the SUBSEA observer

A magazine by Subsea Tech // Issue #21 - May 2021

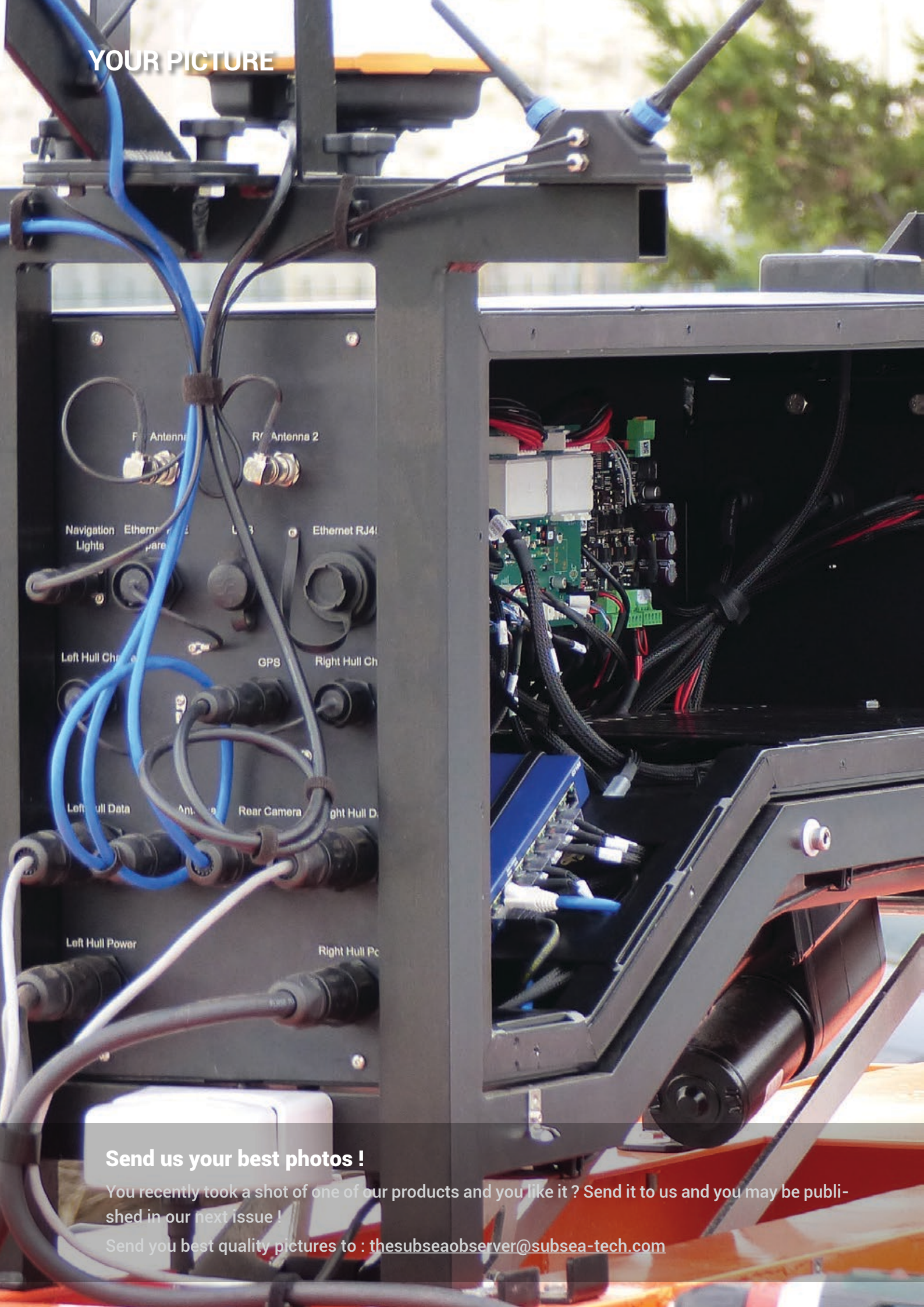
EDF
A long-lasting partnership

And also

Dam inspections in Morocco, Subsea Tech team grows, ColiMinder, user feedback,...

SUBSEA TECH
Marine and Underwater Technologies

YOUR PICTURE



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Dear all,

We don't need to remind you that we are going through a complicated period but as we are doing with our ROV Tortuga, we are looking far ahead to the end of the tunnel: new recruits, new offices, new machines such as the ROV Tortuga Long Range or the USV SeaCat, we are getting ready to leave the tunnel. Despite the difficult 12 months, we have closed sales in China, Saudi Arabia, Panama, Canada and Germany, but it is to a very French customer that we wanted to give a nod in this edition: EDF.

Take care of yourself and see you soon at the fairs.

Yves Chardard
CEO of Subsea Tech

Contents

EDF
A LONG-LASTING PARTNERSHIP

It all started in March 2010 with an underwater inspection by mini-ROV on the Miodet dam in the Puy-de-Dôme region. Subsea Tech was still a young company that was designing its own robots but also providing services for underwater works companies working on engineering structures on behalf of operators. This time, the operator was none other than EDF.

This was of course not a first for EDF, one of the world's pioneers in the 1990s in the use of robotic solutions for underwater inspections, but for Subsea Tech it was the beginning of a partnership that has continued to grow ever since with the French energy leader.

The use of robotic inspection equipment in inland waters has become very widespread over the last ten years. The main driver has been the desire of operators, including EDF, to increase the safety of personnel by avoiding as much as possible the use of divers for simple visual inspection of underwater structures. At the same time, the appearance on the market of light, compact and above all affordable solutions compared to the means available until the end of the 2000s, has made it possible to democratise their use. Whether it is for engineering structures such as dams or bridges, confined spaces such as flooded pipes and galleries, or water transfer infrastructures such as canals, the applications are now numerous and tend to develop further over the years.

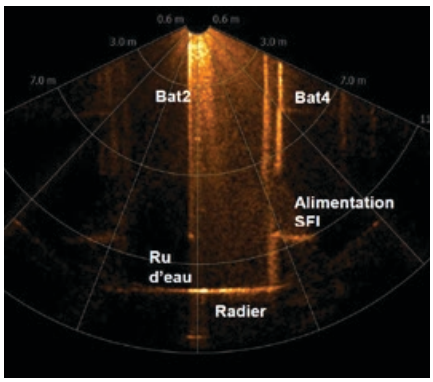
Diversified missions

After having carried out several subcontracted missions, Subsea Tech signed its first direct contract with EDF in 2014 to carry out inspections of the above-ground and underwater parts of the Cattenom power plant in Lorraine (North-East France). Within the framework of this mission, Subsea Tech used a UVS100RL underwater video camera, a product that the company had been marketing since 2012, and a Blueview M900-130 2D multibeam sonar to check the integrity of concrete walls and to assess the level of silting in the basins of the power plant's intake and discharge structures.

Several similar missions were then carried out at the Cruas, Tricastin, Bugey, Saint-Alban, Nogent-sur-Seine, Fessenheim, Dampierre and Civaux power plants.

In parallel, Subsea Tech start diversifying its services and was entrusted with missions of inspection by mini-ROV of galleries on several hydroelectric plants including those of Serre-Ponçon and Jouques, made possible thanks to the capacity of its mini-ROV to carry out excursions over several hundred meters.

Further upstream, inspections were also carried out directly at dam level, mainly for the assessment of walls, turbines and bottom valves. The compactness of the used mini-ROVs allowed access to the most confined areas, especially the interior of pipes with diameters of less than 400mm. Over the last decade, Subsea Tech has carried out more than fifty inspection missions on dams in some thirty departments, most of them managed by EDF, including the dams of Gnioure,



Acoustic imaging cross-section of part of the SROs of the Cattenom power plant

Catarob surface drone on a canal

Mini-ROV Guardian equipped with a Blueview sonar, ready to operate on dam

Couesque, Villefort, Calacuccia, Aigueblanche, l'Aigle, d'Eguzon or Rivières. Subsea Tech's expertise in this field has even extended beyond national borders, as the company has been involved in dam inspections in Switzerland, the Czech Republic, Morocco, Gabon (in partnership with EDF) and Mali.

Subsea Tech robots are also present on many dams around the world, including Australia, Japan and Brazil, through partnerships with local providers.

Subsea Tech also works for EDF in the French overseas departments and territories, for example in the thermal power plants of Bellefontaine and Pointe des Carrières in Martinique, for the internal inspection by ROV of water intakes and discharge pipes.

Illustrating the diversity of the services provided to EDF, Subsea Tech has also deployed its AspiROV cleaning robot to pump out sediment deposits and to perform wall thickness measurements in the fire water tank of the Arrighi power plant (Vitry-sur-Seine).

Driving R&D

In 2016, Subsea Tech embarked on a strong R&D process with EDF's DTG (General Technical Division), in order to fill certain technological gaps in the field of underwater robotic inspections. Tests were especially carried out at the Passy hydroelectric plant to model in 3D a part of the penstock out of water. The modelling was carried out using a 2G Robotics ULS-200 3D laser scanner mounted for the occasion on a motorised trolley equipped with an odometer developed by Subsea Tech and allowing the 3D model to be reconstructed in real time. The laser scanner allows the 3D reconstruction of structures in air and water with a millimetre resolution, in order to control very precise distances on the structures.

But one of the most innovative subjects concerned the performance of long-distance inspections in confined spaces, a recurring problem for the operator. Tests were carried out with mini-ROVs in the Casterino intake gallery on the Mesches dam (06), making it possible to reach a distance of about 300m from the entry point. But we needed to look further, because the galleries often extend over several kilometres and there were few solutions for monitoring these infrastructures over such distances without draining them first and, above all, without human visits.

It was at this time that the idea of a robot capable of travelling several kilometres in flooded tunnels while maintaining real-time monitoring capability (telemetry, video, sensors) was born. At that time, Subsea Tech was developing its new Tortuga ROV, initially designed for offshore inspections and which had the particularity of combining

a powerful propulsion system with a hydrodynamic shape to optimize speed and reduce drag. Based on this ROV, Subsea Tech launched in 2019 the development of a «long range» version using an umbilical cable with fibre optics. The same year, Subsea Tech won the «Industrial Performance» innovation challenge, sponsored by EDF, following a presentation of its long range inspection solutions at the Hydro Business Meeting organised by the Marseille-Provence Chamber of Commerce.

In 2020, the first mission of the Tortuga «Long Range» was carried out in a flooded gallery in Les Mées at the level of the EDF canal on the Durance river. The electric winch equipped with 3300m of umbilical allowed the inspection of 2.7km of gallery with the ROV fitted for the occasion with a Blueprint Oculus M750d multibeam sonar and an Imagenex 831A profiling sonar. As the turbidity of the water was severely limiting the possibilities of video inspection, these sensors complemented the Tortuga's two full HD cameras to provide acoustic imaging and profile modelling of the gallery throughout the excursion. The measurement of the distance travelled in the gallery was provided by an odometer integrated on the umbilical winch.

In 2016, tests were carried out at the Passy hydroelectric plant to model in 3D a part of the penstock out of water. The modelling was carried out using a 2G Robotics ULS-200 3D laser scanner mounted for the occasion on a motorised trolley equipped with an odometer developed by Subsea Tech and allowing the 3D model to be reconstructed in real time. The laser scanner allows the 3D reconstruction of structures in air and water with a millimetre resolution, in order to control very precise distances on the structures.

That same year, DTG entrusted Subsea Tech with a new innovative mission, consisting of taking paint samples (for analysis) at a depth of 120m from a bottom gate of the Serre-Ponçon dam by robotic means. As part of this project, the Tortuga ROV was modified by integrating a propeller on the front of the vehicle, to which a wire brush is attached. The rotation of the propeller allowed the robot to be pressed against the wall of the valve while sucking up the particles detached by the brush, which were then recovered in a net attached to the back of the propeller nozzle.

Underwater... and on the water

On the surface, the story begins in 2012 with the completion of bathymetric surveys on the upstream and downstream water bodies of the Beaumont Monteux dam on the Durance. At that time, the surveys were carried out by a hydrographer from a boat, using a single-beam echosounder. Several missions were subsequently carried out, notably on the Escale and Rioumajou dams.

Always seeking to ensure the safety of personnel during operations, EDF has very quickly resorted to autonomous and unmanned nautical means to carry out bathymetry of dams and canals. Subsea Tech has been developing and marketing surface drones - or USVs for

Deployment of the ROV Tortuga «Long Range» on a canal

CAT-Surveyor surface drone on a canal

Unmanned Surface Vehicles - since the early 2010s, and in 2018 was awarded an exploration mission on the Jouques canal, which included, among other things, multibeam bathymetric surveys to assess the level of silting as well as 3D modelling of the submerged part of the canal with the aim of identifying and locating any logjams.

Subsea Tech used its CAT-Surveyor USV, equipped with the Seabed multibeam bathymetry system, including the Norbit WBMS sounder. The high-resolution sounder combined with the centimetre accuracy of the DGPS RTK integrated on the CAT-Surveyor enabled a fine estimation of the channel's siltation levels and the determination of the nature and exact position of some obstacles representing a risk for the installations. Thanks to the use of the surface drone, which is powerful enough to operate in the canal current, the operation was carried out in only two days and in complete safety for the personnel.

Following the success of this first drone mission, Subsea Tech was entrusted in 2019 and 2020 with the realisation of two multibeam bathymetric campaigns by drone on a 20km stretch of the Sisteron Canal in order to identify and locate submerged obstacles. The multibeam bathymetry system was this time implemented by the USV Catarob, which is more compact and lighter than the CAT-Surveyor and can be deployed without lifting equipment.

Sales of products

Largely supported by the Chatou R&D unit and the DPIH East, the purchase of equipment to conduct its own operations confirmed EDF's position as a major partner for Subsea Tech from 2016.

From underwater video systems to mini-ROVs and sonars, the range of products manufactured and distributed by Subsea Tech has now become part of the daily life of the operator's agents.

Now the future: MREs

Subsea Tech is following with interest the changes in the energy sector, in particular the important development of Marine Renewable Energies in which EDF is very much involved with its subsidiary EDF EN. The desire of many countries, including France, to make the transition towards green energies suggests that many offshore wind farms will be commissioned in the coming decade. As the monitoring and maintenance of these infrastructures requires regular inspections in conditions that are often hostile to humans, Subsea Tech has for several years been involved in R&D on the development of robotic inspection solutions for offshore wind farms.

The SeaCAT USV, the latest product of the Subsea Tech workshops and developed within the framework of the PIA3 Programme d'Investissement d'Avenir (French governmental investment programme) with funding from the French Environment and Energy Management Agency (ADEME), will be launched on the market in 2021 and will offer the possibility of carrying out the inspection of installed and floating wind turbines from their foundations to the tip of their blades. The USV will be able to operate in the open sea with an autonomy of up to seven days and will support a Tortuga ROV and a tethered UAV. The ROV and UAV will be deployed directly from the USV, with a single operator on land controlling the whole unit.

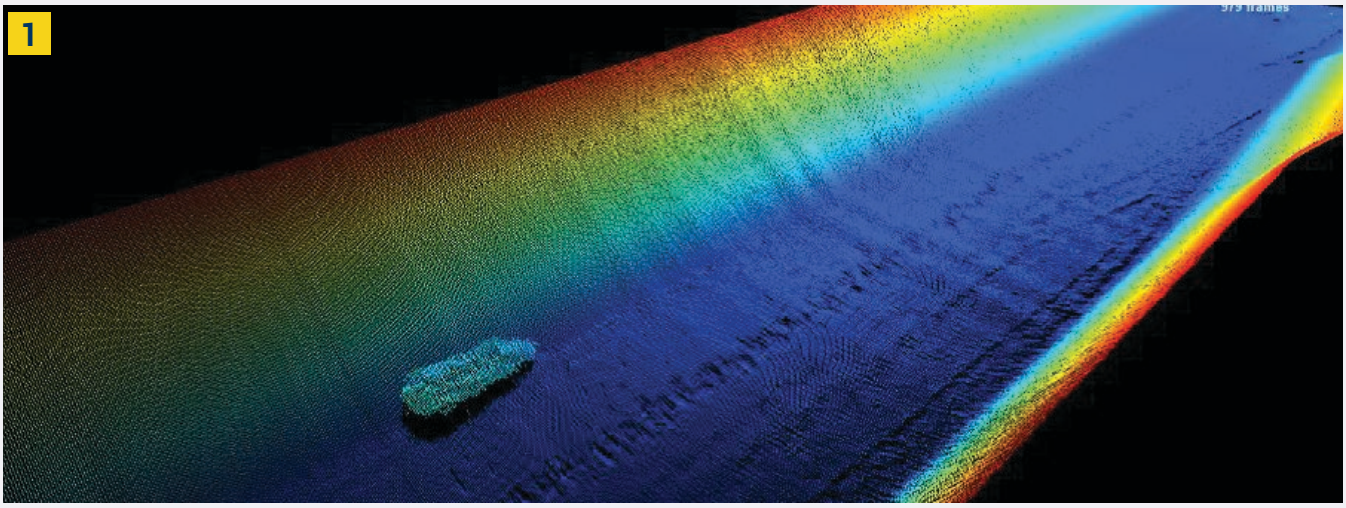
The keys to a win-win partnership

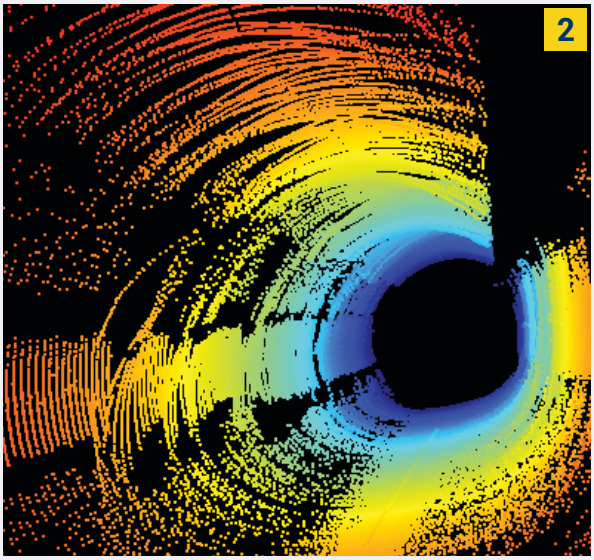
By gradually involving all of Subsea Tech's businesses over the years, from services to product manufacturing/sales to R&D, EDF has contributed significantly to the company's development over the past ten years. In return, by being permanently attentive to its customer's needs, Subsea Tech has probably contributed to the improvement of the safety of the operators and to the realisation of technically complex missions which have allowed EDF to establish its position as a forerunner in the use of robotics in its fields of activity. ■

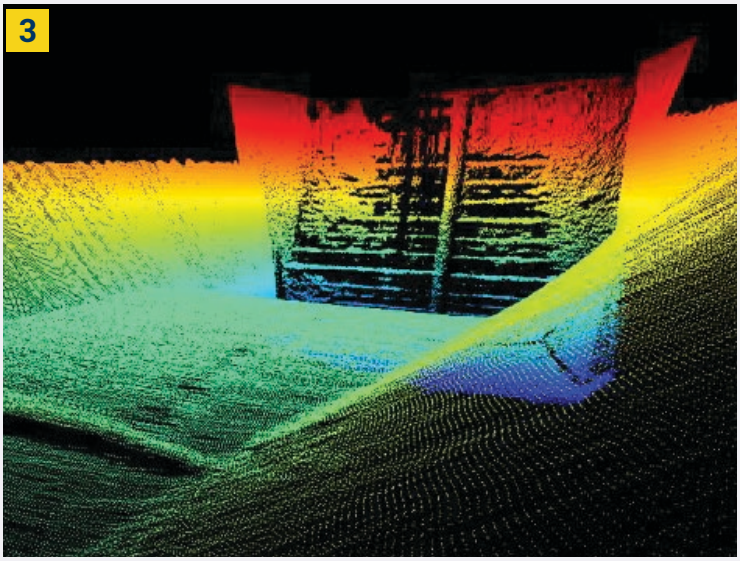
Multi-drone SeaCAT solution for inspection of MRE infrastructures

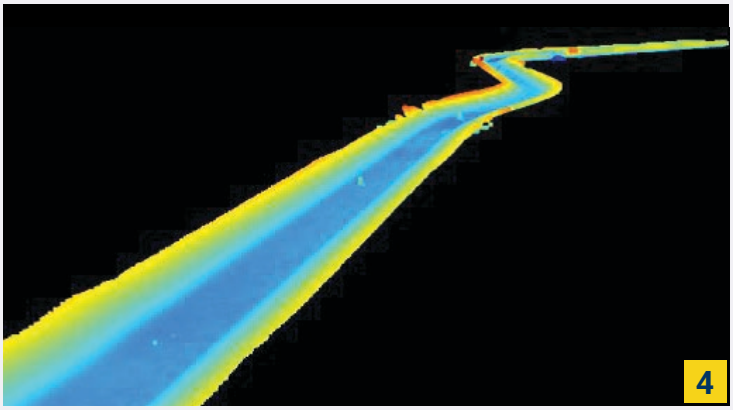
VARIOUS ACOUSTIC AND LASER IMAGING RESULTS FOR ALL INSPECTIONS

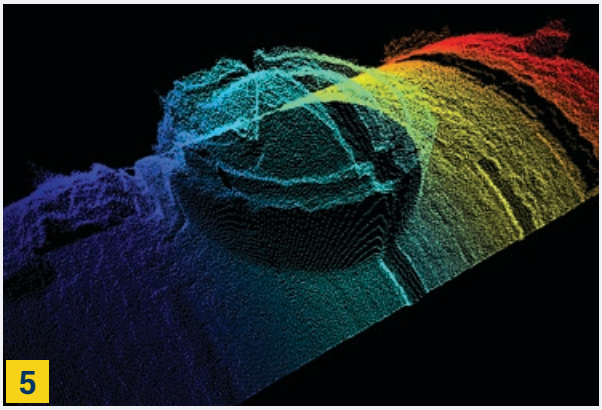
The various missions mentioned in the previous article led to the use of measuring devices such as 3D sonar or laser scanners, some of which are presented below:











1. Detection of a car wreck with a multibeam echosounder. **2.** Reconstruction of a gallery with a profiling sonar. **3.** 3D reconstruction of a canal and the water intake grids with a multibeam echosounder. **4.** 3D bathymetry with multibeam sonar on a canal. **5.** 3D reconstruction by laser scanner in the penstock of a plant.

USER FEEDBACK

Orllati

BY ERIC MESSEILLER, HES GEOMATICS ENGINEER

Our company has been active on lake construction sites since 2017, mainly on Lake Geneva in Switzerland. In 2019, we were awarded a contract for a complex project to lay/immerse a 1m diameter, 1km long PE aquathermy pipe, weighted down with concrete rings. The tasks were numerous:

- Confirm the topography of the lake bottom and see if there were any major obstacles on the planned route
- Confirming the position of a gas pipeline that we were not supposed to approach with our boats and barges
- Recognise the route of the pipe before it was laid to see if there were any objects to be removed
- Laying a bridge 40 m deep over a fibre optic at a specific location
- Immersing the pipe along a defined path, plus or minus a few metres
- Casting the pipe on the bridge (as close to the middle as possible)
- Nail down the suction strainer
- Installing the strainer

Given the high frequency and depths at which we had to work and in order to spare our divers the risks of diving to depths of more than 30 metres, we decided to equip ourselves with an underwater drone with a 150-metre long umbilical cable, equipped with a cloudy water filter, imaging sonar and a USBL to monitor the ROV's position. We chose the Mini-ROV Guardian, which had a good price/quality ratio for the use we had in mind.

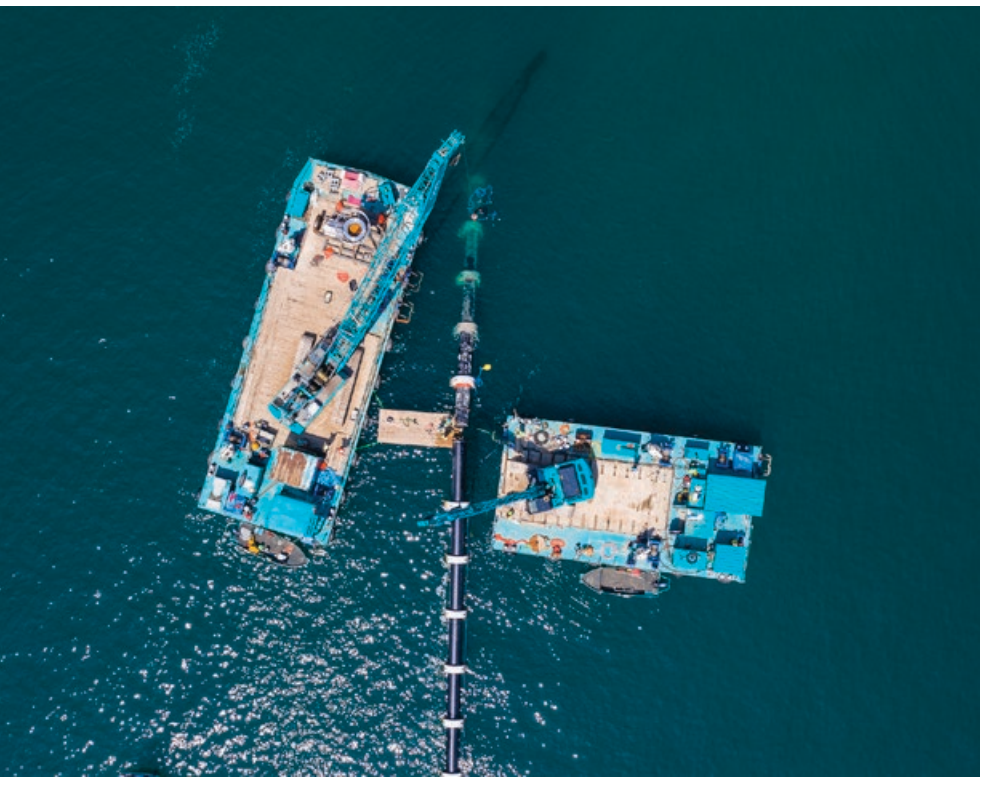
The Subsea Tech team gave us good advice and helped us make the right choices in equipment models and options. Their availability during the first wave of Covid helped us to meet the tight deadlines of our project. The training for the ROV piloting was grouped with the bathymetric survey before the works for which we also mandated Subsea Tech. Within two days we had the equipment in hand and every time we phoned for help, someone was there to assist us.

The accuracy and calibration of the bathymetric survey in Subsea Tech's Swiss Geodetic Datum was confirmed by a similar previous bathymetric survey. The point cloud received, documented from the Subsea Tech report, was easy to process by our team of geomaticians.

The options chosen for our ROV have all been used to their full potential. Our experience shows that it is the combination of all the options fitted to our submarine that brings real added value, each one having its own particularities and uses. At no time did we say «Blimey, this option has cost us a lot of money and is of no use to us» and regret our equipment. Later, we acquired a rolling frame to be able to inspect the inside of the pipes while protecting our ROV, and thus broaden our range of services.

Equipping our company with this equipment has enabled us to increase our knowledge and services in underwater techniques, to save hours of scuba diving, to see, position and measure objects more comfortably, efficiently and reliably than before.

We had very good contacts with the whole Subsea Tech team, and even enjoyed the hospitality of Marseille when we went to pick up some equipment. We still have very good contacts with the team and ask them for advice from time to time. The availability, the proposed solutions and the reactivity make this very nice company a quality partner. ■



Eric Messeiller
HES Geomatics engineer
Head of the geomatics at Orllati SA

Credits : Orllati SA

MEDITERRANEAN, TUNISIA SIDE

History

Our partnership with MarConEx in Tunisia is not new. After a prospecting mission in 2015, the two companies signed a representation agreement for the distribution of Subsea Tech products.

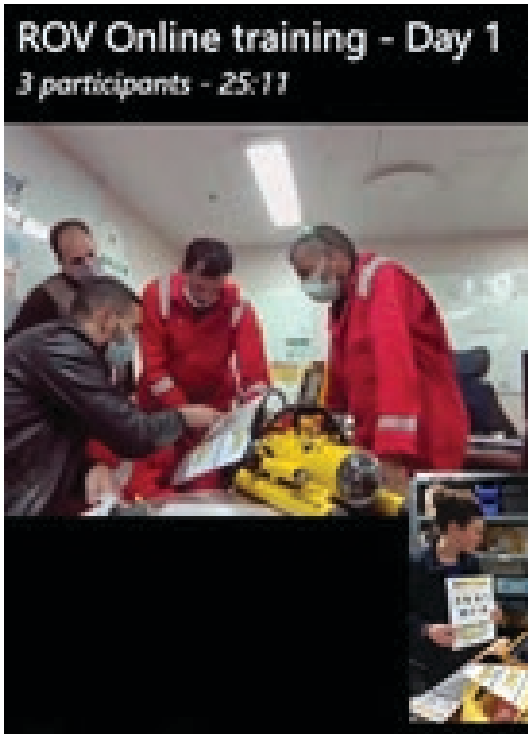
Tunisia, a market with great potential

Due to its geographical location (several flights per day from Marseille to Tunis and only 1h30 flight time), Tunisia represents an easily accessible market for Subsea Tech from a logistic point of view. This geographical proximity is also an asset for customers who want to benefit from responsive technical support and the rapid availability of spare parts. Finally, the country's extensive coastline and important hydraulic infrastructure (32 dams in the country) generate significant needs for marine and subsea inspection solutions in the offshore O&G, defence, port infrastructure and inland water sectors.

A developing activity

The trusting partnership between the two companies has provided several opportunities for the sale of mini-ROVs over the past few years, notably to Tunisian customs authorities and commercial diving companies. More recently, SHELL Tunisia acquired a mini-ROV Observer equipped with several sensors and accessories (SeaTrac USBL positioning system, Cygnus thickness measurement probe, Buckleys CP measurement probe, sediment sampler) for GVI, CVI and NDT missions on offshore platforms.

Despite the current health context, SHELL Tunisia's operators were still able to follow a distance learning course from Subsea Tech in order to be operational quickly. ■



TORTUGA FOR ARAMCO

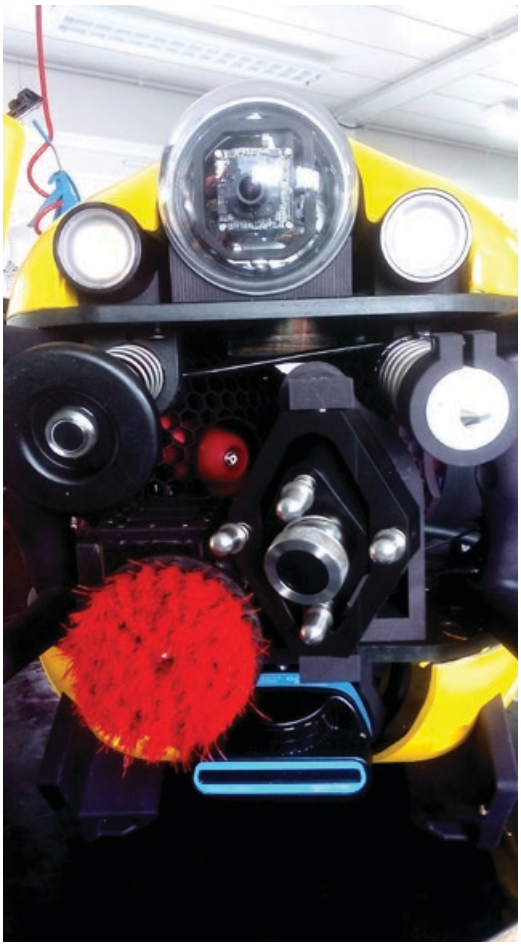
Saudi Arabia's national oil company ARAMCO has selected the Tortuga ROV for subsea inspections and NDT operations on its offshore infrastructure.

Saudi Aramco is the world's largest oil and gas company and as such, high-tech equipment is needed to meet their many requirements.

As part of this, Subsea Tech delivered a unique multi-sensor Tortuga unit, equipped with a Subsea Oculus M750d Blueprint imaging sonar and SeaTrac USBL positioning system, Cygnus Instruments Ltd FMD and thickness probes, Buckleys CP probe (UVRAL Ltd), altimeter, 2 function manipulator, cleaning brush, laser defect sizing tool and laser defect sizing tool, CP Buckleys (UVRAL) Ltd. probe, altimeter, 2 function manipulator, cleaning brush, laser flaw sizing tool and a launching jib.

The large payload capacity of the Tortuga allowed the simultaneous integration of most of the sensors and tools, which is a real achievement on such a compact and light ROV.

Continued investment in technology is a key factor in the long-term viability of the business and with this in mind, Saudi Aramco has chosen Subsea Tech solutions to enhance the efficiency of its oil and gas operations with high value-added equipment such as the Tortuga. ■



CAT-SURVEYOR FOR GDELS

The transatlantic partner for land defence in Europe GDELS has acquired a CAT-Surveyor. GDELS is the business unit of General Dynamics Corporation in Europe. The company designs, manufactures and delivers wheeled, tracked and amphibious vehicles and other combat systems such as weapons and ammunition to customers worldwide. Subsea Tech delivered in November 2020 a CAT-Surveyor USV to General Dynamics European Land Systems-Bridge Systems for reconnaissance missions in flooded areas. GDELS selected Subsea Tech's multi-purpose USV as part of a multi-partner project, including THW (German Civil Security) and the Technical University of Kaiserslautern, to develop a civilian mobile bridge solution for disaster relief operations following a natural disaster. The CAT-Surveyor will assist in the deployment of this solution by identifying and mapping underwater obstacles such as rocks, tree trunks or any other structure that could damage the mobile bridge using sonar technology. Thanks to its shallow draft, the CAT-Surveyor can operate in areas inaccessible to conventional boats. A power autonomy of 12 hours and a range of up to 4km allow the USV to operate in isolated areas and to be controlled by the operator from a secure area. ■

COLIMINDER

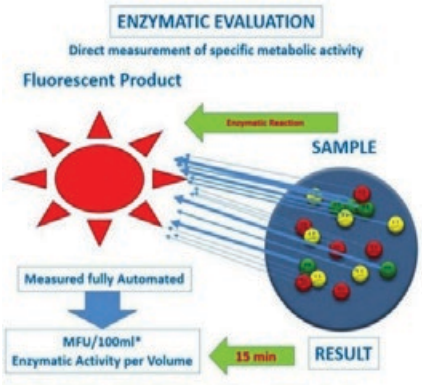
AN INDUSTRIAL DEVICE DEDICATED TO BACTERIOLOGICAL WATER MONITORING

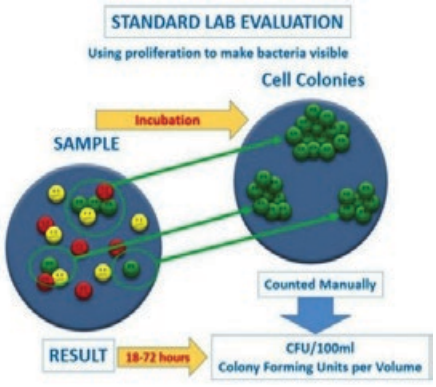
TECHNICAL GUIDE

Monitoring microbiological contamination is an essential element of water quality monitoring. Installed online or as a mobile laboratory (ERU), ColiMinder is aimed at professionals in the drinking water and wastewater sectors, but also at the packaged beverage sector and at industrialists wishing to monitor their process water. The monitoring of surface water quality, particularly in bathing areas, is also a major application for the device. This analysis can highlight a significant health risk linked to the presence of pathogens such as E. Coli or Enterococci bacteria. Conventional (laboratory) methods, however, require too long an analysis time, leading stakeholders to look at new solutions offering shorter analysis times. One of the main advantages of ColiMinder is that it provides fast results, within fifteen minutes. Measurements are transmitted in real time by the system (by wifi, 4G or Ethernet) and can be viewed via a dedicated application on PC or smartphone. Alarms can be set up to immediately warn the operator (by email or SMS) in the event of a pollution peak in order to provide an appropriate response as soon as possible. ColiMinder is currently used by the Société Eau de Paris and by the Marseille Métropole Sanitation Department (SUEZ group) to monitor the microbiological quality of surface water and bathing water. Abroad, many public and private companies in the water and sanitation sector as well as industrial companies also rely on ColiMinder.■

> ColiMinder can autonomously perform up to 54 measurement cycles per day and up 1,000 measurements without the need of an operator.

More informations :
subsea-tech.com/coliminder





NEW FACES...

Despite the health crisis, Subsea Tech has expanded its team during 2020 with the arrival of 5 new people since June. In particular, the manufacturing capabilities have been reinforced with 3 people for the workshop alone, in order to meet the growing demand for Tortuga ROVs and CAT-Surveyor USVs. Discover our new recruits above!

... AND NEW BUILDING!

After a fire in July 2017, a move to the GPMM and then a return to the Estaque site in February 2019 in temporary premises, it is finally a done deal: the construction of Subsea Tech's new buildings started in March 2021 and should be completed in July of the same year. Check out some photos of the construction site below. As the final result is difficult to imagine, we offer you a taste of the future premises!

MISSION FEEDBACK

The year 2020, marked by an unprecedented global health crisis, unfortunately did not facilitate export missions. Subsea Tech nevertheless managed to carry out 2 missions before the general lockdown in March, to Morocco and Switzerland.

OUM ERRABIÂ DAMS MOROCCO

Several years after its last mission in the country, Subsea Tech was mandated by Tractebel, a subsidiary of the ENGIE Group, to carry out visual and acoustic inspections, in air and water, of 3 dams located on the Oum Errabiâ river, south-west of Casablanca: Imfout, Daourat and Sidi Said Maachou. This mission was successfully completed in only 5 days by the intervention team composed of Yves and Damien Chardard, despite some operational difficulties encountered, in particular difficult access to the water bodies which forced them to play the balancing act!

Underwater inspections were carried out with the Guardian mini-ROV equipped with a Blueprint Oculus M750d multibeam sonar, which was very useful due to the poor visibility conditions caused by the turbidity of the water at the three sites. Inspections of the landings were carried out from a small RIB equipped with an electric motor.

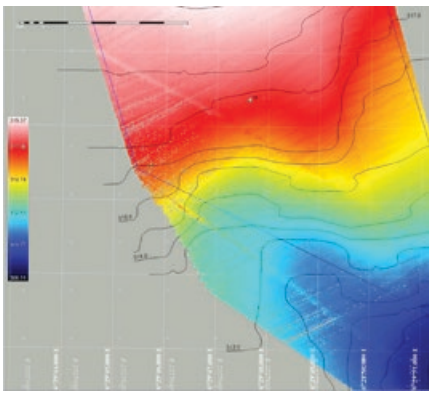
Inspections were carried out on both the upstream and downstream parts of the dams and focused on the intake grates, faces, inverts, cofferdams and spillway gates. At the same time, the use of the mini-ROV made it possible to determine the level of silting at the head and foot of the dam, by comparing the theoretical dimensions of the inverts with the actual depth observed (by the pressure sensor on the ROV). For the air part, the inspections focused on the state of the civil engineering and on the evaluation of the water level in the spillways (thanks to a piezometric probe).

BATHYMETRY ON THE LAKE GENEVA
SWITZERLAND

Following the purchase of a mini-ROV Guardian by the Swiss company ORLLATI for the installation of a water pumping pipe (for the construction of a heat pump) in Morges, the company also entrusted Subsea Tech with the realisation of a pre-construction multibeam bathymetric survey. In addition to the fine depth measurement, this survey also aimed to identify and position very precisely any obstacles as well as structures already installed in the area, notably an optical fibre and two gas pipelines. The bathymetry was carried out over a distance of approximately 1km from the shoreline and over a strip approximately 50m wide.

This intervention was coupled with a training on the Subsea Tech equipment recently acquired by ORLLATI (Mini-ROV Guardian, USBL Seatrac and Oculus sonar). Our hydrographer Caroline Bachet went on site at the beginning of March for this mission.

Bathymetry was carried out using our Norbit WBMS multibeam echosounder, which has the advantage of offering high resolution and an opening angle of up to 150° to minimise the number of swaths. The sounder was deployed from the client's vessel and was coupled to a bathycelity sounder and a NovAtel STIM-300 attitude control unit to correct the vessel's motion in heading, pitch, roll and heave. The whole system benefited from RTK-type centimetric positioning thanks to a GPS reference correction sent by the Swiss GNSS Continuously Operating Reference Station of Geneva. ■



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