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# Offshore

World Trends and Technology for Offshore Oil and Gas

**FRENCH  
SUPPLEMENT  
OTC 2019**



Courtesy TOTAL



# Cold work composite repairs minimize disruption on FPSOs

**OFFSHORE OPERATORS** are monitoring Cold Pad's developments in bonded composite repairs of corroded steel structures in FPSOs. This follows successful outcomes for the first two applications of the company's ColdShield process on floaters in service in tropical locations. In both cases, repairs were conducted with minimal disruption to normal activities, and no impact on production.

Crop and renew (steel cutting and welding) are the conventional methods for addressing corrosion damage for the shipping industry, but the associated risks of hot work in a flammable or explosive environment can force a full field shutdown of an offshore production facility. FPSOs are particularly vulnerable because of their crude oil storage function: if the oil tanks themselves need repairs, cleaning them to ensure safe conditions for welders can lead to weeks of disruption.

For this reason, FPSO owners and operators have long been seeking an alternative cold work process that can be applied effectively in humid environments. Cold Pad adapted the basic principles of bonded composite reinforcements developed by the aerospace sector – applying composite patches and epoxy resin wet layered to reinforce structures in aeroplanes – for ColdShield. The Paris-based company worked on the process for three years under a three-year R&D program supported by Total, the French research institute, IFP-Energies nouvelles (IFPEN), and three laboratories in France.

ColdShield is a prefabricated reinforced product that combines various high-strength materials and polymers which are protected by a super-duplex alloy and a fluorinated silicon joint. For the installation, a surface preparation is first applied to ensure a load transfer through adhesion. To ensure optimum adhesion, a drying process is then initiated to create a humidity level of less than 1% of relative humidity

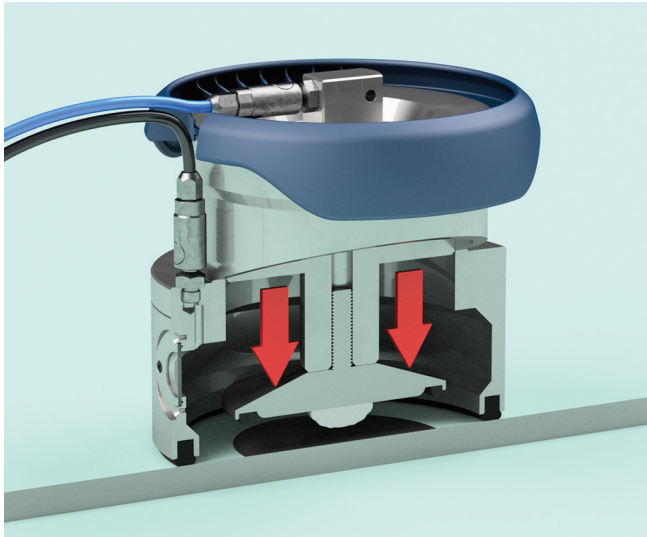


**ABOVE:** Process-controlled tooling of C-Claw. (All images courtesy Cold Pad)  
**BELOW:** Deck repair following application of ColdShield.



(whatever the outside atmospheric conditions might be). Then vacuum-assisted resin injection can begin, using a specially developed injection machine: at the end of this process, an ATEX polymerization console is used to cure the injected resin and ensure optimal structural polymer properties.

Cold Pad claims that because hardening of the resin is performed under a vacuum, the peripheral seal remains permanently compressed tight, with the structural and material property protected from the offshore environment throughout its service life – the company describes this as 'durable encapsulation.' Current class approval of the encapsulation indicates a minimum 10-year design life, but Cold Pad is confident of a likely service life of more than 20 years, according to the company's VP Sales and Marketing Christophe Paillusseau.



**RIGHT:** C-Claw provides structural reinforcement of severely corroded offshore areas.

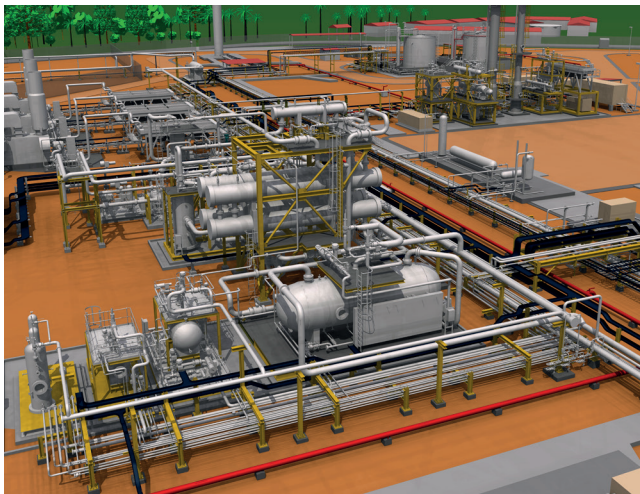
“To date we have completed two ColdShield projects. The first, was on an SBM Offshore FPSO off West Africa, and involved repairs to four brackets inside a void tank. The client told us our ‘cold work’ approach saved more than \$3 million compared with hot work or

an alternative technique, which would have disrupted production and involved more personnel onboard. We had a team of four people for this job, and the work took less than a week to complete. Typically, a hot work crew of 10 people would have needed two weeks. We followed up last summer with a survey to check the status of the areas repaired: all the ColdShield structures were performing as expected.

“Our second job was much larger in scope, a repair covering a 120-sq m [1,292-sq ft] area on the upper deck of an FPSO offshore West Africa, built prior to 2005. There was corrosion all over the affected area which required a repair as per class standards. Due to the midship location of the repairs, the team conducted a thorough engineering analysis with the class society to prove the hull girder strength reinforcement. Once completed, we deployed a team of four technicians at the end of last year for the overhaul campaign. The team spent a total of 25 days offshore completing the work, and other repair campaigns will follow on the same vessel later this year.

“For the client – a major operator – there were two main considerations in choosing a cold work solution, despite the higher cost, in this case Eu4-8 million [\$4.5-8.99 million]. One was safety – the risk that a gas leak during hot work might lead to an explosion. The second was economics, that fact that our team could do the

## Challenging conventional thinking in today's cost driven market



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repair with no impact on normal operations: under a shutdown, the work could have taken two months to complete, with lost crude production over that period in the range 100,000 to 200,000 b/d. The client said the solution saved the partners \$100 million – but technically, we're not even sure hot work would have been possible for a midship repair if it had meant having to make a big hole in the deck amidships, because of the associated risk."

Between the first and second campaigns, the manufacturing process had become more efficient, Paillusseau said. "Now we could produce 60 ColdShield pads, some measuring up to 8 m [26 ft]. In both instances, the process did achieve the required level of less than 1% of relative humidity, as witnessed by class societies."

Cold Pad continues to work on further initiatives. "We have launched a new development with Total concerning life extensions of static pressure vessels, called RSS (Reinforced Strap System). Pressure vessels are critical to platforms and FPSOs: if this equipment has to be shut down due to corrosion, it can lead to a partial or full loss of production.

"RSS will be a new tool for offshore operators to shift their maintenance from planned shutdowns to general maintenance in ATEX

environments, with no hot works. The new process is designed to extend the lives of pressure vessels by three to 10 years and provide enhanced operational flexibility to allow the operator to decide when to enter the pressure vessel. The partners are targeting a commercial product by the end of 2020."

Another new product, introduced last summer and first delivered in September to a facility offshore Angola for a temporary application, is the C-Claw. This is a heavy-duty fastener designed as a solution to repair severely corroded outfitting supports such as hand rails, pipe supports, and cable trays on ballast or crude oil tanks (a common problem on older platforms and FPSOs). According to Paillusseau, maintenance teams are often fully occupied working on production equipment with no spare time for secondary repairs. "A Cold Pad team can handle these repairs during normal production with limited impact on POB and without causing disruption to production. There has been an extremely good feedback from oil and gas clients and this has led to several orders for C-Claws from companies in Angola, Australia, Brazil, Congo, Indonesia, and Malaysia. One is for a permanent leak repair on a hull in an FSO." ◉

## Multi-purpose ROV cuts time and cost of LBL deployments

**DEEPWATER TRIALS** should start later this year of a new lightweight, observation-class ROV with autonomous docking capabilities. Forssea Robotics in Paris has been working on the development of the Atoll system since the company's formation in 2016. One of its main goals is to devise new methods for reducing subsea operating costs.

Last September, Forssea secured funding of Eu2.4 million (\$2.69 million) for the Atoll project from various sources, including the 'Ship of the Future' program managed by ADEME (the French Energy Agency), and the French investment bank BPI's I-Lab competition. The company used some of the money for initial shallow-water trials of the ROV offshore La Ciotat, southern France.

Atoll is slightly larger than a typical observation class ROV, according to Forssea CEO Gautier Dreyfus, measuring 0.8 m (2.6 ft) in height and 1.1 m (3.6 ft) in width, with a weight in air of 200 kg. It is designed to be launched and recovered from a platform supply vessel (PSV) or light vessel of opportunity using a standard hydraulic A-frame. A 20-mm diameter tether connects the ROV to a clump weight which ensures alignment with the surface vessel of the 2,000-m (6,561-ft) long main lift umbilical. The vehicle can carry a payload of up to 25 kg and is also capable of lifting structures from the seafloor weighing up to 1.5 tons SWL.

At present, Atoll is designed primarily for deployment of long baseline (LBL) frames with latching systems for inspections of subsea production networks. But it can also dive autonomously



Atoll being lowered to the seafloor. (Courtesy Forssea Robotics)

toward a subsea target and subsequently connect to a docking station, using its embedded control algorithms. Once connected to the seafloor target, such as a wellhead or export line valve, it can perform power/data transfer for manipulation purposes, or if necessary retrieve the component to the surface for inspection or repair.

To support these tasks, the vehicle is equipped with a 75-kg horizontal thrust, a 50-kg vertical thrust, a 100-kW power transfer capacity, and a 1 Gbit/s data transfer rate (through one twisted shield pair and six single-mode optical fibers). Forssea can design the docking station for resident or non-permanent ROV operations.



Deepwater trials will be performed during a suitable weather window this summer or early in the fall in a water depth of around 1,000 m (3,281 ft), possibly at a location off France's west coast, with a view to completing qualification of the technology by the end of this year. Assuming all goes to plan, the Atoll could then be ready to start its first deepwater field trial, possibly offshore West Africa. The forthcoming program will include simulations of typical subsea tasks and tests of acoustic sensors and will be witnessed by representatives of some of the major subsea contractors (Forsea does not intend to operate its own equipment, Gautier stressed).

Navigation, imaging and positioning specialist iXblue is supporting the development and the trials, proposing a new and more cost-effective method of LBL transponder array deployment and calibration. This would incorporate iXblue's new autonomous survey vessel DriX, fitted with the company's Gaps USBL with embedded inertial navigation system, to assist positioning of the Atoll and provide on-site calibration. DriX is designed to be deployed from iXblue's own launch and recovery system DDS (DriX Deployment System), and from any light vessel equipped with a crane, Davit or A-frame.

According to Olivier Cervantes, VP Energy at iXblue: "The Canopus transponder fitted in the deployed frame comes as part of iXblue's LBL solution, and provides new capabilities such as longer autonomy, using alkaline batteries, and easier configuration via WiFi on deck. Combining Atoll, DriX, and high-accuracy subsea positioning sensors is a flexible approach that does not require heavy logistical support. It also changes the way operators can make LBL deployments and calibration by saving vessel time, through use of a PSV instead of a light construction vessel. It can also provide savings of up to 70% compared to traditional methods."

Forsea has formed academic partnerships with ENSTA Bretagne for subsea robotics and ISEN Brest for underwater vision, both in northwest France, and alliances with DeepOcean. It is also working on various other developments such as a smart ROV for observation/light

intervention tasks, and control algorithms and augmented vision technologies that are said to be compatible with most existing ROVs and AUVs. Another development is a low-cost, fixed focus IP high definition camera which provides a wide horizontal angle of 100° in water to support ROV/AUV inspections, or alternatively, stereo-embedded vision. The camera is said to be fully calibrated with software lens distortion correction and can be adapted to AI and Computer Vision applications. ●



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# Digitalization delivering life of field benefits

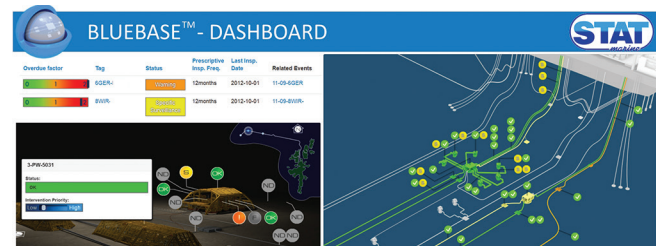
FRANÇOIS THIÉBAUD, DORIS GROUP

**DIGITALIZATION IS** a continuous improvement process that started many years ago. For oil and gas engineering companies, it encompasses a multitude of changes in daily processes; these changes are being enacted at an ever-increasing pace as digital technology provides new tools to create smarter products.

In DORIS' case, digitalizing processes leads to reductions in operating costs, with knock-on benefits in terms of engineering rates and engineering capex. It involves global communications between the company's regional offices, easier sharing of resources (tools and personnel), and of expertise to provide an improved service. These changes lead to a synergy and convergence in work processes between the company's business units to assist inter-group collaboration.

It also means implementing live dashboards with smarter use of data for predictive outlooks to improve decisions on projects and management. Furthermore, digitalization of engineering allows engineers to concentrate on creative design matters.

Another benefit is better-quality engineering services. For instance, 3D modeling now involves creating a digital twin of the fields beginning at the front-end engineering design stage, establishing the foundation for a life of field tracking of the assets. DORIS is working on the integration of subsea facilities into the surface facility model to produce a single field model that can be shared with clients from any location around the world. And through use of augmented reality and virtual reality tools, the company can



Dashboard screenshot. (Courtesy DORIS Group)

assist field operators with training and operations.

Tomorrow's design tool will allow a walk-through the facilities, via wearing of digital goggles; these facilities could be greenfield at design stage or brownfield facilities that have been laser-scanned and imported into 3D models. The integration of time into the digital twin allows monitoring of the project schedule from the early stage of the field development all the way to the operation, leading to time and cost benefits.

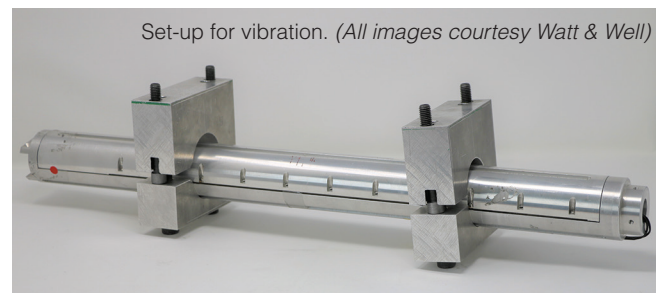
DORIS' STAT Marine business unit has developed an operational database platform which records maintenance and inspection data of equipment during the entire field life and provides a clear and real-time view of the equipment status. In the future, cloud-based digital twins will integrate all equipment items and their entire life history, from the drawing board (screen) to the operation phase, with quick remote access in the field via tablets using data mining algorithms. ●

## Watt & Well fine-tuning power for downhole tools

**OVER THE PAST DECADE** Watt & Well has developed a range of power electronics, associated software and control algorithms for downhole and surface drilling, logging and wireline tools. The company has adapted for its designs some of the best practice applied by clients in the aerospace and automotive sectors.

CEO Benoît Schmitt and COO Raul Iglesias worked together previously at Schlumberger on wireline and drilling tools, Schmitt specializing in hardware R&D and Iglesias in software. They left together in 2008 to form Watt Consulting, based in Paris. At that time two main issues were dominating downhole tool development for offshore wells, according to Schmitt. One was the industry's desire to stretch the envelope for high-pressure/high-temperature drilling; the other was the need for more sophisticated power electronics for rotary steerable and tractor tools.

"We thought it was worth a try to provide more power to small-size motors," Schmitt said, "especially in HT applications. Then after two or three years, we started working with new customers in the automotive and aerospace industries and became interested in



adapting their ways of working, and those of other industries, to the oil and gas sector."

In 2011, the company introduced its first motor control product for HT environments, the first of what has since become the Nar series ('Nar' being Arabic for 'fire'). A year later, Watt Consulting began working with Renault on designing a range of embedded chargers. Then in 2013 the company opened its first facility dedicated to assembly and industrialization of power products,



in Pertuis in the Vaucluse region of southern France.

Other landmark events that followed were a change of name to Watt & Well in 2016 and the establishment the same year of a US subsidiary in Houston; and in 2017, the construction of a larger production facility in Pertuis, and the Ariane Group's selection of the company to develop the motor controller for the second-stage motor of the Ariane 6 European satellite rocket launcher. The company has also devised a solution to reduce the cost per watt of quick charger equipment for the electric vehicles sector.

"The automotive industry is very professional and competitive in its way of working," Schmitt said. "All components of a car are comprehensively modeled prior to development. By working with Renault over several years on their embedded chargers, we have learned how to integrate high-quality modeling in our power electronics development. We hired expert engineers and Ph.D professionals and have now adapted our experience to offer complete modeling of oil and gas power systems. The main purpose of this exercise is to reduce integration times, to ensure you have a good model that works.

"What I see typically in downhole tool development is a sequential approach in which one architect develops the fundamentals of a tool, or hardware, determining input/output requirements. A second engineer focuses separately on software and testing, trying to bring everything together – and then the combined product doesn't work because the interface is incorrectly set, or the connections don't function as they were supposed to do."

Watt & Well uses MATLAB, a multi-paradigm software package developed by MathWorks to integrate computation, visualization, and programming in a way that is said to allow problems and solutions to be expressed in familiar mathematical notation. "Oil and gas companies really like it, because it allows their tools to interact much better with our equipment," Schmitt said. "It's like Open Software, allowing companies to develop their modeling together, giving them an easily accessible view of the development and

the possibility of changing it.

"A typical problem with power electronics development in oil and gas is electromagnetic interference (EMI), and that is why the separate elements do not sometimes work together. Our approach is to offer training to our customers on EMI so that they can improve their working methods."

The Nar range today is extensive, and includes motor controller drivers for DC brushless motors with miniaturized sensed or sensor-less speed mode for HT applications; step-down DC/DC power converters handling a wide voltage input range for a regulated

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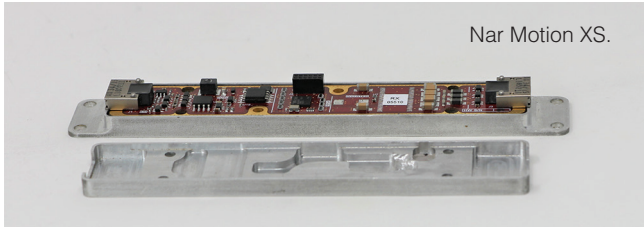
Building upon the extensive track record of successful subsea operations conducted thanks to our AHRS and INS, we are happy to announce that all new purchase of iXblue inertial subsea products will include a 7-year warranty\*



\*Note that the warranty does not cover connectors and/or water ingress.

**iXblue**





voltage output; a wireline modem that provides telemetry between downhole tools and surface equipment on oilfield service cables; and a high-voltage power supply for downhole tools that provides an input voltage range of up to 1.2 kV. "Our focus is on constantly improving our basic products in terms of modeling, software and power capacity," Schmitt said.

"Today in oil and gas, our business is now more than 90% about

selling our products and 10% acting as consultants." Pertuis is the company's specialist center for engineering, R&D, and manufacturing for oil and gas. The facility also undertakes integration of all controls and wiring for printed circuit boards for the company's products, with burn-in tests performed on each individual board at temperatures up to 150°C to ensure no risk of failure (manufacture of the PCBs is subcontracted to two specialist companies). "We have developed our own test benches tailored to our products," Schmitt explained. "If a certain product proves popular, we will create a dedicated test bench. Pertuis can produce more than 5,000 items of equipment per year."

Watt & Well established the branch in Houston to also act as a consultancy to oil and gas clients. "The trend we see is that customers have less and less money for R&D for new tools, but at the same time they want to go faster and faster to market." ◉

## DP digital survey app strengthens audit reliability, data security

**BUREAU VERITAS** (BV), offshore support vessel provider BOURBON, and Kongsberg Maritime have successfully tested a new method of performing dynamic positioning system performance and redundancy audits. They claim this is a first for the maritime industry.

The trio developed the DP Digital Survey application to

run on an industrial management system that is said to ensure a high level of data consistency for the verification of installed systems. It acquires information directly from the DP system, delivering it to auditors via a secure cloud infrastructure, in this way allowing mandatory surveys to be implemented remotely.



The offshore support vessel *BOURBON 508* stationed offshore Angola. (Courtesy BOURBON Offshore)

Vessel owners using the remote survey tool can compile what the trio claim is a comprehensive package of test execution and completion evidence. They add that the app's capabilities go far beyond the photo and video recordings introduced to the offshore and maritime sector over the past few years.

Kongsberg Maritime's plans for continued development of the app include gradually automating the survey by capturing and digitalizing the best practice of DP auditors; re-designing the survey process and tests to suit the new tools, based on industrial data; and establishing a continuous 'DP Digital Survey' framework that will involve detailed remote monitoring of the performance and technical availability of the DP system.

Laurent Leblanc, VP and Marine Operations Director at BV, said: "The key for us is to receive reliable performance and failure data, not just photos and pictures. We have to first check the data is of sufficient quality: data management is a key factor, along with cyber-security for data transfer." BV would then review and assess the data.

Frederic Moulin, BOURBON's Operations Director, added: "This project greatly contributes to the aim of our smart shipping program which is to capitalize on the digital revolutions as to stand out through a connected fleet, while simultaneously reducing our operational costs. With our partners we are ready

to extend the 'DP Digital Survey' to sister ships in the coming months, and plan for further deployment later."

According to Najmeh Masoudi-Dionne, Global Technology Leader, Smart Ships at BV, the company's MAC subsidiary, which specializes in DP systems, was delegated to assist BOURBON and Kongsberg Maritime in ensuring the functionality, availability and reliability of the survey system, providing user-friendly insight for remotely located surveyors.

"This is a digital tool running on an industrial data management system that ensures unprecedented data consistency to verify onboard systems. DP Digital Survey acquires the information directly from the ships' control systems and delivers it to the auditors via a secure cloud infrastructure, thus representing a real improvement in terms of quality of services.

"The benefits of the remote survey are not just reliable data, but also time and cost savings....BV will continue to support any remote initiatives undertaken via a reliable tool, such as the one from Kongsberg Maritime. In addition, BOURBON, BV, and Kongsberg Maritime will continue to work on further enhancements of this tool." ◉

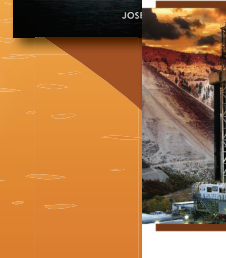
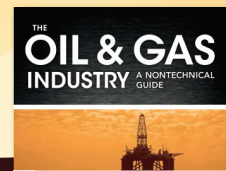
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# iXblue expands subsea survey, positioning product range

**IXBLUE HAS BROADENED** its capabilities in subsea navigation, positioning, and imaging with a view to improving its operational efficiency. Over the past 15 months the company has introduced various new products designed to help its clients reduce the costs and times of their offshore campaigns.

One of these developments is Canopus, a 4,000-m (13,123-ft) water depth-rated subsea transponder that can be deployed either in sparse array mode, with the company's latest generation Ramses ASBL (Acoustic Synthetic BaseLine) transceiver and inertial navigation systems (INS), or in full Long Base Line (LBL) mode.

Canopus provides hundreds of acoustic codes for interrogation and reply. Its environmental temperature, pressure, and inclinometer sensors can be enhanced with Digiquartz depth and sound velocity and can also interface with other external sensors. Other features are internal data logging, a high-speed modem and an accuracy range claimed to be better than 1 cm. The system's standard battery pack allows for up to 1 million pings, or more than two years' battery life in listening mode, enhancing the autonomy of operations.

Another development is Canopus' software, designed to provide a single user interface for controlling and monitoring multiple subsea positioning systems from one location. The software is used initially for planning of an operation, allowing the user to analyze the expected sound velocity profile and digital terrain model in order to assess the likely propagation characteristics, and thereby determine the acoustic range. The user can then develop a beacon array layout, with coverage displayed interactively allowing for easier manipulation, iXblue claims.

The software can also be used to automatically detect and integrate the various devices of the survey/positioning system on the network. Beacons can be programmed over WiFi, and following deployment on the seafloor, can be calibrated using a combination of traditional Box-in, SLAM, or Mutual Array techniques. The software controls all aspects of the array, ensuring that only the correct beacons for the operating area are interrogated, also monitoring positioning performance. Finally, iXblue's Delph INS (Inertial Navigation System) can perform post-processing of the data. One of this system's newest features is

water density management, providing hydrographic-grade bathymetry with full swell reduction.

iXblue's latest version of its Ramses ASBL transceiver is based on the same electronics platform as Canopus, but with new features to ensure a WiFi user interface.

This is an acoustic range meter designed to stop the drift inherent in an INS, with high-accuracy positioning, according to the company. Swedish underwater survey contractor MMT recently used a Ramses in more than 2,000 m (6,562 ft) water depth to steer an ROV to decimetric precision, with only one beacon on the seafloor per 1.8 km (1.12 mi) of the survey route.

Another new product is DriX, an autonomous underwater survey vessel (AUSV) that can accommodate a hydrographic and geophysical survey payload, and which can be used to assist positioning of underwater vehicles and associated data capture. Bibby HydroMap conducted trials last summer with the vehicle over a five-day period around the 576-MW Gwynt Y Môr wind farm in complex tidal waters off the

Canopus transponder.  
(All images courtesy  
iXblue)

North Wales coast. Initially, the joint Bibby/iXblue team identified specific locations in order to provide a direct comparison with conventional survey techniques.

Then DriX, equipped with a Teledyne RESON SeaBat IDH T50 multi-beam echosounder, acquired clean bathymetry at speeds above 8 knots, while remaining on the intended survey line in cross-tides of more than 1.5 knots.

According to iXblue's VP Energy Market, Olivier Cervantes, DriX was able to sail close to the wind farm piles, with the authorization of the contractor, maintaining a good line and speed at all times. "A comparison with a classical small survey launch showed that DriX achieved a faster survey speed by sailing at 8-10 kn, without line re-run and with efficient line keeping in a high sea state. At the same time the vessel delivered better data quality due to the fact that its sensors were in the Gondola position, 2 m [6.6 ft] below the sea surface. Subsequently Bibby conducted a demonstration on the south coast of England that was witnessed by most of the main players in the renewable energy sector. Now it is proposing DriX in its bids for various other wind farm survey jobs."

iXblue's strategy, Cervantes said, is to develop a combination of complementary technologies with open



DriX approaching wind farm offshore North Wales.



architecture that facilitate interfaces with the client's preferred equipment. DriX, for example, can be adapted to accommodate multi-beam echo-sounders from alternative suppliers such as Kongsberg Maritime.

Other offshore programs involving the Canopus, Ramses, and DriX systems over the past year have included a box in calibration for proposed development drilling in the Azeri sector of the Caspian Sea. Another new project is a three-year hydrographic survey to provide seabed mapping offshore Tonga, again using a DriX. "It's a very interesting scenario," Cervantes said, "with a requirement to operate the vehicle in up to Sea State 5 at a speed of up to 10 kn, which would be four times more efficient than a conventional survey spread for this type of application." ◉

## Bourbon providing integrated logistics to Shell

**SHELL HAS CONTRACTED** Bourbon Marine & Logistics to support an exploration drilling campaign in the Bulgarian sector of the Black Sea. This is the first integrated logistics contract for Bourbon. The company said that it illustrates the validity of the #BOURBONINMOTION strategy, which is aimed at new services-oriented business models.

Starting on Feb. 15, 2019, and in partnership with the Bulgarian port operator Bon Marine, Bourbon will provide marine services, a logistics base in the port of Lesport in Varna, warehousing, port facilities, cargo carrying units, waste management, and customs clearance.

The company will deploy two large DP-2 platform supply vessels, the *Bourbon Topaz* and *Bourbon Diamond*, for the campaign and its latest digital data

management tools to optimize operations.

The deepwater drillship *Noble Globetrotter II* was due to start the three- to four-month campaign last month.

Bourbon said its proposal for an integrated end-to-end solution accorded with Shell's desire to test a light-footprint strategy in exploration involving more risk-sharing with its subcontractors.

CEO Victor Chevallier said: "This contract represents a major step in the development of Bourbon Marine & Logistics and encourages us to go further by proposing new services to accompany the evolution of our clients' needs." ◉



The PSV *Bourbon Topaz* will support Shell's exploration drilling campaign offshore Bulgaria. (Courtesy Bourbon Marine & Logistics)



# Eiffage Métal steps up involvement in offshore wind farms

**OVER THE PAST FEW YEARS** Eiffage has extended its offshore construction portfolio through the acquisition of Smulders Group and more recently of Saipem Travaux Maritime (since re-named Eiffage GC Marine).

The offshore activities have expanded into wind farm foundations and substations construction and offshore major civil works. These are in addition to the company's historical business such as construction of technical modules, drilling or wellhead platforms, and living quarters.

Eiffage GC Marine is currently involved in BP/Kosmos' Tortue gas-condensate development offshore Senegal and Mauritania, completing the front-end engineering design for the LNG terminal breakwater jetty, and now starting to place orders following the final investment decision in late 2018.

Smulders, in a consortium with DEME, has just signed a large EPCI contract for the provision of 55 jackets - each three-legged, 85 m (279 ft) tall and weighing 1,000 t - for the Moray East wind farm offshore Scotland. The customer is EDPR/ENGIE. Most of Eiffage Métal's factories will be involved in the project, namely those at Hobokken, Balen, and Wilhems in Belgium; Lauterbourg and Fos in France; and Zary in Poland. Final assembly will take place in the Wallsend yard on the River Tyne in northeast England.

Among the company's other contracts are the Deutsche Bucht Offshore Substation project, installed in March and April this year in the German North Sea by the Seaway Heavy Lifting vessel *Oleg Strachnow*. An integrated team from Eiffage Métal and Smulders managed the EPCI program, combining their respective competencies in the oil and gas and wind sectors.

Another confirmed offshore wind farm project - France's first - is 15 km (9.3 mi) from the port of St Nazaire on the west coast, near Nantes. Here Eiffage Metal is in an EPCI consortium with DEME Group for the monopiles and transition pieces foundations.



**CLOCKWISE:** Installation this March of the 1,500-metric ton (1,653-ton) jacket for the Deutsche Bucht Offshore substation, 100 km (62 mi) offshore northern Germany. Load-out of the 2,500-metric ton (2,756-ton) topsides for the Deutsche Bucht Offshore substation. Installation of the topsides for the Deutsche Bucht Offshore substation. (All images courtesy Eiffage)



Construction will start in 2020 at Smulders in Antwerp and at Fos, and the completed foundations will be transported initially to La Rochelle, south of St Nazaire, then installed by DEME during 2021-2022.

Eiffage Métal's yard at Fos in southern France is presently producing modular bridges for civil purposes in the Philippines. But the bridges are also suited to swamp area or coastal infrastructure related to oil and gas field developments in tropical regions. One of Fos' recent consignments was for ExxonMobil for a near-shore field development in Papua New Guinea.

In the near term Eiffage Métal is monitoring field development prospects offshore Nigeria, in particular the living quarters for Snepco's Bonga FPSO. There may also be opportunities in Libya - here the company delivered the Fast Moving Work Over Rig to Eni 15 years ago. ○

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