iXnews

IXBLUE | MARCH 2020 | OI 2020 SPECIAL ISSUE

SEAPIX-C
Static bathymetry for Marine Works

GAPS M5
Export-free USBL system

DRIX
Autonomous solution for pipe laying operations in Mexico

DELPH SP
Innovative software for subsea positioning

The seas and the oceans are the most extensive - and yet least well-known - expanses of our blue planet. The ocean remains the real "Final Frontier", an immense environment which is particularly hard to access, and man has always had to come up with treasures of ingenuity to explore the seabeds or access its resources, even if still only very partially.

At iXblue, we are convinced that this inherent difficulty in fact constitutes an opportunity. The desire to push back this frontier is what drives us to innovate every day by finding new solutions with our customers and partners.

Whether the task is installing oil platforms and wind farms, servicing cables, managing coastal areas, mapping as yet unexplored seabeds or monitoring fragile marine ecosystems, there are always new technical and technological challenges to be met. Faced with the economic and technical constraints with which our entire community, both industry and research institutes, are confronted, we now also need to manage the environmental impact of our maritime operations. Something which only makes us more motivated to rise to the challenge!

We will meet these challenges above all by developing our technological expertise. For over 20 years now, iXblue has been continually working towards the emergence of new technologies whilst constantly improving its expertise in its "legacy" technologies. Reading this magazine, you will find out how iXblue is embracing the technological and operational revolution of autonomous and unmanned platforms. Thanks to the development of navigation and positioning systems offering ever higher levels of performance, as well as to the accuracy of our imaging and measurement solutions and the autonomization of our solutions, we remain at the forefront of surface operations and subsea exploration.

> "WE ENCOURAGE THE CO-DEVELOPMENT OF SOLUTIONS WITH OUR CUSTOMERS, AS THIS IS ESSENTIAL TO SUCCESS. INNOVATION MUST CONSTANTLY BE CONFRONTED WITH THE REALITY IN THE FIELD!"

These are challenges which we will meet together, working collaboratively rather than in competition with each other. We are after all convinced that now is the time to establish partnerships rather than to compete as rivals. This is why iXblue is investing so much energy in designing its range of products as part of an open and future-proof ecosystem, capable of being easily integrated into partner solutions. We also seek to encourage the co-development of our solutions with our customers, as experience shows us that this is essential to success. Innovation must constantly be confronted with the reality in the field!

I hope that reading these next pages will enable you to share a feel for what iXblue truly believes in and our commitment to build the successes of the future together with you. We are very much looking forward to meeting you during the show to discuss your needs, and the solutions that we can design together to continue to progress.

Thomas Buret
Chief Operating Officer

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01

PRODUCT NEWS

GAPS M5: NEW COST-EFFECTIVE, EXPORT-FREE USBL SYSTEM

After years of continued innovation and successful operations, Gaps, iXblue calibration-free and high-accuracy USBL system, has become a reference for many users across the world. From diver tracking, workclass ROV surveys, and AUV shallow water missions, to the dynamic positioning of 100-meter long vessels, over 300 units are now operating worldwide.

Gaps has been developed for the most critical requirements and offers a typical accuracy better than 0.1% of the slant range. To remain competitive for less constraining jobs, iXblue has decided to extend the Gaps Series to include a new Gaps M5. More compact, it offers a solution reducing costs while keeping its key benefits.

Export-free and omnidirectional USBL, from the surface to medium water depths

Latest addition in iXblue's new USBL product range, the new Gaps M5 joins the renown Gaps (now Gaps M7). Gaps M5 integrates an AHRS based on iXblue FOG technology for stable heading roll and pitch compensation and a true north reference. Smaller, lighter and easy to install, Gaps M5, like Gaps M7, is ready-to-use and calibration-free. It offers an accuracy better than 0.5% up to 995m operating range, making it free of export restrictions for fast and easy shipment. The maximum operating range being achievable even in extremely noisy condition.

A unique design for maximum performance

Gaps unique design has been kept in this new M5 version with slightly shorter legs to reduce its size. The 3D 4-hydrophone antenna has different legs lengths to enhance horizontal tracking capabilities. With the new Gaps M5, no need to tilt the antenna, the acoustic offers maximum aperture and allows up to 200° omnidirectional coverage. This is extremely efficient in shallow water and horizontal tracking conditions especially when multiple vehicles must be simultaneously located at 360°.

Gaps M5 is suitable for any tracking operation, from diver- to multiple subsea assets- or inspection ROV- tracking, while Gaps M7 remains the best asset for highest survey requirements, subsea multibeam and laser scan positioning. Third-party friendly, Gaps M5 can also be used for dynamic positioning. For those operations, Gaps M5 can be used as an acoustic transceiver using either one single beacon in USBL mode, or multiple beacons (3+) in LBL mode. Relative position is computed and can be outputted with commonly used DP protocols.

The new Gaps M5 is a practical, easy to export and cost-effective USBL solution that precisely meets the needs of applications requiring lower accuracy in terms of vertical and horizontal tracking. ■

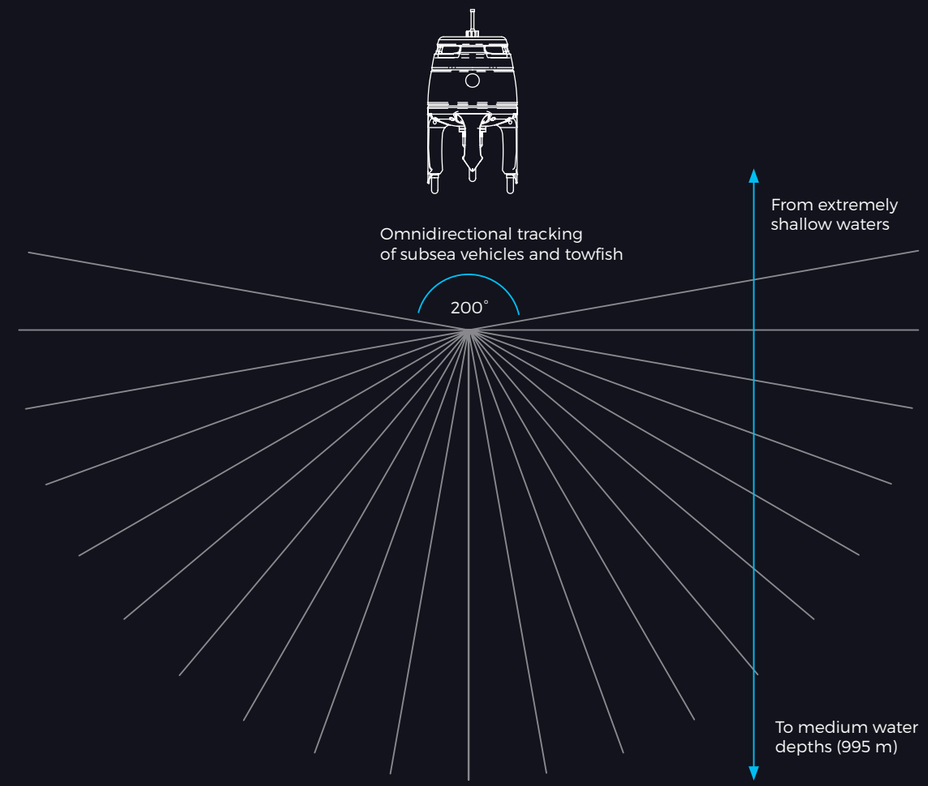
Gaps M5

EXPORT-FREE AND CALIBRATION-FREE USBL SYSTEM

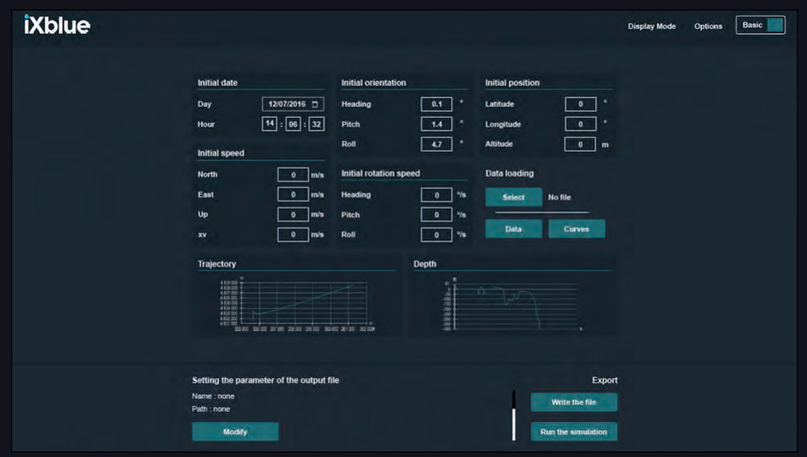
Features
- 200° aperture: above horizontal tracking
- Not subject to export restrictions
- Compact all-in-one AHRS/USBL system
- Robust True North finding sensor
- DP compatible LBL/USBL
- 3D display software included (Delph Roadmap)
- Third-party transponder compatible
- Acoustic communication (telemetry)

Applications
- AUV tracking
- ROV tracking
- Tow fish tracking
- Diver tracking
- Dynamic positioning
- LBL Box-in
- Offshore construction

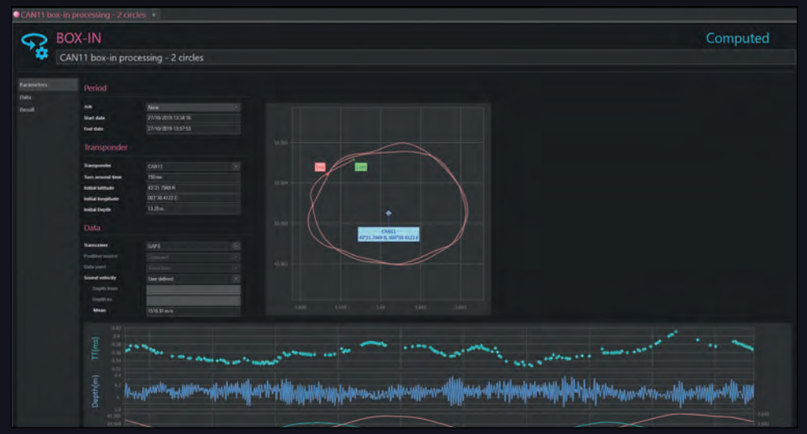
Benefits
- Calibration free
- Shallow water and horizontal tracking
- Highly accurate positioning (0.5% of the slant range)
- Easy to install, operate and repair for cost-efficiency



A real-time visibility map of the LBL array



View of the Navigation Simulation Module



Example of box-in data processing in the Operations Module

DELPH SUBSEA POSITIONING INNOVATIVE SOFTWARE FOR SUBSEA POSITIONING

Improving operational efficiency is a recurring challenge for subsea operations. Throughout the life of a field, from construction up to decommissioning, several subsea vehicles will be deployed to cover various tasks such as pipeline and structure installation, maintenance or repair. An ROV or AUV assigned to a specific task will require multiple positioning sensors (LBL, USBL, INS...) to complete its mission. Defining the "good enough" subsea positioning strategy, i.e. to ensure a minimum accuracy without compromise on safety, can be a complex exercise. For instance, an overestimation of the LBL transponders required will directly induce vessel time and finally costly operations. On the other hand, a certain level of positioning redundancy may be requested for a vehicle operating close to a subsea asset in production.

To ease the design and monitoring of a subsea vehicle navigation, iXblue has developed an integrated solution. Not only has the company broadened its product range with the new intelligent Canopus LBL Transponder and the new generation Ramses transceiver, but with Delph Subsea Positioning Software, iXblue now provides a complete integrated solution for subsea positioning that goes a step further by bringing significant efficiency. Divided in 4 modules (LBL Array Planning, Navigation Simulation, Operations, Post-Processing) with an intuitive user interface, Delph Subsea Positioning (DSP) is an integrated software suite for the preparation, the operation and the post-processing of iXblue positioning devices (USBL, LBL and INS).

LBL Array Planning Module

Deciding on the exact number of transponders to be deployed on the seabed and their location is critical to the success of LBL Jobs. Therefore, careful and efficient planning is key. Dedicated to the preparation of LBL missions, the LBL Array Planning module analyses acoustic propagation by taking into account the Digital Terrain Model and the Sound Velocity Profile. It produces real-time visibility map for a transceiver navigating in an array of transponders by estimating the acoustic coverage of each transponder. It also checks for baselines and acoustic line of sights between transponders.

Simulation Module

This second brick of the software enables to simulate a trajectory of a subsea vehicle and generate associated synthetic inertial and acoustic data. This data can then be post-processed, using DelphINS, to visualize what would be the performance of the navigation. Thus, by using this new simulation module, the operator can simulate the trajectory, visualise the ROV or AUV movement along this trajectory and depending on the level of accuracy required adapt the number of transponders to be deployed and their precise location. This allows a better planning and mitigate the risk for navigation errors during deployment and operation time.

This navigation Simulation Module is a game changer for ROV/AUV manufacturer and operators. Indeed, by simulating an infinite amount of navigation patterns and external sensors availability variation, it reduces the amount of sea trials required for instance for subsea vehicle's qualification and thus allows for significant cost savings.

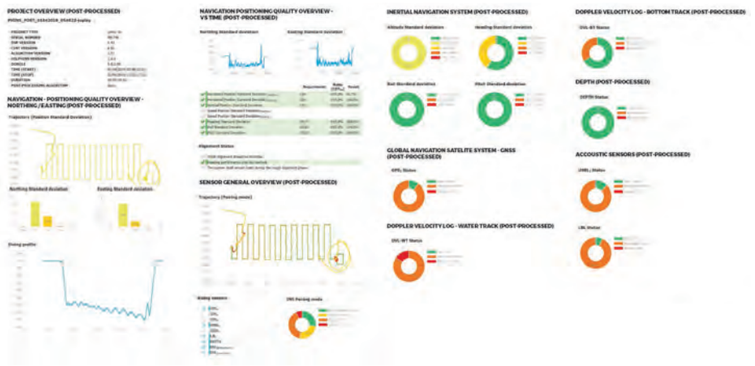
Operations Module

Once the planning and navigation simulation steps are completed, the operators know how many transponders are needed, their precise location and the optimum navigation pattern. They can then start deploying the beacons. During the deployment of the complete positioning solution on the vessel and on the vehicles, the Operation Module of DSP software controls and commands the various iXblue equipment in a unique interface. It supervises all the operations, from equipment configuration, calibration tasks, standard positioning jobs to specific telemetry operations and the monitoring of the tracking. For the calibration of LBL arrays, the Operation Module runs state-of-the-art algorithms and produces automatic calibration reports. Calibration may be conducted via traditional GNSS aided box-in, SLAM and/or mutual array calibration methods.

Post-Processing Module

Finally, DelphINS Subsea is the post processing tool that completes the DSP suite. It takes either real inertial data or data generated by the Navigation Simulation module and runs Inertial Navigation System algorithms to provide statistics and status all along the navigation (or simulated navigation). It also generates automatic report regarding the navigation of the vehicle. Strong data management, highly intuitive visualisation, editing and processing features together with diverse export capabilities make DelphINS Subsea ideal for quick and easy navigation enhancements. By combining the raw data from the INS and from the complementary aiding sensors (GNSS, USBL/LBL, DVL, depth sensor...) during post-processing, DelphINS Subsea provides higher accuracy for the position, velocity or attitude of the vehicle. The module also produces new comprehensive quality analysis and quality check reports (QA/QC), providing quick, easy and highly intelligible information on the reliability of the collected data.

Intuitive and user-friendly, each module of the DSP software suite has been designed to make each step of the subsea positioning operation simpler, error-free and faster, saving vessel and man time. With Canopus transponder, Ramses transceiver and this new integrated software suite, iXblue's subsea positioning and navigation offer is truly enhanced, providing substantial efficiency and reliability to customers. ■



A comprehensive QA-AC is generated by DelphINS Subsea

Delph Subsea Positioning

SOFTWARE

FEATURES

LBL Planning Module
- Manage Sound Velocity profile
- Display DTM
- Drag and drop transponders
- Display visibility map
- Display acoustic line of sight between transponders

Simulation Module
- Sensors configuration (INS, DVL, USBL, Rangemeter, GNSS...), level arms, misalignments, error models
- Environnement configuration (Current...)
- Time reference configuration
- Trajectory definition in vehicle or geographic reference frame
- Trajectory simulation and generation of corresponding synthetic sensor data
- Post processing data into DelphINS Subsea for performance evaluation

Operations Module
- Manage projects
- Interface to iXblue transceivers
- Configure iXblue transceivers
- Collect data from transceivers (box-in)
- Collect data from transponders (mutual calibration)
- Monitor data and watch status
- Filter data
- Run LBL calibration algorithms
- Display calibration results
- Produce calibration reports

Post-Processing Module
- QA/QC reports generation
- INS/DVL post-mission calibration
- Customizable map projections
- 2D plan view
- Forward/backward data processing edit/modify data, add/remove aiding sensors
- Powerful export tools

BENEFITS
- Easy and intuitive
- Does not require any acoustic nor in-depth INS knowledge
- Cost-effective

CHARACTERISTICS
- Supported platform: Win10 x64
- Processor: Intel Core i5 2 Ghz
- Memory: 4 Go

COMPATIBILITY
- Ramses transceiver
- Gaps
- Canopus transponder
- iXblue INS

SEAPIX-C: REAL-TIME STATIC BATHYMETRY FOR HIGH-PRECISION MARINE WORKS

Increasing efficiency and reducing vessel-time has been a key focus for all companies working in the Offshore industry for several years now. As a major provider of advanced navigation, subsea positioning and imagery solutions dedicated to the Offshore market, iXblue is striving to bring new innovative solutions to support operators in their daily operations. It is with that in mind that the company has developed a unique seabed mapping solution dedicated to marine works: the new SeapiX-C sonar.

Based on iXblue's SeapiX 3D volume sonar, a proven solution originally developed for the fishing industry, the new SeapiX-C offers wide coverage (up to 10,000 m² at 30m range) and real-time georeferenced static bathymetry capabilities to marine works operators for instant monitoring and decision-making.

"SeapiX-C being a solid-state "3D" multibeam sonar with no moving parts, it allows for each of the detected points on the seabed to be seen in two different ways, without requiring any movement of the sonar. To fully benefit from this particular feature and offer a unique static bathymetry capability, we have developed a very specific algorithm so that the sonar is able to automatically choose, in real-time, the configuration that will offer the most accurate measurement possible," explains Maxence Rioblanc, Software & Products Manager at iXblue. "Our algorithm has proven to be highly robust, as it was able to reject side lobes and multi-travel echoes which usually limit the performance of standard MBES installed on rotators. »

Providing highly accurate and robust station-based bathymetry, SeapiX-C is a valuable seabed-mapping solution that will bring about more efficient and flexible operations, as well as increased safety to marine works, and which will be perfectly suited for challenging jack-up barges deployments and dredging operations.

Increasing safety and efficiency for jack-up barges deployment

jack-up barges being very large platforms that need to be securely positioned on an even seabed, and which maneuverability is limited, it is of the utmost importance for operators to know exactly where they are positioning the legs of the platform. However, current operations remain challenging, with the jack-up barges legs being deployed blindly using seabed information found on pre-lay survey maps. A difficult exercise as operators can never be entirely sure that they are positioning the legs exactly where they should be, and as the bathymetry of the terrain displayed on those maps can have changed since the pre-lay surveys.

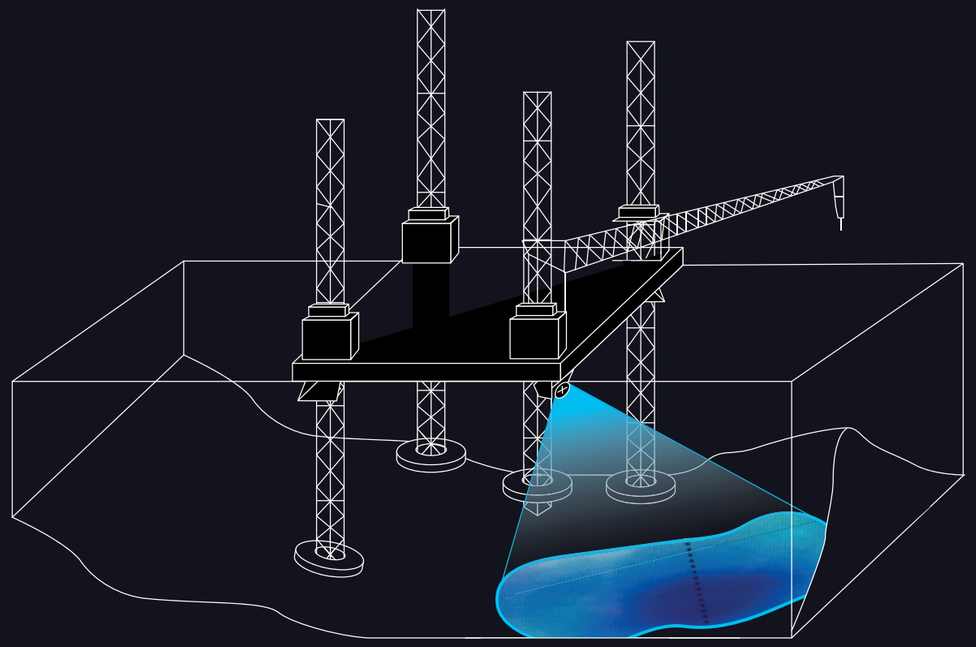
By providing a new station-based3D imagery solution able to display the seabed in real-time and covering a wide area, the new SeapiX-C completely removes this challenge and enables operators to directly see where they are positioning the legs during the deployment. A highly efficient tool that increases the safety of deployment and brings higher efficiency to the operations by removing the need for time-consuming and costly pre-lay diver operations.

To make deployment operations even more straightforward, iXblue is also providing a new software dedicated to this solution. The real-time bathymetric results provided by the installed SeapiX-C (usually one per leg), along with the information coming from the platform itself (legs position, displacement, height when rising above the waterline...) are all displayed within a single user-friendly interface that also enables the operator to switch between three available modes (static bathymetry, standard bathymetry used during transit, and scanning to visualize the deployment of legs in the water column). Additional indicators displaying critical information such as the distance between the legs and the seabed are also available within the interface to facilitate the operation.

Reducing dredging time through real-time operation monitoring

SeapiX-C sonar is also a valuable solution that increases operational efficiency for dredging works by enabling real-time monitoring of construction or maintenance operations. SeapiX-C indeed provides real-time high-resolution and georeferenced static bathymetry of the seabed on a wide area (120° aperture), allowing operators to directly observe and monitor their work.

Preventing ineffective or out of specifications dredging and reducing dredging-time, the new SeapiX-C can be easily operated by the end-user without the need for a specialized surveyor. All acquired data is furthermore directly integrated and displayed into the existing dredging software for easier use of the system.



SeapiX-C

VOLUME 3D SONAR FOR MARINE WORKS

Features

- Station-based bathymetry covering a wide area (up to 10,000m2 at 30m depth)
- Real-time monitoring
- No moving parts for better accuracy and reliability
- High resolution (1.6°x1.6°x7.5cm)
- Multi-head configuration capability
- Easily operated, no need for specialized surveyor

Marine works applications

- Jack-up barge deployments
- Dredging operations
- Infrastructure monitoring

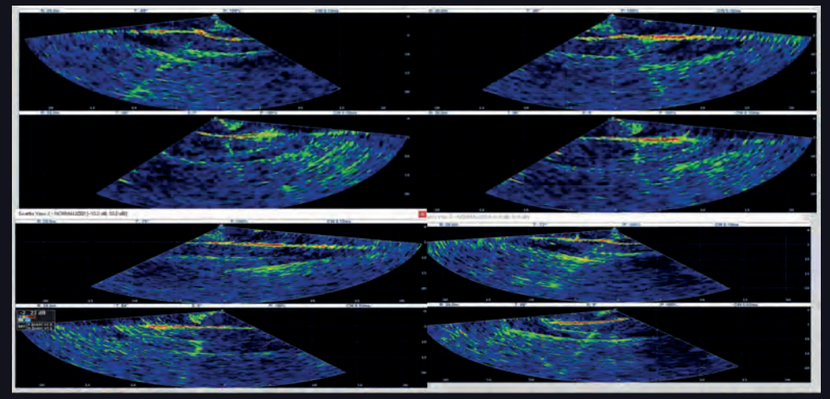
ECDIS-BASED SOFTWARE

Jack-up barge deployments

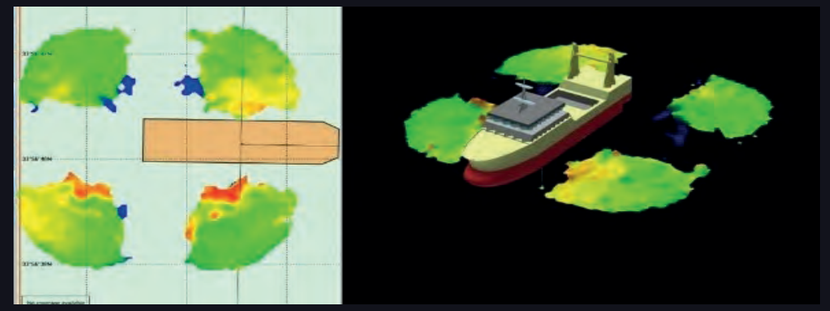
- Single user-friendly interface
- Real-time static bathymetry data displayed in 2D/3D volume map
- 3 available modes: static, standard, scanning
- Additional indicators displaying critical information

Dredging operations

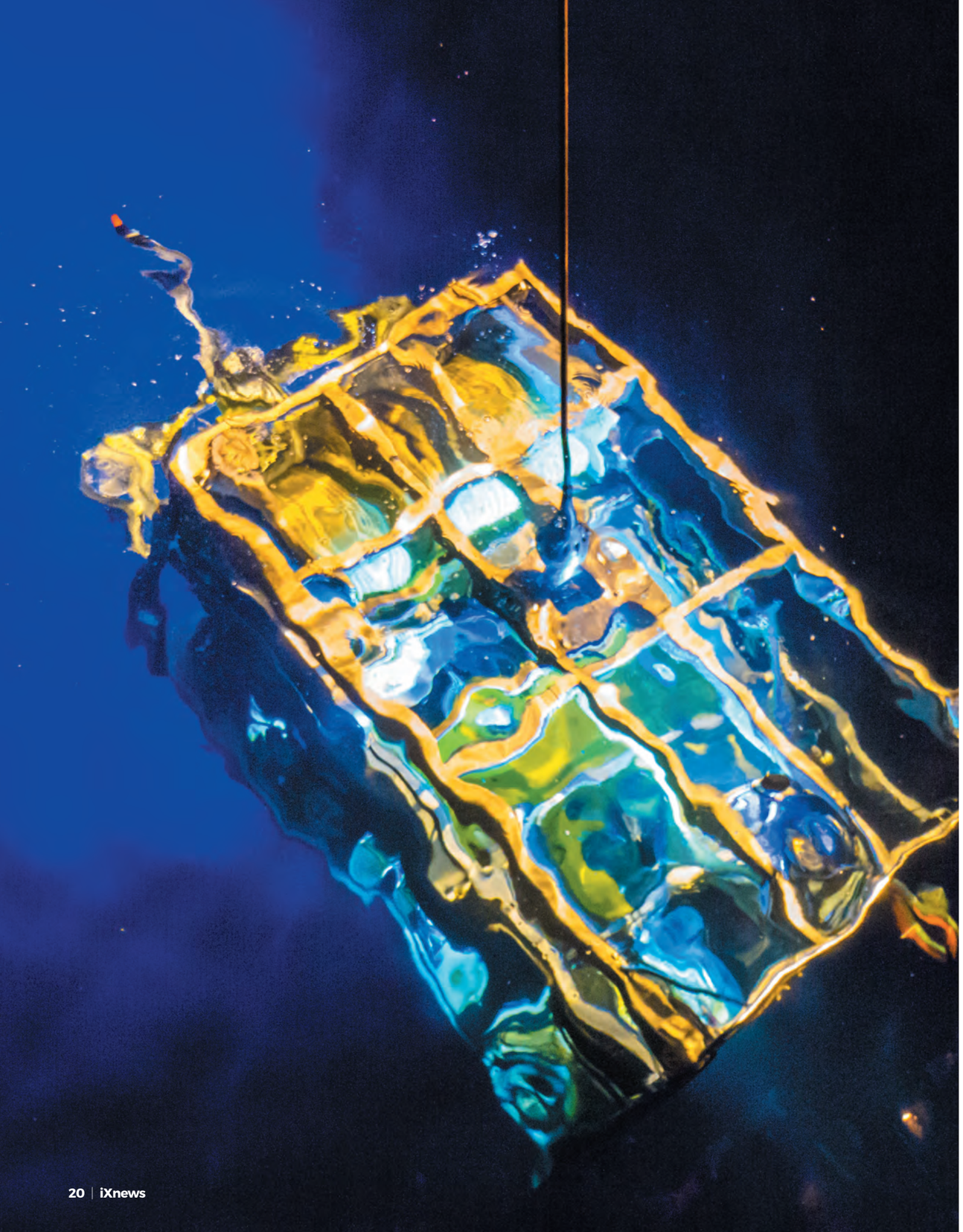
- Acquired data integrated within existing dredging software



Swath view displaying across-track and along-track swaths during operation mode



SeapiX-C provides reliable digital elevation model from a static standpoint.



INCREASED PERFORMANCE AND FLEXIBILITY BROUGHT BY INS/DVL TIGHT-COUPLING

Accurate positioning of subsea vehicles is critical for the success of underwater operations. This is why the development of ever more performant Inertial Navigation Systems has always been a key focus for iXblue. Striving to always bring increased efficiency to companies operating in the subsea world, and to enhance its Inertial Navigation System positioning performance, iXblue has recently partnered with DVL manufacturers Nortek and Teledyne RD Instruments to offer a new INS/DVL tight-coupling solution. Benefitting from iXblue's field-proven Fiber-Optic Gyroscope (FOG) technology, that has revolutionized navigation in the past decade, and from the latest DVL developments that Nortek and Teledyne RD Instruments have been working on, this new solution combines the best navigation technologies available today and offers a scalable, plug & play solution which performance and characteristics can be best suited to the user's needs.

Modularity and ease-of-use

Offering modularity and flexibility, this new tight-coupling solution enables users to choose the INS and DVL combination best suited to their needs in terms of accuracy, volume, weight and altitude, without compromising on the solution's ease-of-use. Additionally, integration on the vehicle is made flexible thanks to the possibility to separate both the INS and DVL and individually place them anywhere and in any convenient orientation.

The risk posed by a damaged DVL is furthermore mitigated due to the ability to directly swap the DVL on the field, without dedicating vessel-time for DVL calibration prior to re-starting the operation. Performing calibration in hidden time directly via iXblue's Delph INS post-processing software or iXblue 24/7 support is also made possible due to the available INS data logging capability

Increased INS positioning performance

Sea trials conducted by iXblue, Nortek and Teledyne RD Instruments in order to qualify the characteristics of this new solution, as well as repeatable results, confirmed the new high positioning performance offered and allowed iXblue to review the positioning performance of its INS (see table below). ■

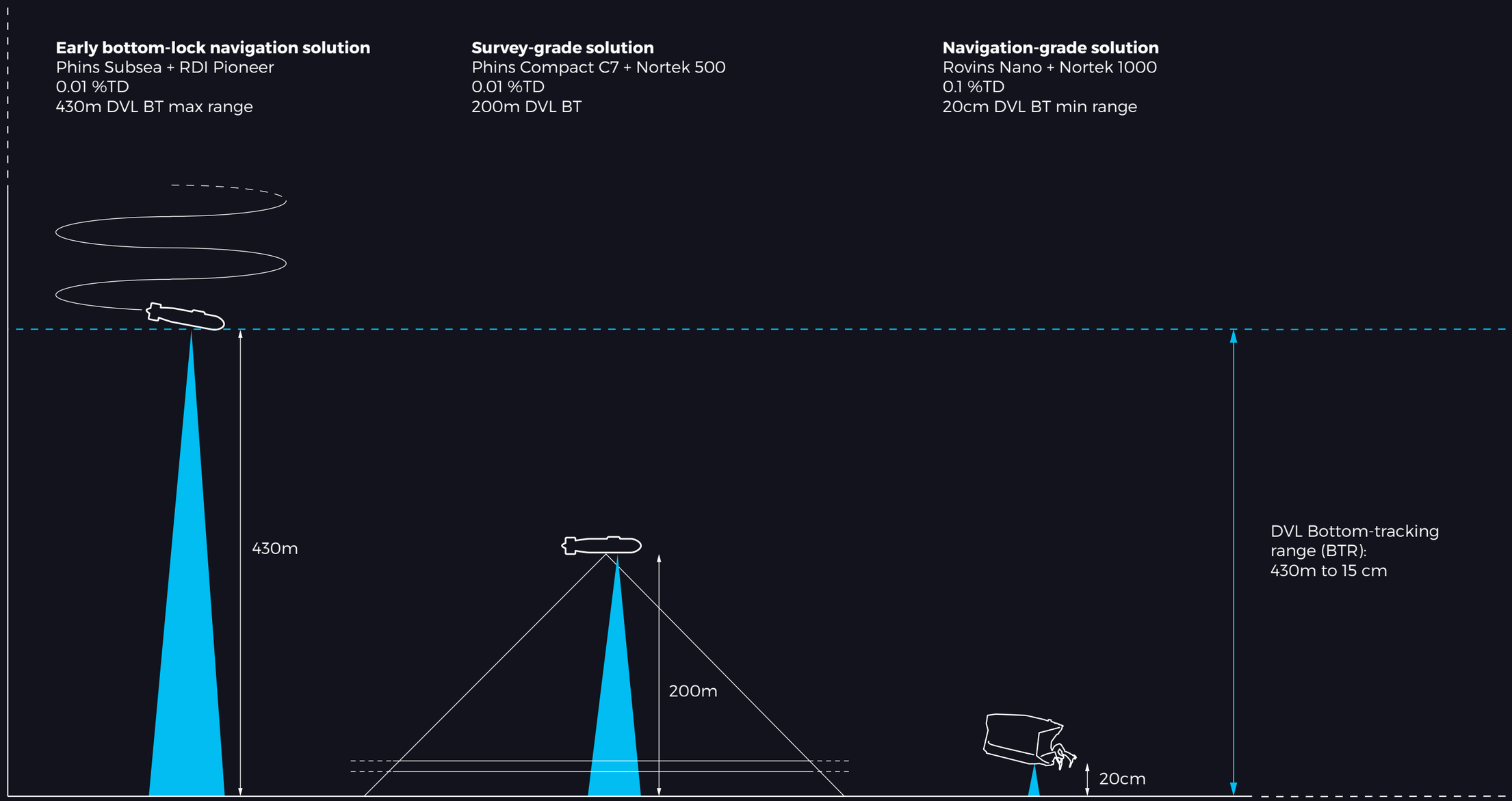
	Rovins Nano	Rovins	Phins Subsea	Minimum improvement factor using Delph INS post-processing software
DVL-aided optimal performance in typical conditions (%TD)	0,04	0,02	0,01	x2,5
DVL-aided straight line performance (%TD)	0,2	0,1	0,05	

OPTIMUM INS/DVL SOLUTION FOR ALL SUBSEA APPLICATIONS UP TO 6,000 M

Early bottom-lock navigation solution
Phins Subsea + RDI Pioneer
0.01 %TD
430m DVL BT max range

Survey-grade solution
Phins Compact C7 + Nortek 500
0.01 %TD
200m DVL BT

Navigation-grade solution
Rovins Nano + Nortek 1000
0.1 %TD
20cm DVL BT min range



IXBLUE SHOWCASES FLIPIX ITS FIRST ACTIVE DEPRESSOR

Building on its know-how in complementary technologies, iXblue has developed this towed active depressor to improve the accuracy of data acquisition, reduce survey duration, and reduce risks of equipment loss.

INTENDED FOR USE IN HYDROGRAPHIC AND BATHYMETRIC RESEARCH, FLIPIX WILL PROVIDE SUPPORT FOR SURVEY EQUIPMENT (SONARS, MAGNETOMETERS, ETC.) TO ALLOW THEIR DEPTH, ALTITUDE AND PITCH TO BE CONTROLLED WITHOUT ANY HUMAN INTERVENTION.

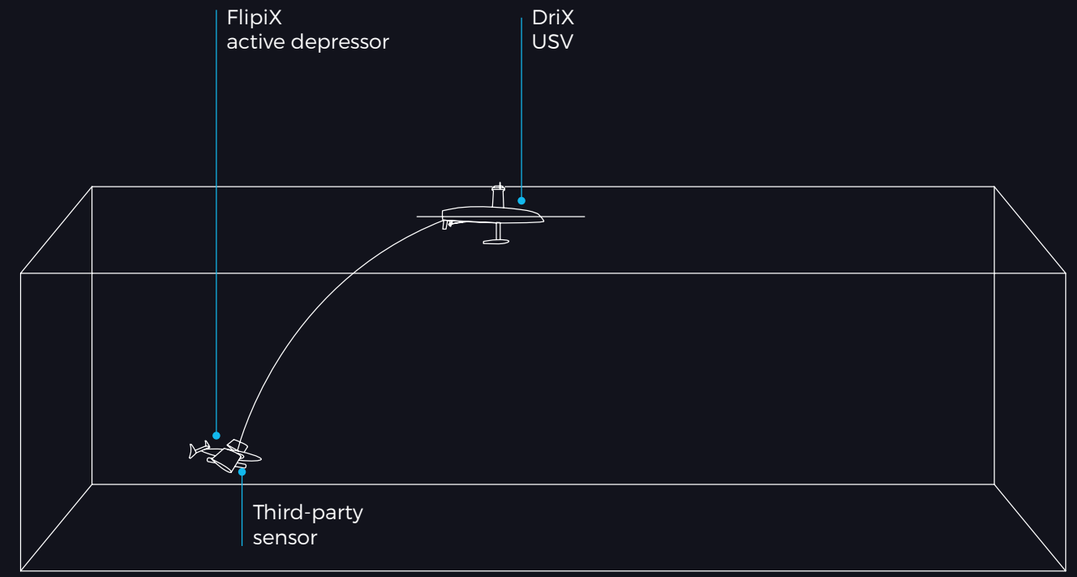
"Today, the altitude of a towfish is regulated manually by adjusting the length of the cable and the speed of the survey vessel.", explains Damien Vignes, Project Manager for iXblue Shipyard division. "This is an adjustment which, in addition to being tricky to carry out, mobilizes the attention of an operator to perform this task."

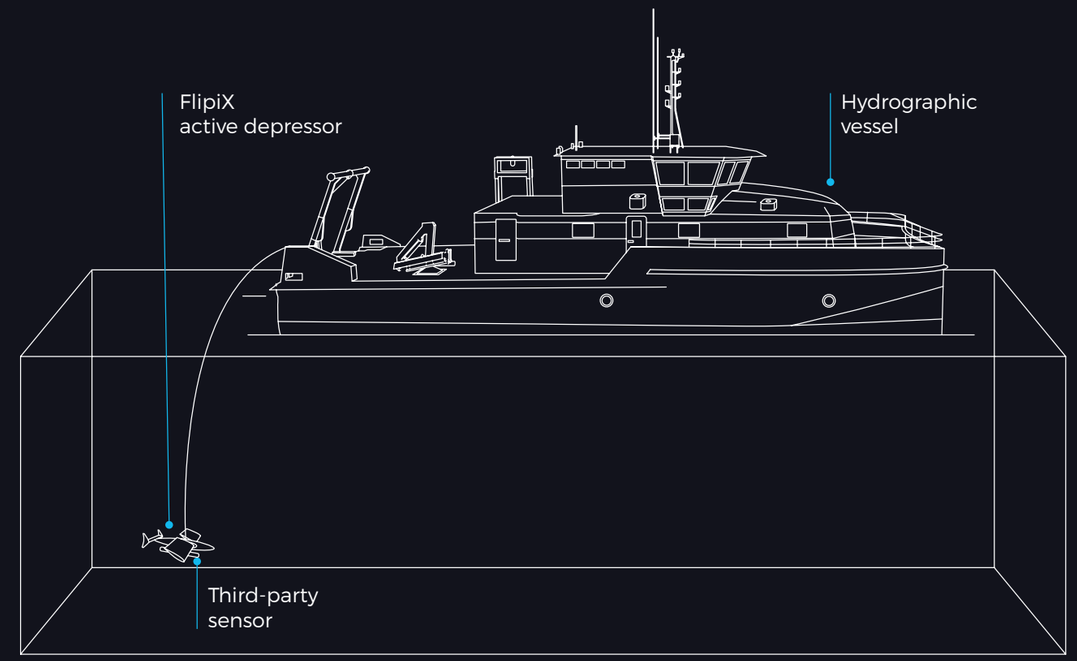
It is to address this issue and make survey operations more effective that the idea of this new carrier was brought up. Thanks to FlipiX, it will now be possible to maintain measurement instruments at a given altitude and constant attitude, and to do this in a perfectly autonomous way.

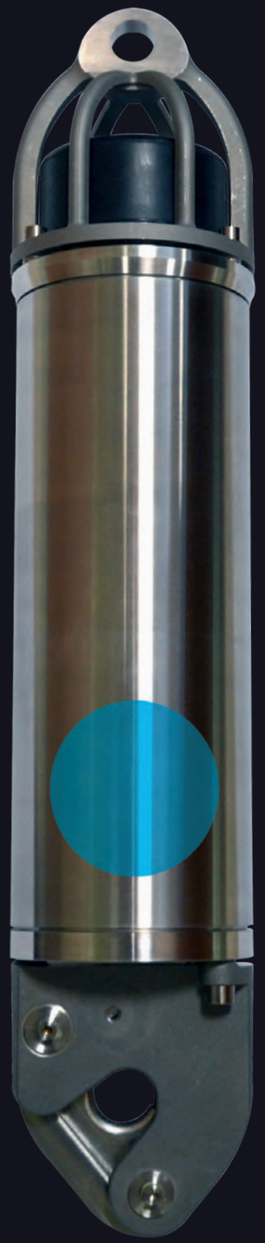
"The idea at the outset was for the towed active depressor to serve as a complement to DriX, so that the latter could broaden its range of portable payloads, in particular with the capacity to tow a side scan sonar and a magnetometer," continues Damien Vignes. "But FlipiX will of course also be able to be towed behind a survey boat depending on the customer's needs."

FlipiX is indeed the ideal complement to any autonomous platform thanks to its automatic management of the towfish. It fully manages not only its depth, but also its longitudinal and transverse pitch, whilst guaranteeing stability through curves. In addition to working with autonomous platforms, FlipiX will also make these same operations on board any conventional survey vessel safer and more efficient.

With the first tests conducted in December 2019 and further sea trials planned in the near future, FlipiX towed active depressor, has already attracted interest from numerous hydrographic and bathymetric research teams and should be taking to the oceans soon to bring even greater autonomy and efficiency to survey operations. ■







OCEANO R5
NEW ACOUSTIC RELEASE, ROBUSTNESS AND RELIABILITY IN A MORE COMPACT VERSION

Leveraging 40 years of experience and with over 15,000 units delivered across the globe, iXblue's acoustic releases have proven their reliability and robustness by meeting the most demanding needs of scientific campaigns and offshore works. Strength, accuracy, long-battery life and a permanent concern for quality make iXblue's Oceano acoustic releases a state-of-the-art product range designed for payloads from 200 kg to 5,000 kg and available for coastal to ultra-deep deployments. To meet customers' demand for lighter and smaller product, but without compromising on robustness and reliability, the Oceano series is evolving. The first model of the Series to be released is the Oceano R5, the successor of the well-proven Oceano AR861B2S unit (with more than 3,000 units sold over the last 20 years).

A more compact unit and a new mechanical design

Conceived for deployment of long-term instrumented moorings down to 6,000 m water depth, this new model has been redesigned in smaller dimensions compared to the previous version. The overall length of the Oceano R5 is shortened by 150 mm and the weight in air down by 5 kg, making it possible to be handled by one operator only. Its reduced weight in water also lowers the need for floatation package, ensuring a more cost-effective deployment and recovery operations for users.

A special care has also been taken to improve the mechanical design of the Oceano R5 to maximise corrosion resistance. With a housing built of high tensile strength super duplex stainless steel and thanks to the reduction of mechanical interfaces, the new Oceano R5 offers an excellent robustness to corrosion, reinforcing its endurance in harsh environments. Furthermore, the release mechanism has also been redesigned to improve the reliability of the release function and to overcome concretion or biological deposits. The Oceano R5 is now fitted with a 2 500 kg full positive drive-off release mechanism ensuring safe recovery of equipment and sensors. Finally, this unit is obviously equipped with the newest generation electronics.

Durability and ease-of-use

The standard features include a safe working load of 2 500 kg for lifting operations, long ranging capability as well as pinger mode and diagnostic built-in functions. Like the whole Oceano Series, the Oceano R5 operates with off-the-shelf alkaline batteries, making it easy for customers to operate and maintain. It also includes a backup battery cell to secure the release process when the main battery pack is almost empty. Its autonomy (3 years with alkaline batteries and 7 years with lithium batteries) addresses most of the users' requirements for durability. The Oceano R5 acoustic release can be actuated from any low frequency deck set unit from iXblue's range.

Overall, this compact yet durable design of the new Oceano R5 acoustic release offers great reliability and robustness without compromising on performance and is ideal for long-term deployment and recovery of moorings in harsh working conditions. In the future, the whole Oceano Series will benefit from this new and more compact design. ■

The new design of the release mechanism

Oceano R5

OCEANOGRAPHIC ACOUSTIC RELEASE

Features

- 2 500 kg SWL* and 2 500 kg RL**
- Full positive drive-off release mechanism
- Reduced size and weight to lower the floatation need
- 6 000 m water depth
- Corrosion resistant super duplex stainless steel housing
- Secure command coding system
- Acknowledgment of received and executed commands
- Very low power consumption
- Off-the-shelf alkaline batteries
- Back-up cell for release mechanism

Options

- Remote transducer head configuration
- Lithium batteries (no hardware modification)
- Tandem coupling kit
- Titanium housing

Applications

- Oceanographic deep moorings
- Long-term instrumented deployments
- Extreme environmental conditions

02

CUSTOMER STORIES

DRIX AN EFFICIENCY MULTIPLIER AGAINST TRADITIONAL METHODS

AFTER SUCCESSFUL TRIALS CONDUCTED FOR TOTAL IN THE CASPIAN SEA IN 2018, DRIX WAS ONCE AGAIN CHOSEN TO BRING AGILE, DISRUPTIVE AND INNOVATIVE SERVICES TO THE ENERGY SECTOR. SINCE ITS LAUNCH, IXBLUE'S UNMANNED SURFACE VESSEL (USV) HAS INDEED PROVEN TO BE A REAL GAME CHANGER AND HAS GATHERED THE INTEREST OF MAJOR ACTORS OPERATING IN THE ENERGY AND GEOSCIENCES INDUSTRIES.

Drebbel, provider of offshore inspection, construction and trenching services for the Oil and Gas industry, and survey contractor Sulmara Subsea, having identified DriX as a lever for innovative competitiveness, approached iXblue in April 2019. The request? Evaluating DriX as an alternate to ROV-based pre-lay surveys in the shallow waters of the Gulf of Mexico.

One of the most important offshore petroleum production regions in the world, the Gulf of Mexico covers a surface area of 1,550,000 km² with an average depth of roughly 1,615 m. The more localized area off the coast of Mexico, where DriX operated, however possesses much more shallow water oil production in the range of 100 m. This specific area, that has undergone a major O&G commercial boom in the past few years, with many new platforms being installed, has now become the theatre of important subsea operations, pipeline coupling being needed to connect the various installed platforms and take production to shore. Seeking to conduct more efficient and cost-effective operations, offshore companies are now looking at new disruptive ways to gain more efficiency for their surveys and the positioning of their subsea assets.

"Sulmara Subsea is a very innovative company that is seeking to bring disruptive innovations to their clients," explains Olivier Cervantes Vice-President Marine Services at iXblue. "They believed in DriX potential from the very start and reached out to us as soon as they received Drebbel's request for pre-lay survey operations in such a challenging region of the world."

Pipeline route surveys prior to installation campaigns being required to define the subsea topography, its hazards, debris, as well as the soil characteristics prior to trenching operations, ROVs equipped with Multibeam Echosounders and Sub-bottom Profilers, are traditionally used to acquire all the necessary data to create a comprehensive cartography of the seabed, including a Digital Terrain Model (DTM) that will give all bathymetric information and a seismic profile showing the soil composition to around 50 m depth under the seabed.

"For this particular mission, the end client was requiring a DTM with a 25 cm resolution," Olivier continues. "One of the challenges was to make sure we reached this resolution from the surface in 80 m of water depths and at a high speed (6 knt). The use of a surface vessel, that can conduct operations at a much faster rate than a ROV, was of particular interest for Sulmara Subsea and Drebbel."

A more efficient and cost-effective solution compared to traditional ROVs which operate at 1 knt and require more people and logistics, it was decided that DriX would be sent to Mexico where it subsequently surveyed 90 kilometers of pipeline route at up to 6 knt in the shallow waters off the coast of Mexico.

For the first phase of the project dedicated to the pre-laid survey, a multibeam Echosounder with a specific set-up was installed within DriX gondola, two meters below the surface of the sea. The USV performed the survey operation at speeds reaching up to 6 knots and successfully provided images within the required 25 cm resolution.

"Using DriX during over several months on our project in Mexico was a real game changer. Its efficiency was second to none and enabled us to drastically reduce vessel time," explains Kevin McBarron, CEO at Sulmara Subsea. "Within 24 hours, DriX proved to be able to provide high resolution imaging 4 times faster than traditional data acquisition by ROV in up to 100 m water depths. Thanks to the efficiency delivered by the iXblue USV we were able to gain much more efficiency as compared to using traditional methods and we expect to improve on this on the next year's campaign. DriX is truly a new and disruptive technology that really moved the needle for our customer and fits very well with Sulmara's approach to delivering innovative solutions for our clients. We look forwards to further collaboration with iXblue in the near future."

This first phase of the pipe laying operations completed and other production sites having already undergone the trenching operations, DriX then performed the last phase of the project: the as-laid survey. Still equipped with a Multibeam Echosounder, DriX successfully surveyed the pipelines and concrete mattresses already laid on the seabed to record their position and physical condition.

"Overall, this 7-month mission was another success. DriX not only proved to be the perfect tool to save precious vessel time by conducting surveys much faster than traditional assets, it also provided incredible data resolution at shallow water depths, no compromise being needed between efficiency and quality. It was also proven that DriX offered a carbon footprint 10 times lower than a traditional vessel. This all makes the overall operation a great success for us" Olivier adds. "And, in order to further increase DriX operational efficiency for a new upcoming mission in Mexico, we are now in the process of integrating our Echoes sub-bottom profiler into DriX gondola, along with its current multi-beam Echosounder. Both sensors will thus be able to be used simultaneously during the survey, exponentially increasing our USV efficiency. Beside seabed mapping applications such as pre/post lay surveys, DriX will furthermore be conducting subsea positioning operations in the near future, widening the scope of its missions. We are very thankful for Sulmara and Drebbel's confidence in our USV that has for sure increased DriX reliability and efficiency in the Offshore environment and will allow us to be able to offer even more capabilities in 2020."

After successfully completing the required phases of the project and bringing highly sought-after efficiency to the operation, DriX will thus return to the Gulf of Mexico's waters in early 2020. With a bright future ahead of iXblue's new USV in the Offshore Energy sector, 2019 will have finished proving that DriX is a disruptive force that is to be reckoned with and that brings agility and innovation to a market that is actively looking to reinvent itself. ■

DriX provided high resolution imaging 4 times faster than a ROV

© Courtesy of Ifremer

Enhanced autonomy for Ifremer AUV

Nowadays, various positioning techniques are available for companies and institutes that need valuable navigation information to operate undersea. And while LBL usually remains the preferred solution for the highly accurate positioning of ROVs and AUVs, this method remains costly as it requires the use of many transponders to produce a single position. Operators are thus now looking for new ways that are more efficient, flexible and less costly to conduct their operations.

To do so, they can now rely on sparse-LBL, a method that uses the INS equipping subsea vehicles, and that achieves similar or better performance than traditional LBL, while using less transponders. This is indeed made possible by fixing potential INS drift using the measured ranges to the seabed transponders while at the same time filtering acoustic ranges using INS data.

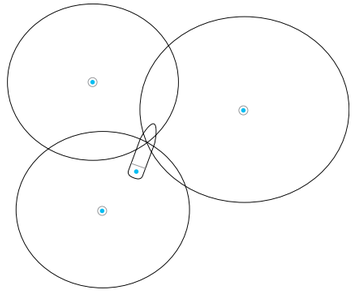
This method, that brings increased performance and flexibility, and that reduces deployment costs, has recently been used and evaluated by the Ifremer oceanographic institute, using iXblue's new Canopus LBL subsea positioning solution.

Introduction to sparse-LBL

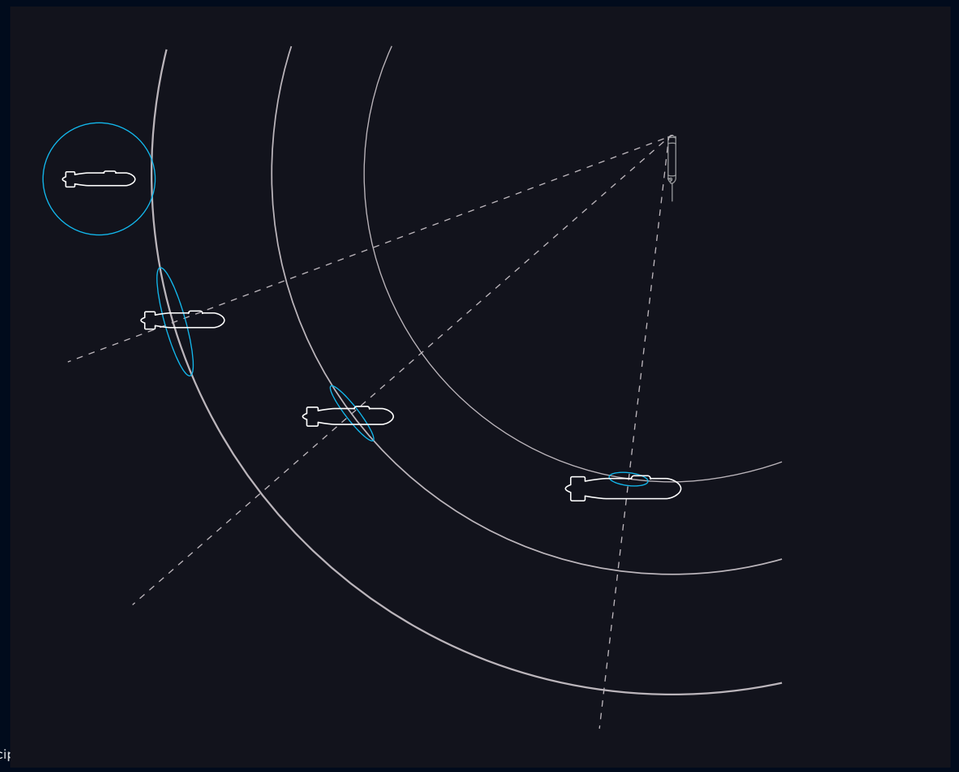
Although the Canopus solution enables various techniques such as SLAM (Simultaneous Localization and Mapping) and traditional LBL (Long BaseLine), it has been especially designed for sparse-array applications.

Using fewer transponders than conventional LBL systems, the sparse array technique reaches the same accuracy as traditional LBL systems, while optimizing transponders' battery power consumption. iXblue's Canopus transponders can incidentally be deployed on the seabed for multiple years thanks to their extremely low power consumption, both during operation and in standby mode.

"The Canopus solution concept, procedures and performance are all based on one basic principle: the ability to merge precise range measurements to an acoustic transponder with the very precise short-term movements from an INS in order to optimize navigation accuracy." Explains James Titcomb, Offshore Technical Manager at iXblue. "Contrary to classical LBL, the optimum real-time fusion is obtained using a Kalman filter, which allows the asynchronous merging of information of various natures, including acoustic range measurements performed by our Ramses transceiver." Adds James.



Classical LBL principle



Sparse-LBL princip

The above “sparse-LBL principle” graphic illustrates this data fusion:

1. Initially the vehicle’s INS position has a large error ellipse represented by the blue circle surrounding the AUV.

2.The ellipse error is then updated thanks to Ramses transceiver measurement of the first range to the beacon, and its transmission to the INS. The position is now well known in the axis between the vehicle and the transponder.

3. The vehicle moves along the route, the INS providing precise relative movement between acoustic interrogations.

4.As the vehicle moves relative to the beacon, the error ellipse progressively improves on multiple axis, gradually resulting in a more accurate positioning.

Following this principle, each range measurement helps computing a new position, as opposed to classical triangulation algorithms (for which at least three simultaneous range measurements are required in order to compute a position). It is therefore possible to navigate with fewer transponders (i.e. sparse array), without any compromise made on performance.

Canopus integration on an ifremer auv

French oceanographic institute Ifremer recently tested the complete Canopus solution and deployed their “IdefX” AUV from the Europe vessel in the Mediterranean Sea. Conducted in water depth between 1,300 and 1,700 m, those sea trials aimed at evaluating the level of accuracy that could be reached for the navigation of the AUV with only two transponders deployed within a 16 km area.

iXblue’s Canopus solution made use of an INS (Inertial Navigation System), a Ramses transceiver and a DVL (Doppler Velocity Log) mounted within the subsea vehicle. It also made use of the dedicated Canopus transponders, deployed on the seabed and regularly interrogated by the Ramses transceiver.

© Courtesy of Ifremer

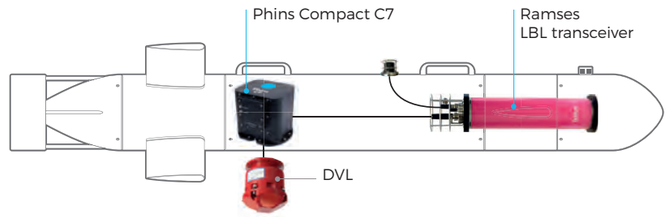
Ifremer IdefX AUV integrates iXblue Ramses LBL transceiver

Within this system, iXblue’s Phins INS was at the core of the positioning system. Its role was to gather all measurements (mainly speeds from the DVL and ranges from Ramses to fixed calibrated transponders), merge them with its internal sensor (gyroscopes and accelerometers) and deliver the optimal real time navigation information.

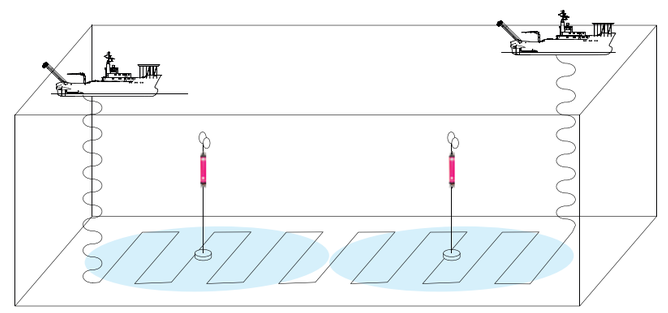
The Canopus transponders used were the latest generation of iXblue smart seabed transponders, with long lasting listening and pinging capability, embedded environmental sensors and storage, acoustic modem and WIFI features.

Operating scenario

The Ifremer purpose was to navigate in the largest possible area using a minimum of transponders, while ensuring a high level of positioning accuracy. For these tests, two Canopus transponders were deployed and calibrated, covering a 2 km × 8 km area. Thanks to vertical acoustic propagation, the AUV was able to detect the closest seabed transponder as



Vehicle system architecture



Deployment scenario

soon as it started diving and helped the INS navigation. Once the sea bottom reached, the AUV started a preprogrammed survey while maintaining a constant altitude above the seabed. During the whole trajectory, the Ramses transceiver within the AUV detected at least one transponder and a single range aiding navigation was performed.

Calibration of seabed fixed transponders

In the same way as with the available positioning modes, Canopus offers great flexibility for the method used for transponder calibration. Both SLAM and LMS (Least Mean Square) based techniques are indeed available, and calibration may be conducted using either iXblue's Gaps USBL system, or Ramses transceiver, as the acoustic interface to the array. If available, inter-beacon ranges are employed and the calibration may be conducted from a surface vessel or a subsea vehicle.

For these trials, the Ifremer chose to use Gaps USBL system to perform the box-in operation. The surface vessel thus circled the transponder location in real time and the Ramses transceiver measured the range to the Canopus transponder and used a LMS, reporting the results and giving an estimate of quality (standard deviation and residuals).

Navigation in the field of fixed transponders

Once calibration of the transponder was done, the AUV was deployed and started its mission. During the survey, the AUV was furthermore tracked from the surface vessel using a Gaps USBL system. After the dive, the direct comparison between USBL tracking and embedded INS/sparse-LBL/ DVL navigation could be performed and showed extremely good results. The positionings estimated in the AUV being much more precise than USBL and overall absolute positioning accuracy was estimated around 1 m. Finally, bathymetry data was extracted and geo referenced using the INS/sparse-LBL/DVL navigation.

Below graphic (Fig. 1) shows a correct continuity between the different isobathymetry curves and confirms the quality of the positioning.

This simple and straightforward real grid survey example demonstrates the efficiency of iXblue's Canopus solution used in Sparse Array navigation mode:

To gain the full benefit of Canopus sparse array navigation, it is only necessary to add a Ramses transceiver to a ROV already equipped with an iXblue INS & any DVL.

The system is made extremely redundant and tolerant to data outages (transponder out of range, DVL bottom tracking loss, etc...).

While the Canopus supervision software can be used for configuring and monitoring the system, it is also possible to directly connect the Ramses transceiver to the existing INS & ROV power, the use of a topside system not being mandatory.

The test below (Fig. 2) conducted by the Ifremer thus shows that excellent positioning can be achieved, even at extreme ranges outside of the conventional LBL array. This leads to the possibility of greatly improving the positioning information for significant distances along field routes, and outside of conventional coverage. ■

Fig. 1.a - AUV survey

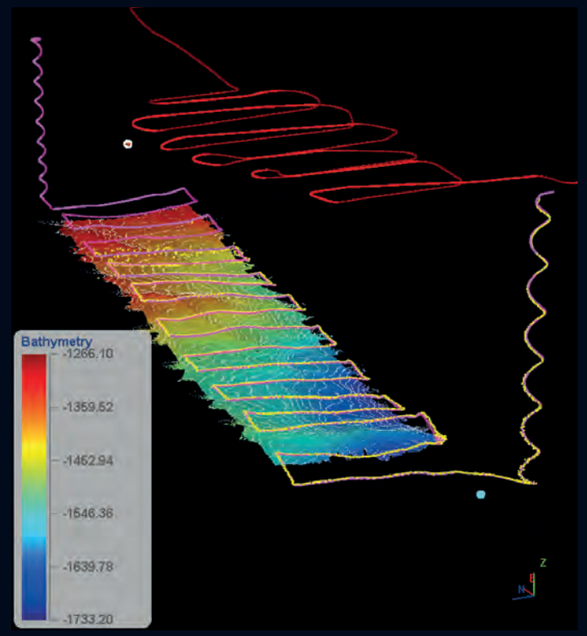


Fig. 1.b - Calibration of first transponder

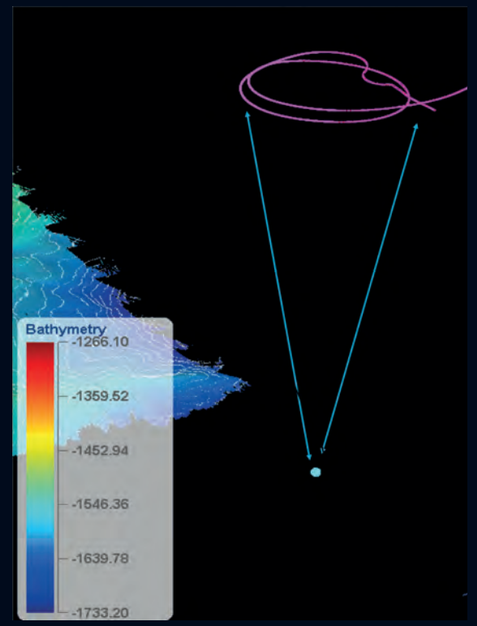
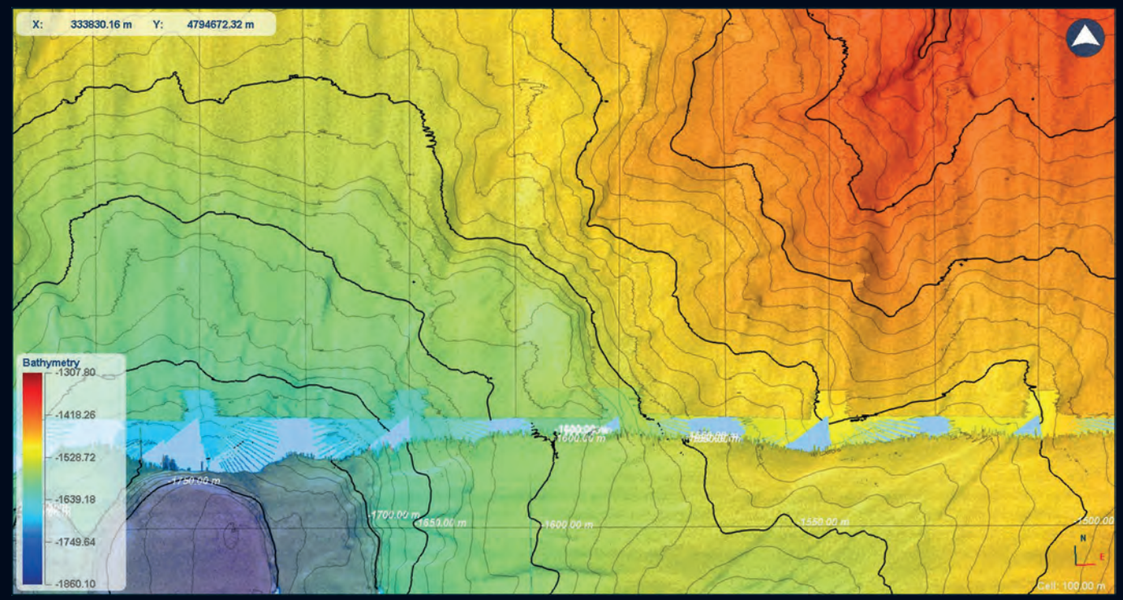


Fig. 2 - Isobathymetry continuity between lines and surveys

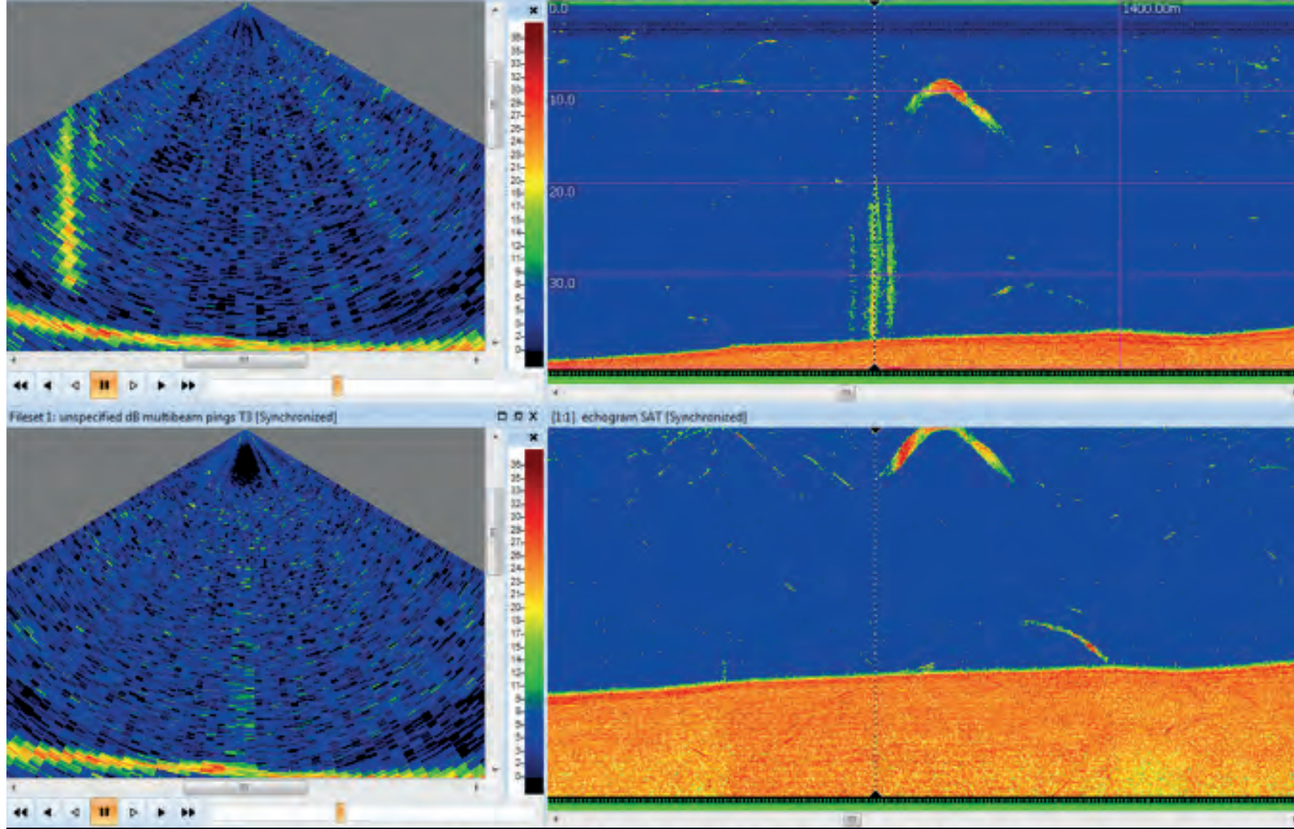


USING ECHOES AND SEAPIX FOR GAS DETECTION AND QUANTIFICATION

In collaboration with four French, Belgian and German geoscience laboratories, iXblue's Sonar Systems division recently mobilized its SeapiX 3D multibeam echosounder and Echoes 10 000 sub-bottom profiler to image the Laacher See. Located in the Eifel region of Germany, the Laacher See is a caldeira volcanic lake of 2 km diameter which was formed by an eruption 12,900 years ago. The main goal of this scientific mission was to detect gas bubbles that would help to better understand the volcano's activity.

Gas is one of the causes that can trigger volcanic and limnic eruptions and can be easily detected by hydro-acoustics methods. However, until now, its quantification remained complex due to the 3D structure of clouds and the acoustic interactions between bubbles. Thereby it is necessary to accurately map the different bubble clouds, to monitor their evolution and to dissociate different gas origins to evaluate the volcanic risk, which is major in aqueous environments.

The use of 2 hydro-acoustics instruments designed and built by iXblue, Seapix and Echoes 10 000 (10 kHz), proved to be of great help for this scientific purpose on the Laacher See. Remotely controlled at several hundreds of meters, the SeapiX sonar recorded the lake's bathymetry, and different backscatter signatures of elements in the water column. As SeapiX software can generate in real-time several maps representing those elements, the scientists could clearly distinguish fish and gas bubbles during the survey. Thanks to SeapiX selectivity function, different Target Strengh (TS) will help researchers to identify different categories of elements detected and to best understand physics of gas bubbles, their generation, origins and dynamics. Since SeapiX was used together with a gas probe installed on the lake during the mission for long-term monitoring, it raises great potential to better understand the life cycle of gas generation by combining the acoustic data from the two different systems. This also brings new insights for developing automatic gas detection module using the SeapiX Software.



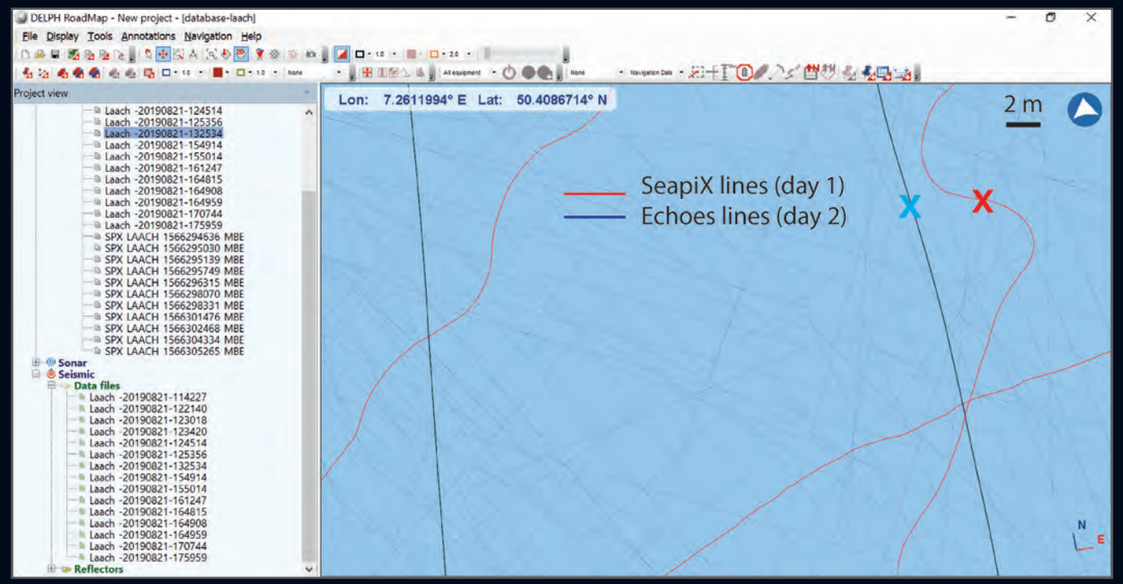
Fish and gas bubbles detection using SeapiX

Meanwhile, the Echoes 10 000 provided high-resolution images of the architecture of the lake deposits, that could be visualized in real-time thanks to Delph Software (iXblue software suite for acquisition, processing and interpretation of geophysical data). Derived from 30 years of expertise of low distortion and high efficiency power amplifiers, Echoes technology ensures the acoustic signal transmitted is very close to the theoretical CHIRP waveform. The resulting seismic profiles reflect, with more accuracy, changes in the nature and texture of sediment layers. More than 35 meters of sediment penetration provided high-resolution images of the sediment architecture (with a theoretical 8 cm-resolution) suggesting great potential for paleoenvironmental and paleoclimatic reconstruction. Indeed, combined with sedimentological analyses of sediment cores, 3D modeling of the main reflectors will allow to reconstruct past remobilization of materials derived from extreme events and potentially linked to past volcanic activities. Finally, the quality of the signal revealed the presence of shallow and deep gas diffusion in the sediment, enabling the scientists to dissociate gas from different origins, such as those from organic matter decomposition (shallow) and from volcanic activity (deep).

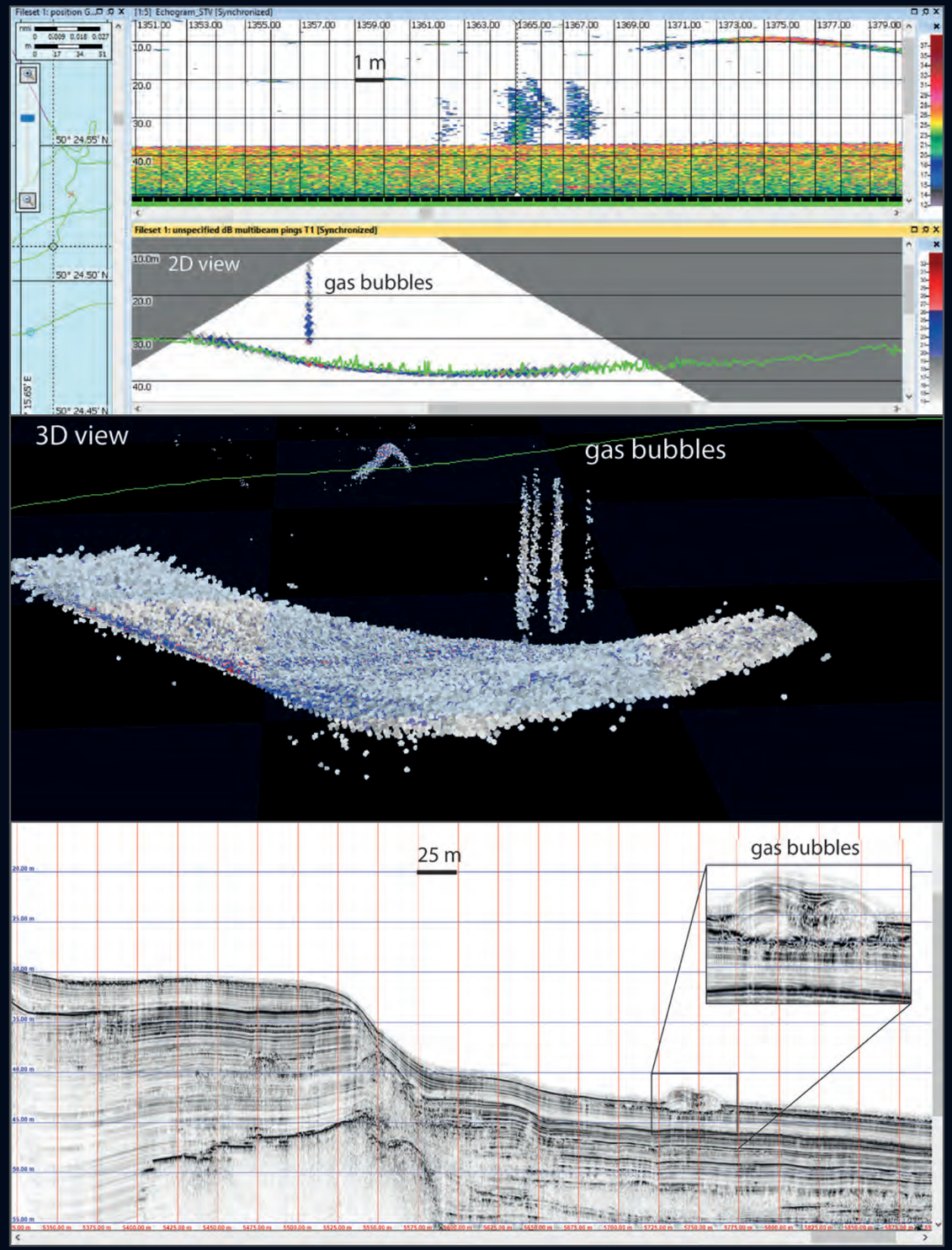
Real-time and multiproxy hydroacoustic data participate to ongoing and global scientific efforts to increase predictability of volcanic and limnic eruptions. Intrinsic and spatial dynamics of volcanic gas bubbles is thus cornerstone for developing new generation of early warning systems needed for future risk assessment. Echoes 10 000 and SeapiX have a part to play in it! ■

Seapix data: 2D and 3D views of backscattered signatures of elements showing vertical release of gas in the water column. Note that maximum distance between gas chimneys in about seven meters.

Echoes data: Seismic reflexion profiles with a ~ 30 meters-large gas release from the sediment (zoom area), suggesting a potential link between a main gas conduit and the four chimneys diffused in the water column.



Delph Roadmap visualization of SeapiX (red, first day) and Echoes (blue, second day) survey lines. Crosses indicate position of profiles visible on the right page:



NEW SEAPIX-C BRINGS EFFICIENT SEP DEPLOYMENT TO PENTA-OCEAN

Penta-Ocean Construction, a major Japanese construction firm specializing in marine works, and iXblue, a global high-tech company specializing in advanced subsea imagery and positioning solutions, have recently collaborated to adapt iXblue's SeapiX volumic 3D sonar, to provide both dynamic and static seabed imagery for Penta-Ocean Construction Self-Elevating Platform (SEP) dedicated to marine construction.

A long-standing customer of iXblue in the Asia-Pacific region, with most of the company's positioning and imagery solutions already in use on their equipment, Penta-Ocean approached iXblue with a special request: to collaborate and produce a brand new imagery concept dedicated to Self-Elevating Platforms. With this new concept, Penta-Ocean was seeking the ability to see, in real-time, where the legs of the platform are being positioned, bringing safer deployment and supporting legs touchdown monitoring to the offshore construction industry.

"This had never been done before, as such technology did not exist on the market," explains Quentin Teo, Regional Sales Manager at iXblue. "Traditionally, before construction firms begin the deployment of an SEP or a rig, a survey is conducted by a hydrographic vessel in order to ensure that the chosen location is safe for deployment, as hazards can be encountered, and the seabed can be uneven. And because SEP are very large platforms, their maneuverability is limited and the positioning of their jacks (legs) is done blindly, based on the survey that has been conducted. One can easily understand how tricky the whole operation is."

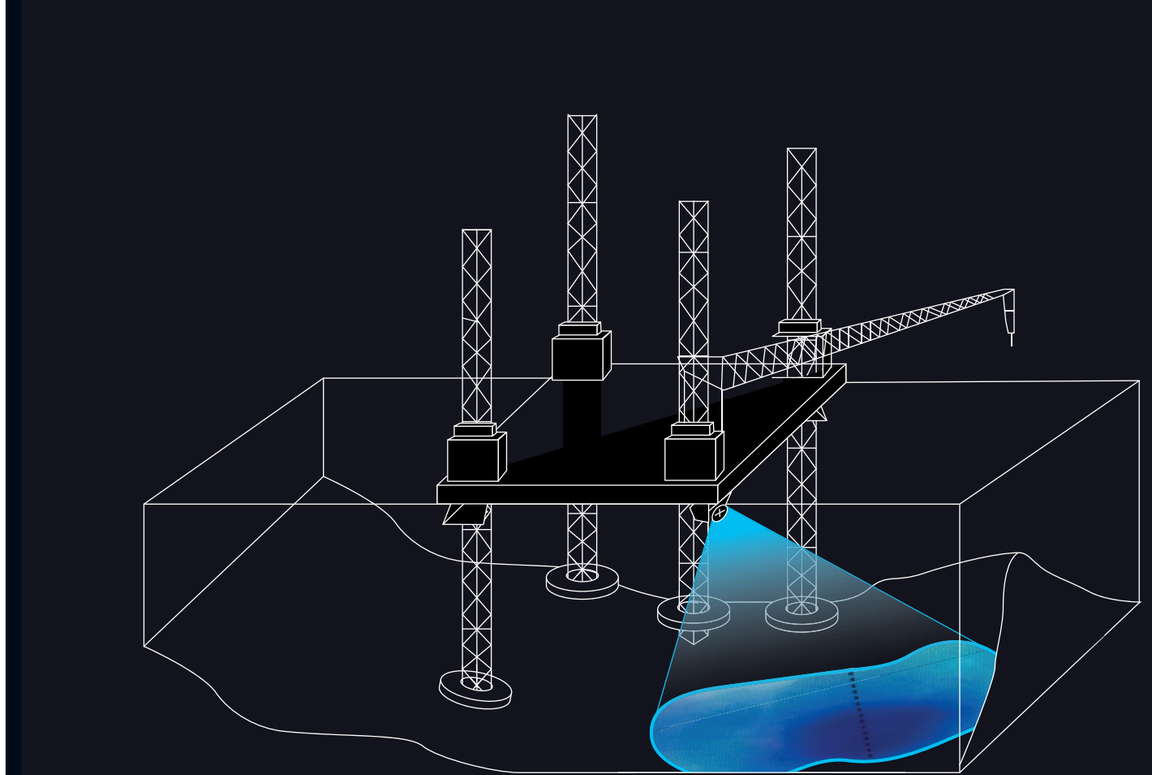
The use of an imagery system able to display the seabed in real-time, for operators to see where they are positioning the legs of the platform is thus a major breakthrough as it removes the need for pre-survey operations conducted by costly vessels and brings about more efficient and more flexible construction operations, as well as increased safety as a whole.

Recognized for its innovative spirit and agility, as well as for the advanced imagery technology developed by its Sonar division, iXblue thus started to work on this new request. The company's SeapiX volumic 3D sonar being particularly close to the client's requirements, it was decided to adapt the existing product to this particular marine construction application.

"SeapiX is one of the only solid-state solutions able to measure the bathymetric profile of a specific area from a still position, while still covering a wide range and being straight-forward to use," explains Maxence Rioblanc, Product Manager at iXblue. "Penta-Ocean having identified SeapiX as a viable solution, we worked on adapting it to their specific needs. We focused on four major developments; from the algorithms that allow the sonar to perform a "static bathymetry", to the new MMI, based on the GECDIS used for fishing applications and that we adapted for offshore operators while also adding new elements such as a 3D model of the SEP and its four legs, as well as new features including the possibility for the user to switch between the new three available modes (static bathymetry, standard bathymetry, and scanning). We also worked on integrating the information coming from the SEP (legs position, displacement, height when rising above the waterline), and on how to control the 4 SeapiX (one per leg) and how to visualize their bathymetric results all within a single user interface."

After less than a year working on this project, iXblue SeapiX-C sonar was ready to provide both dynamic and static seabed imagery for Penta-Ocean SEP and a first commissioning was conducted back in March 2019.

"The commissioning was a great success. As soon as the system was connected, installed and activated, our new SeapiX-C was able to successfully retrieve images of the seabed under the SEP. Penta-Ocean was pleased with our work and this collaboration at sea enabled us to work closely together to further improve our new system" Quentin rejoices. "A year after this commissioning, we are pleased to officially be able to widen the range of our SeapiX sonar applications, already used for fishing and academic research, to include the offshore construction industry. With this new SeapiX-C, dedicated for dredging and SEP applications, marine construction operators will gain highly sought-after efficiency and safety for their operations." ■



Rendering of an SEP deployement operation

IXBLUE BUILDS NEXT GENERATION VESSEL FOR FRANCE'S UNDERWATER ARCHAEOLOGY RESEARCH DEPARTMENT

In the wake of the André Malraux in 2012 and the Triton in 2016, iXblue Shipyard division has won a new contract from France's Underwater Archaeology Research Department (DRASSM) for the construction of a third vessel. Intended to expand the DRASSM's range of activities in French overseas territories with a new deep-sea platform, this new versatile and high-performance vessel is due to be delivered by the iXblue shipyard in 2021.

"This new ship will be one of the largest composite vessels in operation worldwide."

- Edouard Waldura, Project Manager at iXblue Shipyard division

It is in 2015, as part of a call for tenders for the Future Ship program launched by the French Environment and Energy Management Agency (Agence de l'Environnement et de la Maîtrise de l'Energie (ADEME)), that the teams of iXblue Shipyard division and of the DRASSM start working on this project.

"The market for research vessels of more than 25 meters, which has to address new demands of understanding climate change, observing ecosystems, safeguarding biodiversity and developing renewable marine energy (Energies Marine Renouvelables (RME)), is experiencing a strong growth", says Edouard Waldura, Project Manager at iXblue Shipyard division. "And, while these vessels have to respect the marine ecosystem, they are not really suited to the environments in which they have to work."

This is how the NESSIE (Novel Efficient Survey Ship InitiativE) collaborative research and industrial development project was born. The objective being to develop a new generation of monohull scientific research vessel. This vessel will enable a set of innovative technologies to be implemented minimizing the vessel's environmental footprint throughout its entire life cycle, as well as increasing its versatility through innovative solutions.

"To respond to this call for tenders from the ADEME, we have proposed major innovations in the materials used, the vessel's instrumentation, as well as its energy efficiency," says Edouard. "Our project was one of the most ambitious, and we won the call for projects and received the order from the DRASSM for this new vessel."

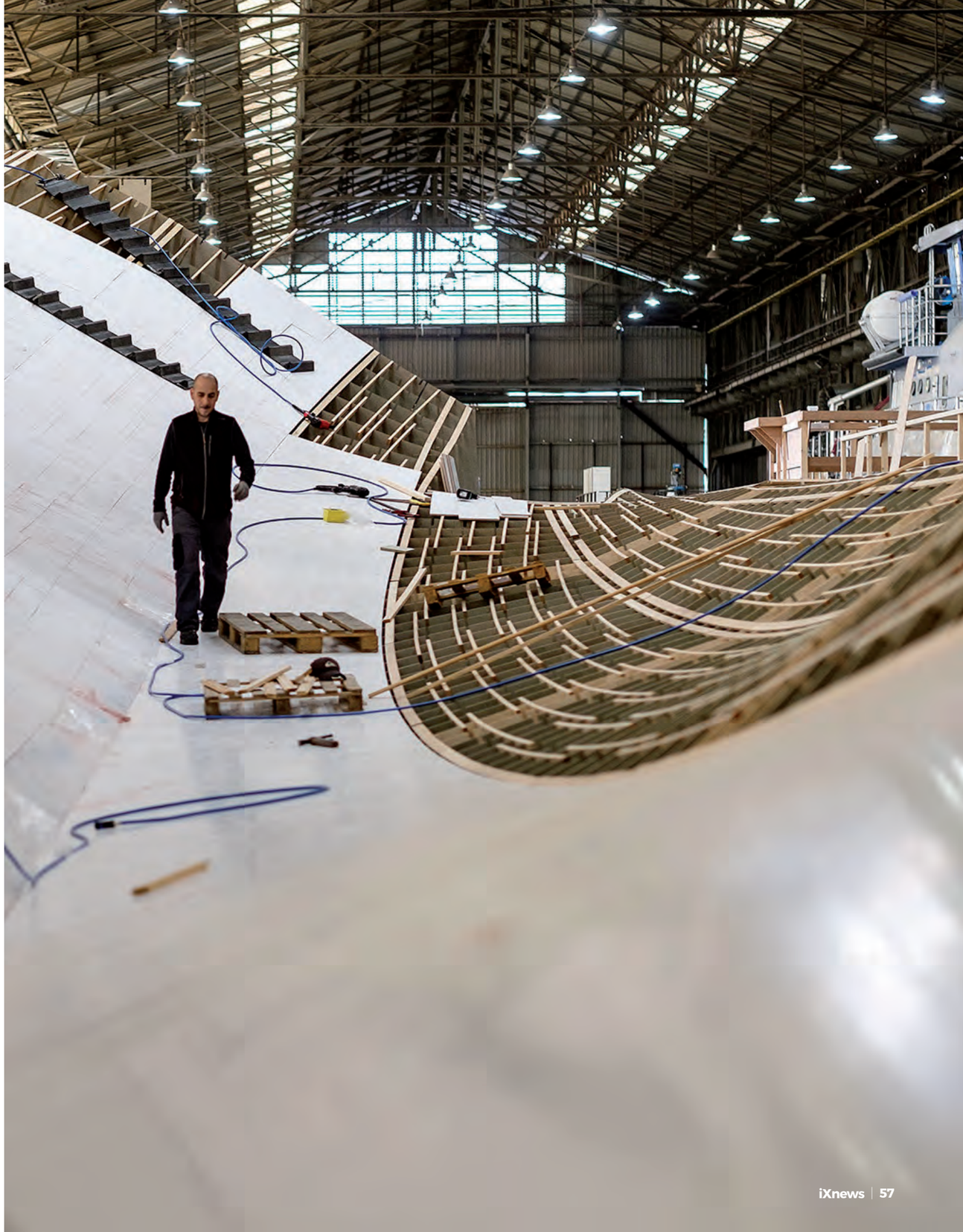
With a length of 46 meters, a beam of 9.50 meters and a draft of 3.2 meters, this new ship will be one of the largest composite vessels in operation worldwide. Its displacement will be 400 tons, and it will be able to reach speeds of up to 15 knots and operate independently for a period of 10 days. This vessel will have a reduced environmental impact and will offer more working comfort for its crews thanks to its semi-SWATH monocoque hull that gives it increased stability.

"We expect to reduce the vessel's carbon footprint throughout its entire lifetime thanks to the various weight reductions in the structures and equipment that have been achieved, as well as the use of recycled carbon fibers" continues Edouard. "The vessel will also benefit from having a smaller displacement than conventional ships and should therefore have a smaller impact on the marine environment, especially in terms of emissions and noise."

The NESSIE project has been in progress for some months now at the La Ciotat shipyard: architectural studies, tests on new composite materials, construction of the semi-SWATH monocoque hull, undertaking sea trials in operational conditions...

This new vessel will also enable iXblue Navigation division, and more specifically the teams working on the new E-Navigation solution developed within the frame of the PASSION project, to integrate the most innovative add-ons of the solution, namely the E-vision and E-positioning, into the bridge.

Assembling the hull molds.



This new vessel will help the DRASSM respond to increased demand in relation to maritime archeological sites.

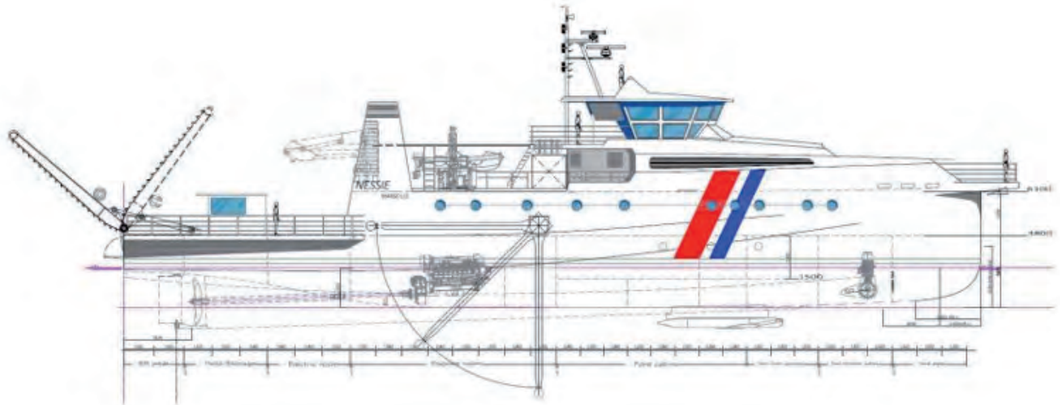
"In addition to the GECDIS Chart Display and Information System, and to our Bridge Management System (BMS) that we developed internally, the bridge of the new vessel will also integrate our augmented reality add-on, the E-vision, thanks to which the crews will be able to visualize, within a panoramic video that will recreate the surrounding environment, all necessary information for the safe navigation of the vessel, including routes, lighthouses, buoys, etc...all of this precisely positioned within this recreated environment," explains Josselin Manceau, System engineer at iXblue. "The second add-on is the E-positioning, that we will integrate in order to make this new vessel a true laboratory that will record all collected data to help us improve our algorithms and performance by enhancing our database."

Once in service, this new vessel will help the DRASSM respond to increased demand in relation to maritime archeological sites and more generally speaking Underwater Cultural Heritage both off mainland France and in its overseas territories. Indeed, due to numerous economic development projects at sea, submarine excavation campaigns are required at sites selected for wind farm projects, cable installation or the extraction of aggregates.

On a larger scale, it is planned to develop a range of vessels for the scientific vessel segment, with lengths of between 20 to 50 m, for a wide variety of assignments (oceanographic, hydrographic, fish-production, geophysical, meteorological, etc.) This new range, which is contributing to the development of new composite materials to meet the most stringent standards in terms of fire safety, will thus constitute a real technological breakthrough on the market, and will, in particular, strengthen the French shipbuilding industry's position in the construction of vessels with lengths of between 25 to 50 m.

A bright future, therefore, for this project, whose first ship, earmarked for the DRASSM, will be sailing from French harbors in 2021. ■

Technical drawings for the future vessel.



Progress meeting with the DRASSM.

NOAA tests DriX to demonstrate survey force-multiplier capability

The end of 2019 saw DriX sailing alongside a U.S. NOAA's (National Oceanic and Atmospheric Administration) hydrographic survey vessel, NOAA SHIP Thomas Jefferson for a series of sea trials. Those tests, designed to demonstrate hydrographic survey force-multiplier capability in offshore waters, were successfully conducted thanks to the ship's crew, DriX and its unique Deployment System (DDS).

DriX being deployed from the ship's survey launch davits

"We had the chance to meet with NOAA's Office of Coast Survey Director, Rear Admiral Shepard M. Smith, right after the launch of DriX in December 2017" explains Guillaume Eudeline, Global Business Developer for iXblue Shipyard division. "He is advancing NOAA's Office of Coast Survey initiatives by modernizing digital charting, and by increasing the use of autonomous systems for hydrography and was truly impressed with DriX capabilities. We worked through an industrial partnership with the University of New Hampshire in order to test DriX and assess how NOAA and the U.S. hydrographic community could benefit from our USV."

One DriX was subsequently sent to New Hampshire (New England) in October 2018 and stayed with UNH for over a year. The University's team of surveyors ran a series of tests to assess how DriX could be operated in the field, and if it could be used to conduct continuous survey operations in unchartered waters to increase surveying efficiency.

The tests being a success, NOAA decided, in October 2019, to integrate DriX into its daily hydrographic survey operations in a field trial, to see if iXblue's USV could overcome the drawbacks of many ship-deployable USVs such as their speed, sortie endurance, ability to collect multibeam data in moderate sea states, as well as the difficulty in deploying and recovering them from a pitching and rolling ship in a seaway. USVs' launch and recovery is indeed a true challenge for operators trying to bring more autonomy in their surveys and represents about 50% of the operational effectiveness.

"The tests, during which we learnt a lot, were overall another great success and NOAA was truly pleased with the DriX evaluation and that of its DDS, as it demonstrated a novel, custom-designed method for deployment and recovery via the Thomas Jefferson's installed survey launch davits," concludes Guillaume Eudeline "It was also a great opportunity for iXblue to work with an iconic administration, and benefit from their first-rate feedback, opening possibilities for improvements. We now look forward to the next steps in our collaboration, with further sea trials in 2020." ■

DriX DDS

A functional launch and recovery system

Certified by Bureau Veritas, the DriX Deployment System (DDS) has been designed for the safe and efficient launch and recovery of the USV. Benefiting from a RHIB shape and making use of either one or two lifting points, DriX DDS can be deployed from a davit, a crane or an A-frame. On this particular occasion, the Thomas Jefferson's Vestdavit was temporarily altered with the addition of a removable metal adaptor, bolted on the existing structure, that acted as a cradle for DriX and its DDS during the sea trials.

DriX furthermore benefits from an auto-docking capability, which enables the USV to perform an automated maneuver to reenter its DDS, without the need for human intervention. The auto-docking capability relies on continuous exchange of positioning information between DriX (provided by its embedded GNSS and Phins C7 INS) and the DDS (through its GNSS and Quadrans AHRS). This auto-docking will be a feature of future trials on the NOAA Ship Thomas Jefferson. ■

QUADRANS GYROCOMPASS FOR THE WORLD'S FASTEST SAIL RACING

Marseille, September 2019. A crowd of people flocks to cheer on their favorite teams during SailGP Season 1 Grand Final as the six national teams representing Australia, China, France, Great Britain, Japan and the United States compete in identical wing-powered, foiling F50 catamarans equipped with iXblue's inertial technology.

The Australian Team leaning during the first race.

The company's Quadrans gyrocompasses have indeed been selected to provide extreme high-precision navigation to the six revolutionary F50 catamarans competing in the new SailGP global sports championship. A thrilling new concept in high performance racing, the F50 catamarans are a showcase of cutting-edge technology and awe-inspiring athleticism. They have been designed to produce close, heart-stopping racing as they fly above the water on wave-piercing hydrofoils and at speeds exceeding 50 knots (60 mph).

"We are very proud to have been chosen as an official technical supplier for such a forward thinking and exciting global event as SailGP," states Marine Slingue, VP at iXblue, Inc. "As ever faster boats are being developed to compete in high performance competitions, gyrocompasses and inertial navigation systems have become a critical element from a navigation standpoint. Crews need the highest-grade roll, pitch and heading inputs in order to have very precise control of their boat and to be able to react quickly at great speeds. The fact that SailGP has chosen iXblue's Quadrans gyrocompass to provide this data for the one-design fleet is a clear endorsement of our technology."

Built around the revolutionary Fiber-Optic Gyroscope technology pioneered by iXblue, the Quadrans gyrocompass is a solid-state and strap-down system, perfectly suited for high-performance in the harsh environment of foiling catamarans. Once in situ, its open architecture guarantees seamless interfacing with all major GPS systems and third-party navigation software packages. Working in tandem with the raceboat's GPS system, the Quadrans provides highly accurate and reliable heading and attitude data for precise control of the aerohydrodynamic performance of the craft, helping the teams get the most out of their boats.

©Simon Bruty for SailGP

The F50 fly above the water on wave-piercing hydrofoils.

> “FLYING AROUND AT 50 KNOTS ON AN INSHORE RACE COURSE REQUIRES HIGH PRECISION AND SPLIT-SPEED DECISION MAKING.”
>
> MARK SHEFFIELD, SAILGP LIVELINE DIRECTOR

“Flying around at 50 knots on an inshore race course requires high precision and split-speed decision making by the six teams,” said Mark Sheffield, SailGP LiveLine Director. “Accurate data feedback is vital to make continual improvements and ensure the boat is at optimum performance. The other challenge that comes at these speeds is ensuring that the equipment is of the highest spec but also small in size and as light as possible. iXblue measured up in all of these areas and their solutions are perfect to meet this tough challenge.”

iXblue’s Quadrans gyrocompasses have thus helped all six competing teams putting on a show for fans around the globe during this exceptional first season that touched down in various cities all around the world, including Sydney, San Francisco, New York, Cowes and Marseille, where the Australian team captured the sough-after SailGP Championship trophy.

Having attracted over 130,000 spectators who lined on seawalls, shorelines, peninsulas and took to the water to witness the high-adrenaline racing across the world, the Quadrans-equipped F50 catamarans will resume their racing during SailGP Season 2, that debuted on February 28-29, 2020 in Sydney. ■

The Australia Team with the China Team and the France Team’s boats during practice in Sydney.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