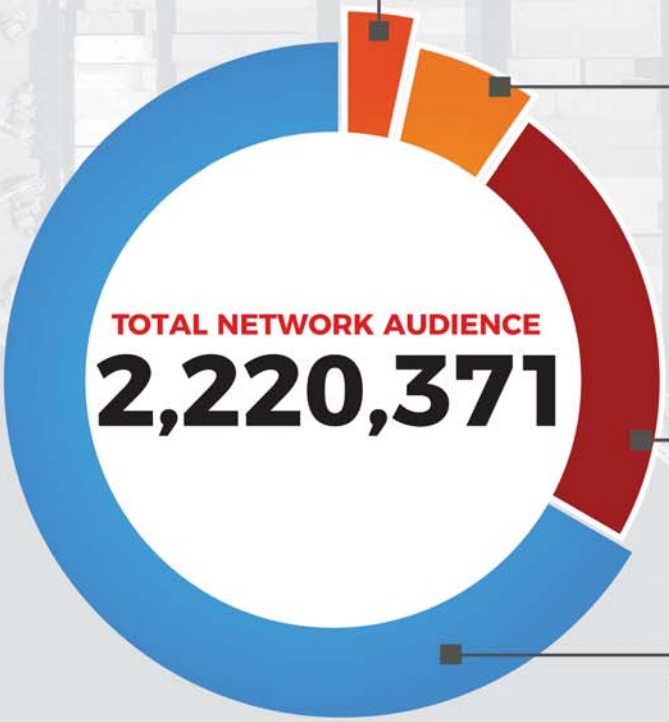

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