

DEVELOPING TECHNOLOGIES FOR THE EVOLVING ENERGY INDUSTRY

SUBSEA 7 NESP

CARBON FOOTPRINT ESTIMATOR

Sizing up our carbon footprint and knowing our impact

FLOWLINE SYSTEMS

Mechanical Lined Pipe: continuing our journey on corrosion mitigation

RISER SYSTEMS

Gimbal Riser Joint: withstanding harsher environments

ASSET INTEGRITY

Award winning new Nano Engineered Sensor and digital twin

ENERGY TRANSITION

Renewables and stored energy systems



subsea 7

BALANCING THE DEMAND FOR ENERGY WITH ENVIRONMENTAL RESPONSIBILITY

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deep 7

HEAD OF TECHNOLOGY GROUP
Olivier Lodeho

GROUP EXTERNAL
COMMUNICATIONS MANAGER
Tracey Miller

August 2021

WELCOME TO DEEP 7

Olivier Lodeho

HEAD OF TECHNOLOGY GROUP



“We must be more agile and responsive than ever before.”

The energy landscape today is increasingly diverse and complex with our society and industry facing an extraordinary period of change. To meet the challenges ahead and to balance demand for energy with environmental responsibility, we must be more agile and responsive than ever before.

The good news is that Subsea 7’s expertise, experience and world-leading portfolio of products and services put us in a great position.

To help us address the challenges we face, we have developed a strategic vision for Subsea 7. It’s focused on two key areas – Subsea Field of the Future, and the Energy Transition.

SUBSEA FIELD OF THE FUTURE – SYSTEMS AND DELIVERY

Over the past year we have brought ground-breaking innovations to market and thus strengthened our Technology portfolio. These include high-performance heated flowlines, free-hanging deepwater risers, cost-efficient materials and digital asset integrity management.

Our active heating flowline technology, Electrically Heat Traced Flowlines, known as EHTF® has been successfully installed in both the North Sea and the Gulf of Mexico. We continue to strengthen our anti-corrosion pipelines solution and our first project using the GluBi® Corrosion-Resistant Alloy lined pipe for Reel-Lay application is under execution. We’ve also successfully completed the qualification of a polymer-lined pipe for a steel catenary riser application in the Gulf of Mexico.

As for decarbonising our work, we are completing the qualification of a Subsea Electrical Power Distribution Unit (SEPDU) with our Subsea Integration Alliance Partner OneSubsea, optimising electrical subsea field architectures. We are collaborating with operators for the final qualification of a Subsea Chemical Storage and Injection Unit and a subsea hydraulic power unit which will enable longer distance tie-back and all-electrical systems and we are also partnering with Buoyant Production Technologies (BPT) to propose a normally unattended installation concept for various processing combinations.

Last but not least, we’re complementing our Asset Integrity Management system offering, with the introduction of a nano sensor. This will disrupt traditional monitoring approaches through its multi-physics capabilities and improved commercialisation.

ENERGY TRANSITION – PROACTIVE PARTICIPATION

Subsea 7 is committed to playing a proactive role in the transformation of the energy industry.

One of the first steps in reducing our CO₂ footprint is to understand how much CO₂ we are actually producing and to achieve this, we have developed the Subsea 7 Carbon Footprint Estimator Tool.

Along with our partner GEPS Techno, we are commercialising autonomous buoys which can harvest green energy. These combine wave generation with solar panels to supply power to subsea modules such as Subsea Chemical Storage and Injection Units, Autonomous Underwater Vehicle docking stations and other technology.

The commitment of the Northern Lights project in Norway demonstrates our expertise in transporting CO₂ in pipelines. In addition, we are currently working with our partner, Strohm, to complete the qualification of Thermoplastic Composite Pipe for Riser application and H₂ transportation.

In offshore wind, we are achieving significant cost reductions through design improvements. At the same time, with our partner FLASC, we are developing new, innovative energy storage solutions which can provide certainty of power supply to consumers and/or maximise H₂ production.

These examples illustrate our commitment to invest in innovative products and systems and to bring them rapidly to market. They present fresh opportunities for Subsea 7, and for the industry as a whole.

These are exciting times where innovation is dictating the future and we are already in play in many important aspects. We are committed to the future of the energy industry and look forward to working with you on the journey.

Olivier Lodeho
Head of Technology Group



STUART HOLLEY
Global Field Development
Group Director

SIZING UP OUR CARBON FOOTPRINT

As the energy industry evolves and recognises the need for a sustainable future, the carbon footprint of field developments is becoming an increasingly important value consideration. In many new developments, reduction of greenhouse gas emissions is fast becoming a necessity to meet local licensing requirements, as well as the operator's sustainability commitments.

As an industry partner of choice for the transition to sustainable offshore energy, and through early engagement with our clients, Subsea 7 recognised that early identification and screening of a development's carbon footprint is an integral element of the value delivery process.

Leveraging the existing knowledge of our autonomous subsidiary, Xodus Group, and following 12 months of development and validation, the Subsea 7 Carbon Footprint Estimator digital tool was launched in late 2020. The tool allows us to identify and estimate all material greenhouse gas emissions associated

with our project deliveries. This includes emissions from our supply chain, vessels and operations.

Since its launch, the Carbon Footprint Estimator has been used more than 100 times to evaluate early engagement studies, FEEDs and tenders. The results captured to date are being used directly to identify which sources of emissions from Subsea 7's project activities are the most significant, and where we should focus our attention and resources when developing our energy transition strategies further. The tool is used actively to identify, evaluate and screen the carbon footprint of different solutions in order to inform and enhance our clients' decision-making, providing greatly improved visibility to ensure emissions targets are achieved.

As the focus increases on the carbon footprint of new projects, we continue to evolve the Subsea 7 Carbon Footprint Estimator, in co-operation with our supply chain, to ensure that we deliver the solutions our clients need to meet their energy transition targets.



Subsea 7
Carbon Footprint Estimator

JULIEN VERDEIL
Strategic Technology Manager –
Technology Development Group

HOW NEXT-GEN EHTF® IS HELPING TAILOR NEW SOLUTIONS

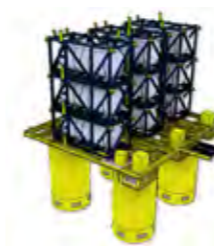
Subsea 7 is now pushing the limits of the technology with the development of the next generation Electrically Heat-Traced Flowline (EHTF®). This combines the best-performing insulation material with a new set of wires to tailor cost-effective solutions and reduce delivery time.

It reflects our ambition to unlock future reserves, improve return and reduce the carbon footprint of our industry. At the same time, it will help us consolidate our leadership in active

heating technology EHTF®, Direct Electrical Heating (DEH), and Hot Water Circulation (HWC).

EHTF® refers to new pipe-in-pipe (PIP) technology designed to remove the risk of wax or hydrate formation in long distance tie-back pipelines. Subsea 7 is a global leading provider of EHTF® technology (a co-development of Subsea 7 and ITP SA) and last year we installed the deepest, most thermally efficient EHTF® in the world.

“Last year Subsea 7 installed the deepest, most thermally efficient EHTF® in the world.”



SUBSEA CHEMICAL STORAGE AND INJECTION

For any field, fluid needs to be conditioned by the regular injection of chemicals in order to ensure integrity of equipment. Traditionally, these chemicals are brought to the injection point by an umbilical.

At Subsea 7, we are currently developing an alternative based on local storage, and injection of chemicals from a Subsea Chemicals Storage and Injection (SCSI) skid. This solution is particularly applicable when umbilical cost is prohibitive – for example with very long tie-backs, or for a brownfield development with limited available space on the host platform due to congested topsides. It brings significant savings in CAPEX, with reasonable OPEX.



SUBSEA ELECTRICAL POWER DISTRIBUTION UNIT

Relocating a major part of the subsea power distribution equipment allows the use of higher voltage, with a reduction in the umbilical cross section. This can help minimise the space required topside, a critical consideration for brownfield developments.

Our Subsea Electrical Power Distribution Unit (SEPDU) – a qualified subsea modular, expandable system – combines a standard subsea transformer and switchgear, and allows reliable power distribution and control in the immediate vicinity of consumers in the field.

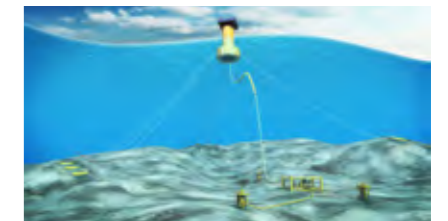


Illustration: BPT

UTILITY BUOYS

Subsea 7 works in partnership with a range of companies to develop new technology and products. Examples include Buoyant Production Technologies (BPT) and GEPS Techno, where we are collaborating to deliver cost-competitive utility buoys which can provide chemicals and power to remote tie-backs. This technology allows the use of minimum-length umbilicals to supply power and chemicals from surface to seabed. Renewable energy sources including wave, wind and solar could be used on these utility buoys, lowering carbon emissions for a sustainable solution.



Richard Jones
Strategic Technology Manager –
Welding and Materials,
Technology Development Group

“Two recent developments have arguably put us even further ahead of the competition – the use of thin liners and an adhesively bonded product, GluBi®.”

INDUSTRY LEADERS IN MECHANICALLY LINED PIPE

For many years, Subsea 7 has led the industry in the fabrication and installation of cost-effective Mechanically Lined Pipe (MLP), particularly when installed by the reel-lay method. Two recent developments have arguably put us even further ahead of the competition – the use of thin liners and an adhesively bonded product, GluBi®.

The use of a thin Corrosion Resistant Alloy (CRA) liner – in this case 2.5mm in place of 3.0mm – can give a significant cost saving, particularly for the more expensive liner grades like Alloy 625. Already well established for flowlines within Pipeline Bundles, the use of a 2.5mm lined MLP has now been qualified for critical fatigue risers installed by Reel-Lay using internal pressurisation. This key technology will have a positive enabling influence on the economic viability of deep water production.

To improve the economics of reeled MLP even further – without thickening the liner – BUTTING developed a solution in the form of the GluBi®-lined pipe. The liner is adhesively bonded to the outer pipe, which maintains its integrity despite the global plastic strain applied by the installation method. Eliminating the need for internal pressurisation greatly simplifies the installation process. This new lined pipe has been qualified for offshore use, as an uncoated product to date, in collaboration with Subsea 7. Subsequently, Subsea 7 was awarded the world’s first GluBi® pipe installation project in 2020, applying it as an inner pipe for the Hod Field pipe-in-pipe system.

New cost-effective pipeline corrosion mitigation solutions continue to be a key focus area for Subsea 7. The company’s polymer-lined pipe products

have demonstrated their quality, longevity and cost effectiveness for water injection flowline applications for years. Building on the success of these water injection products, Subsea 7 is now developing a polymer-lined solution for production flowlines. A key feature is the Linervent™ system, which manages the impact of gaseous species which may diffuse through the liner. Liner corrosion testing and product development to support the qualification process is ongoing. This new polymer-lined solution aims to provide production pipeline corrosion protection, while managing challenges presented by the multiphase product to the liner material.

Subsea 7 continues to develop more competitive pipeline fabrication solutions, and a recent example is the solid-state Friction Stir Welding (FSW) process. A laboratory pipe rotator system was designed, built and mounted on our existing welding machine, allowing full circumference welding of pipes up to 12" OD. A detailed programme of welding qualification testing is progressing, using specifically developed stir-welding tools, carried out on several steel materials up to S690 grade and several thicknesses up to 15,3mm, providing very good mechanical and fatigue results. On completion, a preliminary qualification package will be available to support a technology qualification process involving end users. This will be performed in accordance with international standards to facilitate project adoption.

DEEPWATER RISER VERSATILITY

DEEPWATER RISER VERSATILITY

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VINCENT LOENTGEN
 Strategic Technology Manager –
 Riser Systems, Technology Group

“Currently we are focused on gamechanging technologies which will significantly enhance Steel Catenary Riser and Steel Lazy Wave Riser designs.”

Subsea 7 has a world leading portfolio of riser systems, including coupled and un-coupled solutions. In a rapidly evolving market we are recognised as a key partner for this technology, responding positively to growing demand for greater functionality particularly for deployment in harsh environments. Currently we are focused on game-changing technologies which will significantly enhance Steel Catenary Riser (SCR) and Steel Lazy Wave Riser (SLWR) designs.

GIMBAL JOINT RISER

The Gimbal Joint Riser is an ingeniously simple concept based on the insertion of a multiple hinged joint within the suspended catenary. This absorbs the dynamic movements coming from the floating host. It improves strength and increases the flexibility of the riser in a critical area, allowing the use of SCRs instead of SLWRs. It removes the associated costs of ancillary equipment and delivers significant cost savings in field-layout optimisation. The Gimbal Joint Riser is now undergoing an experimental qualification phase, which will demonstrate its ‘Technology Readiness’.

POLYMER LINED PIPE IN SCR

Subsea 7’s polymer-lined pipe has qualified its first polymer-lined water injection SCR, offering a highly cost-effective corrosion barrier for riser applications, thanks to its inherent fatigue-resistance and lower weight. With its 50-year qualified design life and improved flow assurance properties, polymer-lined pipe has the potential for greater system simplicity. It provides a single and continuous water injection polymer-lined barrier between flowlines and risers, achieving greater CAPEX and OPEX cost reductions.

THERMOPLASTIC COMPOSITE PIPE (TCP)

The development of Thermoplastic Composite Pipe (TCP) in free hanging riser configurations is a promising area – so much so that Subsea 7 has recently made a strategic investment in the leading TCP manufacturer, Strohm. TCP risers are characterised by their robust pipe structure, optimised ancillary and reduced top tension, as well as their imperviousness to corrosion. This results in outstanding performance in H₂S and CO₂ corrosive environments. The smooth-bore, fully bonded polymer liner ensures the best achievable flow delivery properties. In addition to superior mechanical properties, TCP risers can offer a lower global CO₂ footprint.



THE ROADMAP TO SUBSEA AUTONOMY

JIM JAMIESON
 Strategy and Technology Development
 Manager, Subsea 7 Global Inspection,
 Repair and Maintenance (IRM)

Deploying autonomy in underwater vehicle services to navigate the ocean is proving a success. With an established road map, devised to help navigate technical and commercial milestones along with key stakeholder requirements, this technology is now being implemented on operational projects.

REMOTE PILOTING

A recent milestone was the successful deployment of Subsea 7's in-house developed technology to pilot remotely operated underwater vehicles (ROVs) onboard the inspection, repair and maintenance (IRM) vessel *Seven Viking*. Our first remotely piloted dive with a Mohican Observation class ROV was closely followed by the commissioning and piloting of a Schilling work-class ROV.

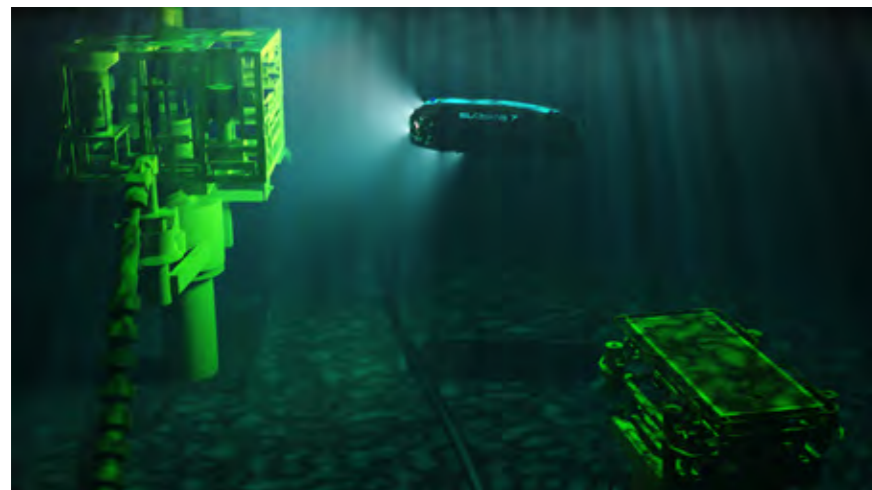
Subsea 7's dedicated Onshore Control Centre (OCC) Stavanger, Norway now supports ROV piloting services for three ROV systems onboard *Seven Viking*. Introducing this technology in a dynamic IRM project has confirmed that our operationally robust implementation delivers the levels of performance expected of a commercial service. In line with our technology roadmap, this supports the efficiency and sustainability objectives of Subsea 7 and our clients.

AUTONOMY MILESTONES

The next steps in the roadmap are already under way. They include the preliminary design of a vehicle capable of seabed residency, supported by a subsea docking station and integrated into the seabed infrastructure. The vehicle will be capable of remaining underwater, providing inspection and light intervention for more than three months at a time. This battery-powered light vehicle platform (LVP) delivers inspection tasks across the entire field in a fully autonomous operating mode, switching to human-in-the-loop control for supervised light intervention on subsea equipment. The LVP builds on technical and operational knowledge gained while deploying remote ROV piloting. It incorporates 'autonomy engine' technology developed and proven by the Subsea 7 autonomous inspection vehicle (AIV) programme.

The LVP form factor and flexible modular layout uses proven components and has been developed in collaboration with one of Subsea 7's long-term suppliers to leverage a best-in-class capability. It's designed to support multiple operating and deployment methods including conventional vessel, unmanned vessel, fast inspection and seabed resident.

Subsea 7's LVP technology will deliver the next generation of subsea services while supporting energy transition for the oil and gas and renewables sectors.



LVP next generation vehicle capable of seabed residency.

THE ROADMAP TO SUBSEA AUTONOMY

SCANNING: 57%

41% ██████████ #1

53% ██████████ #2

25% ██████████ #3

15/01 03% S-6

02/72 21% H-8

99 #1 32 #2

NAVI - 1.8

80-3

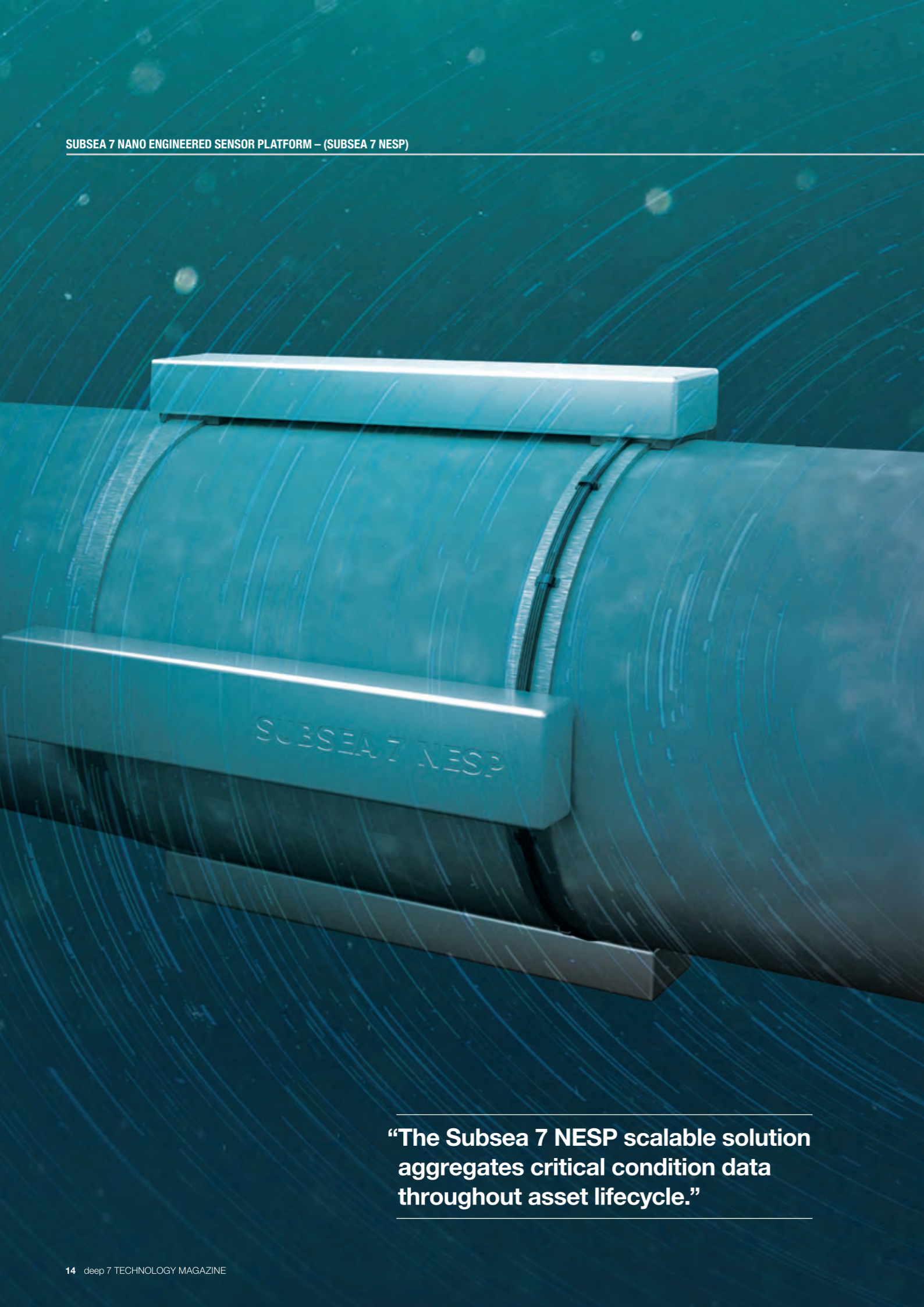
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21.45%

88-12-74

8,167,043

4,301,944



“The Subsea 7 NESP scalable solution aggregates critical condition data throughout asset lifecycle.”



HIMANSHU MAHESHWARI
Director of Integrity Engineering,
Subsea 7 Global Inspection,
Repair and Maintenance

“Subsea 7 NESP delivers perpetual monitoring and measurements throughout life of field, with no required maintenance, resulting in extended life and improved uptime.”

AWARD-WINNING NEW SENSOR PLATFORM

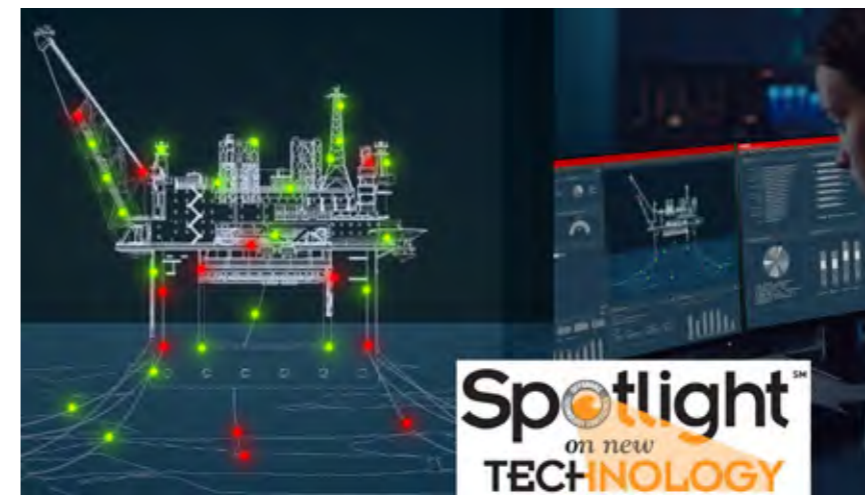
The Internet of Things (IoT) is transforming asset management as it gains traction for remote operations and predictive maintenance of energy infrastructure. The 2021 Spotlight on New Technology® award winner, ‘Subsea 7 Nano Engineered Sensor Platform (Subsea 7 NESP)’, is at the forefront of building this collaborative ecosystem, and providing smarter, safer, and more efficient asset monitoring solutions.

DIGITAL ASSET MANAGEMENT

Subsea 7 NESP is a transformative solution developed in collaboration with Xodus, an autonomous subsidiary of Subsea 7. It continuously monitors fatigue and corrosion offshore. Subsea 7 NESP delivers a scalable solution that aggregates critical condition data throughout asset lifecycle, providing operators with a cost-effective alternative to traditional operation and maintenance methods. Developed using patented, nano-engineered material technology, Subsea 7 NESP is uniquely capable of quantifying critical mechanical integrity issues in the marine environment – including fatigue, corrosion and erosion which can reduce OPEX in these areas. Subsea 7 NESP delivers perpetual monitoring and measurements throughout life of field, with no required maintenance, resulting in extended life and improved uptime.

A COMPLETE SOLUTION

Subsea 7 NESP is easily installed on new or existing facilities, above water or subsea. Above water it is passive, with no batteries or wiring, and sensor status is read wirelessly over an ultra-low power Bluetooth® connection via a securely paired reader that also provides wireless radio frequency (RF) power to the sensor. Below water Subsea 7 NESP communicates through a field-proven infrared (IR) communication interface for subsea data acquisition. The Xodus XAMIN data-management platform aggregates Subsea 7 NESP data. XAMIN’s large dataset enables an accurate predictive model for decision support, providing operators with automated notification following events of interest, and providing data that will help to optimise maintenance programmes and late-life management while influencing future design.



An OTC Spotlight on New Technology® award has recognised Subsea 7 NESP as a step-change innovation which will help power the future of subsea development.

IRMVault

A NEW STANDARD IN DATA ARCHITECTURE

The digital toolsets developed to support Subsea 7's Subsea Field of the Future and Energy Transition strategic objectives continue to be deployed at pace. A standardised underlying data architecture, the repository of operational media, is now accessible across the organisation through the 7Media portal. We're unlocking data to provide greater insight and business value.

IRMVault

IRMVault is the first of a series of applications that sit within the 7Media portal, an innovation developed by Subsea 7 to support the company's Subsea Field of the Future and Energy Transition objectives. The 7Media portal provides a common foundation for multiple repositories, standardised on a common underlying data architecture that connects datasets to provide broader situational awareness. Stored in a cloud environment, the 7Media products enable enhanced collaboration and online delivery.

STREAMLINING DATA

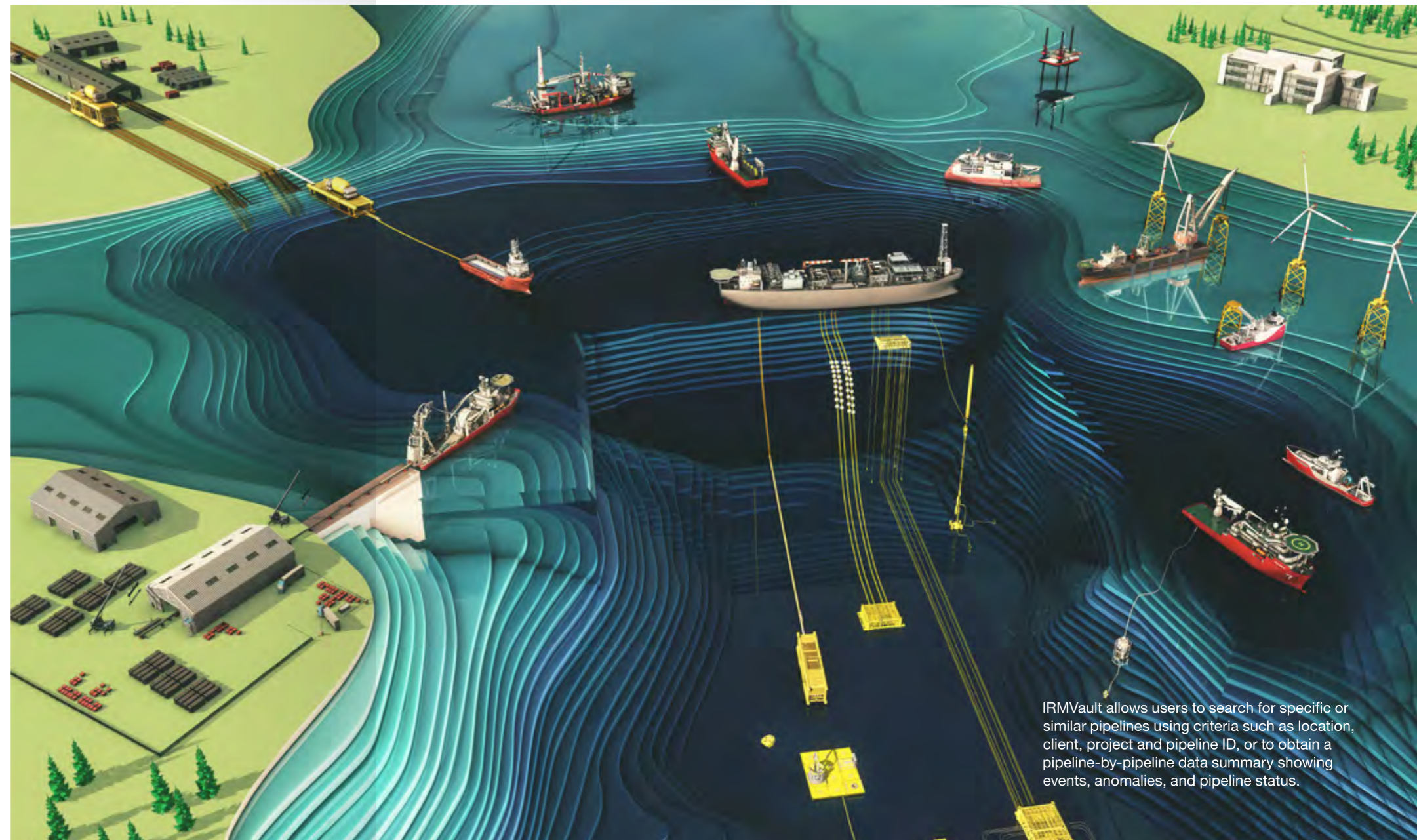
IRMVault is loaded with pipeline survey and inspection data. It allows users to search for specific pipelines, or comparable examples, using criteria such as location, client, project and pipeline ID, or to obtain a pipeline-by-pipeline data summary showing events, anomalies, and pipeline status. The map view function is a handy feature that locates pipelines visually. Users can compare event condition, categorise event status and interchangeably cross-reference events and images. The IRMVault application also enables searching for subsea pipeline features or infrastructure via filters such as water depth, location, seabed, environment or time. IRMVault provides quick, intuitive, and secure global access to survey and inspection eventing data, leveraging underlying metadata and enhanced search capability to quickly identify data for review. Reporting dashboards are enabled to deliver business intelligence and broad decision-making information. IRMVault is an exciting addition to Subsea 7's innovative suite of data management solutions.



MARTIN BERRY
Global Data Solutions & Delivery Manager, Subsea 7 Global Inspection, Repair and Maintenance (IRM)

“Unlocking data to provide greater insight and business value.”

IRMVault enables searching for subsea pipeline features or infrastructure via a range of parameters to streamline workflows.



IRMVault allows users to search for specific or similar pipelines using criteria such as location, client, project and pipeline ID, or to obtain a pipeline-by-pipeline data summary showing events, anomalies, and pipeline status.

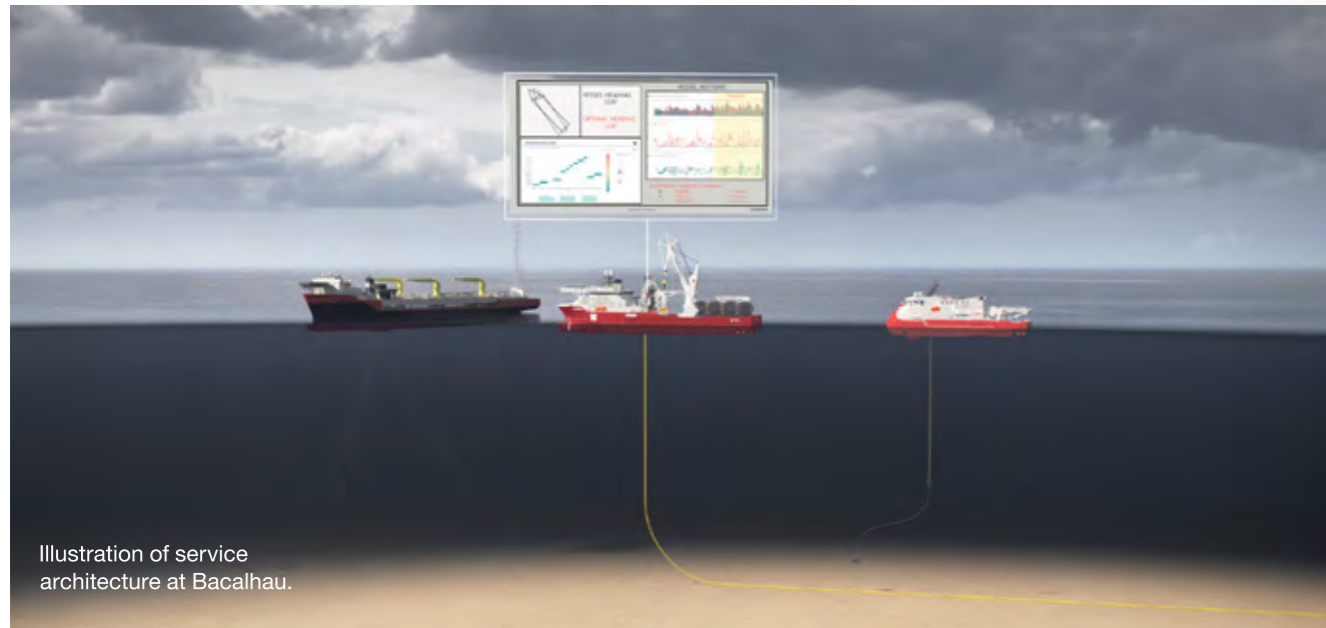


Illustration of service architecture at Bacalhau.

PETER JENKINS
CEO 4Subsea

EXPERIENCE AND TECHNOLOGY COMBINE TO MAXIMISE ASSET LIFE

4Subsea, an autonomous subsidiary of Subsea 7, is a leading provider of technology and services which help operators optimise projects, maximise the lifetime of the asset and reduce operational costs. This is achieved by combining operational domain experience and digital capabilities with technology like autonomous sensors, advanced algorithms and machine learning.

4insight® Subsea Asset Integrity services continuously monitor the physical integrity of different subsea infrastructures using retrofittable autonomous sensors, algorithms and machine learning methods, all optimised for different assets and measurements.

Sensors monitor strain, movement, eigenfrequency and other subsea infrastructure parameters, uploading time-series data to 4insight® – a cloud service – that performs advanced analytics. The results are presented as easy-to-interpret insights and dashboards, simplifying the complex analysis and informing engineers about the integrity and safety of subsea infrastructure.

The data is available to clients' own engineers, as well as to 4Subsea engineers who can provide expert

services. It can be shared easily with any third party. The asset integrity service can be combined with asset register and digital twin service from 4Subsea for optimal insights, maintenance and enhancements during field life.

CUSTOMER DEPLOYMENT

The solution is being deployed to monitor steel catenary risers on the Subsea 7 project for Equinor Bacalhau field in Brazil. It uses a combination of strain sensors, motion sensors and a gateway to aggregate data. The sensors are well proven, with millions of hours of use, and require no specialised personnel for installation onboard the FPSO.

Data on vessel motions and riser load are measured, along with calculations of riser pressure and hoop stress. The service is delivered as dashboards and data, which are fed into Equinor's data platform for further analysis.

Overall, several Subsea 7 marine operations are benefitting from 4insight® data streaming services and algorithms to optimise vessel operations.

Established in 2007, 4Subsea is headquartered in Asker, Norway, with additional offices in Aberdeen, Bergen, Kristiansand and Rio de Janeiro.



4insight® is a digital service that captures data from sensors and applies advanced algorithms and machine learning to deliver insights supporting critical decisions. The open architecture means that any data source or sensor can be connected. 4insight® empowers engineers to perform their own analysis alongside deep domain expertise from 4Subsea engineers. It easily and securely allows access to third parties, and connects to customers' own data platforms such as Cognite, Delfi and Omnia.



Example dashboard.

INNOVATIVE SOLUTIONS FOR OFFSHORE FIXED WIND

Seaway 7, the Renewables business unit of Subsea 7, has been working continuously in offshore wind construction for more than 10 years. It has become a leading global player in the delivery of wind turbine foundations and array cables.

Offshore fixed wind is one of the lowest-cost forms of new electricity generation, as well as one of the most environmentally friendly. It is deployable at relatively large scale with a comparatively short development schedule and is now the backbone of future energy supply plans in many coastal states around the world. Given that around 40% of the world's population lives within 100km of the coast, the market potential is truly exciting.

In many of these countries, sites are awarded to developers whose projects show lower costs-per-unit of electricity. This competition has significantly driven down prices and encouraged both developers and their supply chains to work collaboratively, further reducing cost and risk.

Another factor is the drive for ever-larger turbines. Bigger turbines reduce costs for the remainder of the offshore infrastructure. However, larger turbines mean bigger foundations, so larger construction vessels are required for installation.

There is a significant degree of standardisation in offshore wind – for example in turbine manufacture. One of the most challenging areas to standardise is fixed foundations, where varying water depths, metocean conditions and often complex soil conditions mean that site-specific solutions are required. This is a key challenge, as projects need to find the lowest-cost compromise between structural optimisation and design standardisation to allow serial production in fabrication.

It's a similar scenario for the electrical cables that connect the turbines. The cables themselves are relatively standardised type-tested products, but every site layout is different and there is a need to manage site-specific risks.

Larger turbines are driving up array cable voltages. Just a few years ago 33KV was the norm, now it is 66KV and the industry is planning for 132KV in a

few years' time. In floating wind, one of the major research areas is around the durability of high voltage cables in a dynamic environment. Another focus is the need to connect and disconnect cables from the floating turbines cost-effectively.

Seaway 7 is developing innovative solutions in fixed offshore wind, including foundations and array cables. This will entail finding lower-cost design solutions, developing product lines, and reducing risk in deployment. Areas of interest in fixed offshore wind foundations include:

- Incremental improvements on current designs.
- Collaborative early engagement with contractor-led design solutions.
- Novel structural designs to mitigate soils risk, and accommodate larger turbines.
- Extending structural designs into deeper water.
- Ways of installing wind turbine generator foundations with reduced environmental impact, for example noise mitigation.

Seaway 7 is currently delivering the Seagreen project, in the North Sea, off the coast of Scotland with responsibility for the engineering, procurement, construction and installation of 114 wind turbine foundations, and 328km of array cables.

Seagreen is one of the world's largest projects to adopt suction caisson foundations. The deepest locations across the site will also have the world's tallest fixed-jacket foundations in offshore wind. The project is at the leading edge of technology deployment in the global industry.

It is exciting to visualise the scale of structural fabrication and logistical challenges on Seagreen, which adds up to the equivalent of more than 20 Eiffel Towers. Offshore installation will be undertaken in late 2021 and 2022.



ALAN MACLEAY
Engineering Director, Seaway 7

“It is exciting to visualise the scale of structural fabrication and logistical challenges on Seagreen, which adds up to the equivalent of more than 20 Eiffel Towers.”





NOUZHA BOURAS
Strategic Manager –
Energy Transition

STRATEGIC FOCUS ON SUSTAINABLE ENERGY SOURCES

As part of our strategic focus, Subsea 7 has adopted a proactive approach to the Energy Transition. To achieve this, we use the extensive experience gained in oil and gas and renewables projects and apply it to the design and delivery of new, more efficient and sustainable offshore energy systems.

Subsea 7 is committed to supporting the development of technology to support the Energy Transition, and place early engagement together with one of our corporate values, Collaboration, at the heart of our efforts.

1: ENERGY HARVESTING SOLUTIONS

Subsea 7 has partnered with GEPS Techno, an engineering company which develops autonomous hybrid energy production platforms designed to supply off-grid marine applications, with a reliable and renewable power source. The platform converts wave energy and solar into electricity.

Following the successful launch of the WAVEPEARL® low-power platform, Subsea 7 and GEPS Techno are currently working together to qualify the WAVEGEM®, a medium-power autonomous platform. This platform generates electricity from a combination of wave energy harnessed by an innovative converter, and solar energy from photovoltaic panels.

The platform is modular in design. It can accommodate embedded applications and/or provide power to external submarine or surface consumers, harvesting renewable energy to supply continuous power to remote systems. For example, powering a subsea Autonomous Underwater Vehicle (AUV) docking station to provide a fully remote survey station; powering a Subsea Chemical Storage and Injection Unit to provide a full alternative to umbilicals; and powering subsea sensors for environment and wildlife monitoring.

2: ENERGY STORAGE SOLUTIONS

One of the key challenges of the Energy Transition will be integrating large-scale renewable energy sources to deliver a power output that varies over time. Specifically, the challenge is to address the gap between intermittent renewable energy production, and the end-users'

demand for reliable power. The pace of decarbonisation therefore hinges upon the development of energy storage technologies which will deliver clean, renewable power as a stable and reliable resource.

In 2020, Subsea 7 established a strategic collaboration with FLASC B.V., one of the first movers in the offshore energy storage space. This collaboration leverages Subsea 7's world-class technical expertise in the development of offshore subsea solutions and has culminated in the PowerBundle concept. The PowerBundle integrates FLASC's award-winning Hydro-Pneumatic Energy Storage (HPES) technology within Subsea 7's well-established Pipeline Bundle technology.

The result will be a fully integrated subsea energy storage solution that delivers stabilised renewable power, across a range of applications, in an inherently safe, reliable, and cost-effective manner.

ENERGY TRANSPORTATION SOLUTIONS

The transportation of carbon dioxide and hydrogen will be key to the Energy Transition but this presents several challenges that may affect pipeline integrity.

Subsea 7 is well positioned to support our clients in overcoming these challenges, thanks to an extensive product portfolio and experience in handling complex hydrocarbon fluids. We're playing our part in key industry projects and initiatives in this new arena.

3: HISTORIC NORTHERN LIGHTS PROJECT

Subsea 7 is proud to be part of the pioneering Northern Lights project. Northern Lights is Norway's first licence for CO₂ storage and a major part of the initiative that the Norwegian government calls "Longship". This full-scale carbon capture and storage (CCS) project comprises transportation, receipt and permanent storage of CO₂ in a reservoir in the Norwegian Continental Shelf (NCS).

Subsea 7's scope includes engineering, fabrication and installation of a 100km CO₂ pipeline running from Øygarden to the CO₂ storage complex, as well as installation of umbilicals, ties and pre-commissioning activities.

4: THERMOPLASTIC COMPOSITE PIPE

Operators are looking for proven Energy Transition technology solutions that meet their high standards for sustainability while keeping CAPEX investment low.

The development of Thermoplastic Composite Pipe (TCP) in free hanging riser configurations offers opportunities – so much so that Subsea 7 has recently made a strategic investment in the leading TCP manufacturer, Strohm, based in the Netherlands.

Strohm's TCP is a strong, flexible, non-corrosive, and spoolable pipe technology, with a proven track record and more than 25 years' design life. It offers up to 60% reduced CO₂ footprint compared to steel pipeline alternatives.

Its non-metallic nature makes it immune to hydrogen embrittlement. TCP is also insensitive to pressure cycling from power fluctuations, thanks to excellent fatigue resistance. The long design life of the product (approx. 25+ years) and its resistance to degradation allows operators to produce hydrogen reliably, and without the need for inspection and maintenance.

TCP's total elimination of any corrosion, its long design life and ability to be pulled through old pipelines make the technology equally beneficial for CCS projects.



“Harvesting renewable energy to supply continuous power to remote systems.”



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