the SUBSEA observer

A Subsea Tech Magazine // Issue #22 - January 2022

NEWS
Our new products, our new offices

ACTIVITIES
Interventions, our products in the world

EUROPEAN PROJECTS
SleekShip and SeaClear

SUBSEA TECH
Marine and Underwater Technologies

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Send your photos to: thesubseaobserver@subsea-tech.com

EDITO

Dear customers, partners and friends,

A year has just passed with its procession of variants and sanitary constraints. Another one is coming with its hopes and uncertainties. Whatever happens, the whole Subsea Tech team joins me in wishing you an excellent year 2022, full of projects and successes.

For us, this year will clearly be a new one as we have just moved into our new offices whose exceptional view on the bay of Marseille will certainly make some people jealous... We invite you to discover it during the open days that we will organize at the beginning of May. Details will be in our April magazine.

We look forward to seeing you again this year in a calmer health context and once again, we wish you all the best for 2022.

Yves Chardard
Subsea Tech CEO

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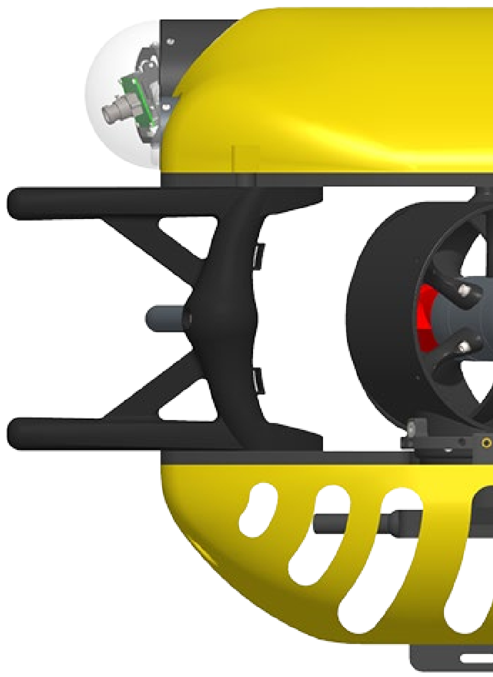


TECHNICAL GUIDE

The Mini TORTUGA

THE NEW BORN OF OUR INSPECTION ROVS

A family resemblance? The Tortuga's little brother has arrived!

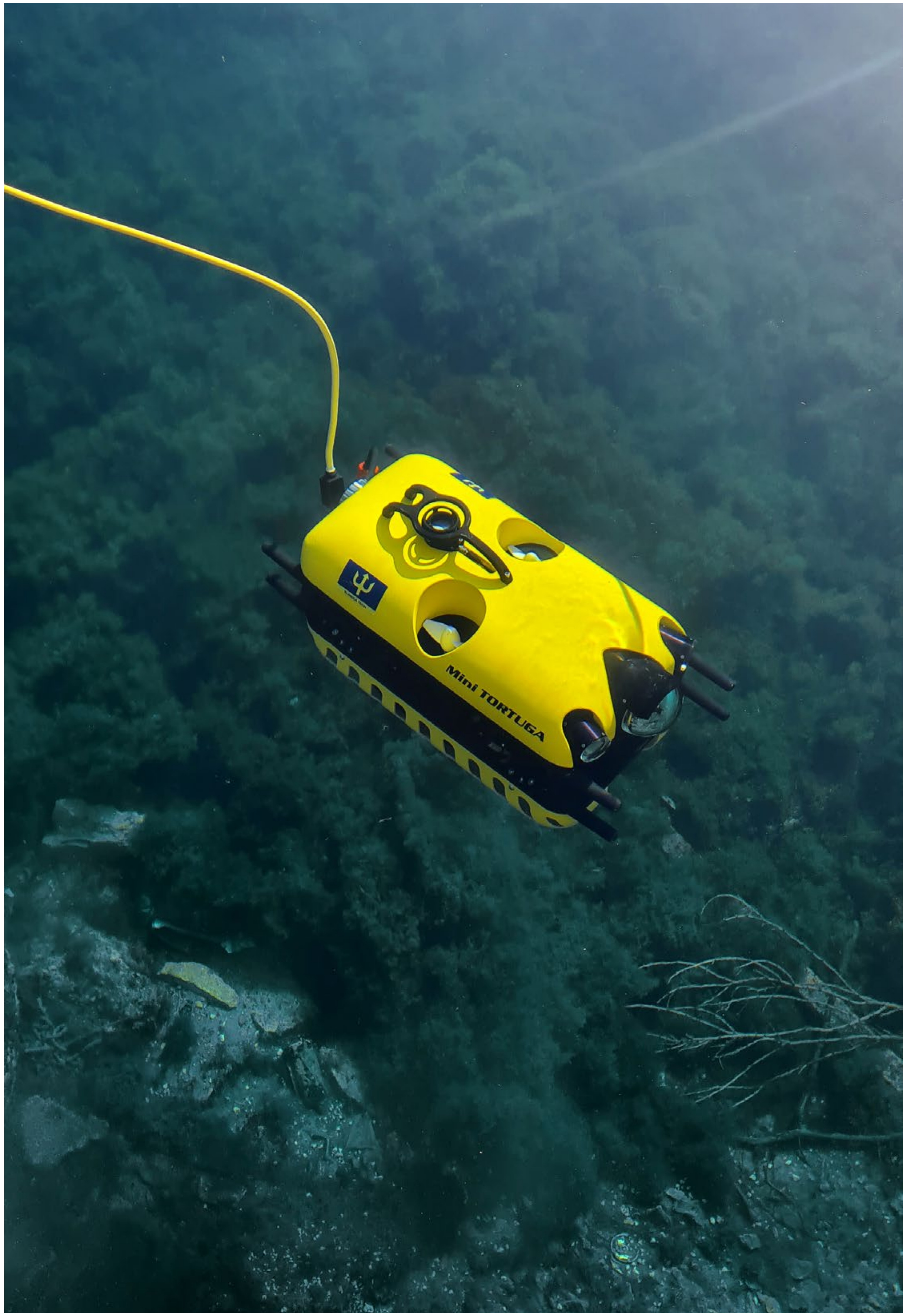
In this new year, Subsea Tech's range of ROVs has been extended with the arrival market release of the Mini TORTUGA, a 15 kg robot, carried by one person, 300 m depth rated and which looks like its predecessor in many respects: hydrodynamic form factor, same control console, same operating software, same umbilical.

Despite its small size (L650 x W310 x H350 mm), the Mini TORTUGA is equipped with powerful thrusters (4 horizontal and 2 vertical) allowing operations in currents up to 3 knots and to carry up to 5 kg payload. Among the main sensors that may be integrated are various types of sonar (multibeam, 360° scan, profiler, side scan), underwater positioning systems (USBL), manipulators 2 or 3 functions, thickness measurement probes, CP probes, physico-chemical multiparameter probes, etc.

Its compactness makes it possible to carry out missions in confined spaces such as internal pipe inspections (from 500mm diameter) over long distances. The Mini TORTUGA's small size, light weight and low energy consumption (max. 3kW) also make it possible to carry out operations from light vessels for various types of inspection and research missions (civil security, defence). As with the Tortuga, it is possible to manually or remotely change the orientation of the horizontal thrusters (azimuthal control) in order to adapt the ROV to changing current conditions or to specific types of missions (long distance excursions, dock inspections, etc.).

The Mini TORTUGA bridges the gap between the Tortuga ROV and the Guardian and Observer mini-ROVs, and now allows Subsea Tech offering a complete range of observation/inspection ROVs from the surface to 500m depth, operable in all waters (inland, port, coastal and offshore). ■

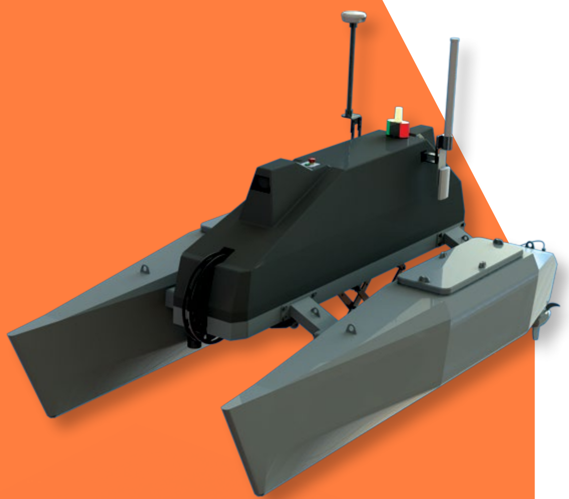
The **Mini TORTUGA** was originally developed for the European project **SleekShip** *(see p.14-15)*. Equipped with a cavitation rotor, it is used for ship hull inspection and cleaning.



5 MONTH BATHYMETRIC CAMPAIGN IN THE BALTIC SEA FOR THE CAT-SURVEYOR

Ostwind 2 is a 50Hertz project to connect the two Arcadis Ost 1 and Baltic Eagle wind farms in the Baltic Sea to the onshore substation in Lubmin, Germany.

Boskalis has been empowered to install about 270 kilometers of export cable to connect the wind farms to the German high-voltage electricity grid.
Subsea Tech and its USV CAT-Surveyor were called on to monitor the work by carrying out daily bathymetric inspections of the area throughout the duration of the work (dredging, cable laying, backfilling). The acquisitions were carried out by our hydrographic engineer, Bastien Dubegny.



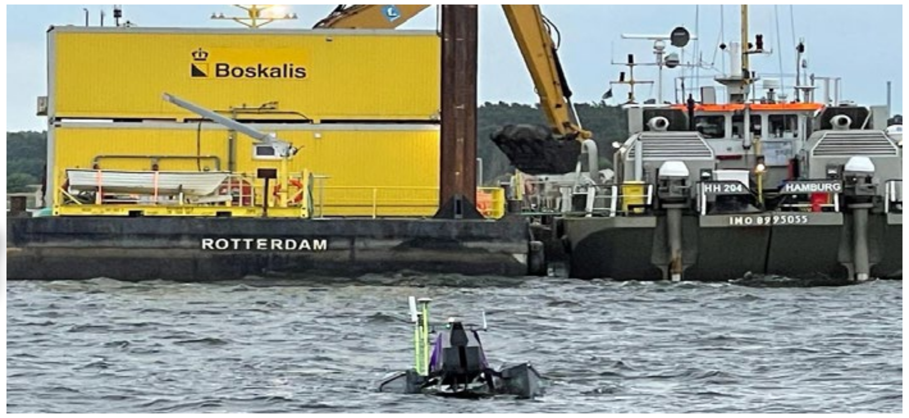
The CAT-Surveyor and its sensors

Norbit iWBMS Multibeam Sounder

Compact, high resolution bathymetric system specially designed for shallow water surveys.

Applanix Wavemaster II inertial unit

Provides accurate USV attitude data (roll, pitch, heave) to refine acquisitions. The position, speed and heading of the catamaran are given by a dual antenna RTK GPS.



Why the CAT-Surveyor ?

Compactness and agility

As the missions took place in coastal areas, its shallow draught (less than 50cm) was an advantage as it allowed the surveys to be carried out even in ultra-shallow waters without risking damage to the multibeam echosounder.

Cost optimization and security

The CAT-Surveyor is remotely controlled by a single operator, significantly reducing operational costs compared to conventional spreads, while improving staff safety.

Autonomous and enduring

The USV has an autonomy of at least 12 hours, maximizing the daily operating time. It can navigate in adverse weather conditions and in sea states 3-4.

USV CAT-SURVEYOR

- Range 5km
- Autonomy >12h
- L 3m x W 1.6m x H 1.2m
- Payload 80kg

The CAT-Surveyor's missions

During the digging of the trenches

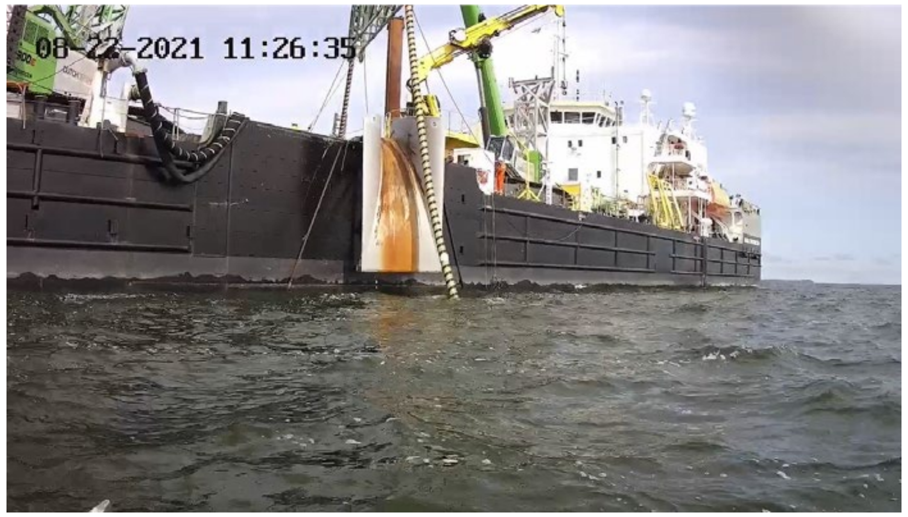
The three trenches had to comply with a predefined shape. Inspections carried out by the CAT-Surveyor allowed the dredgers ensuring that the work carried out complied with technical requirements.

During the preparation of the trenches

The trench bottoms should be covered with sand in muddy areas to prevent the cables from sinking and to better dissipate the heat from the cables. The CAT-Surveyor carried out an inspection after each unloading of sand to obtain a visualization for validation of the result.

During cable laying

Once the trenches were ready, the CAT-Surveyor assisted a cable ship by carrying out bathymetric surveys to check that the cable was correctly laid in the centre of the trench. ■



View of the cable ship from the CAT-Surveyor camera.

UNDERWATER INSPECTIONS AND BATHYMETRIC SURVEYS AT THE LAVALETTE DAM

SL Ingénierie was commissioned by Saint-Étienne Métropole to manage the revision of the dam's hazard study. Subsea Tech was called in to carry out underwater inspections as well as bathymetric surveys.

These operations took place over 5 consecutive days and mobilized 2 teams to carry out all the missions entrusted to Subsea Tech.
This service was provided in consortium with the companies Fugro and Hubble Aerial Data.

BATHYMETRIC SURVEYS

The first team carried out bathymetric surveys upstream and downstream of the dam by surface drone.

Objectives:

- High resolution bathymetric survey of the reservoir (upstream)
- High resolution bathymetric survey of the dissipation basin (downstream)

Equipment

USV CATAROB
Lightweight USV (50kg) ideal for underwater investigations in shallow water.

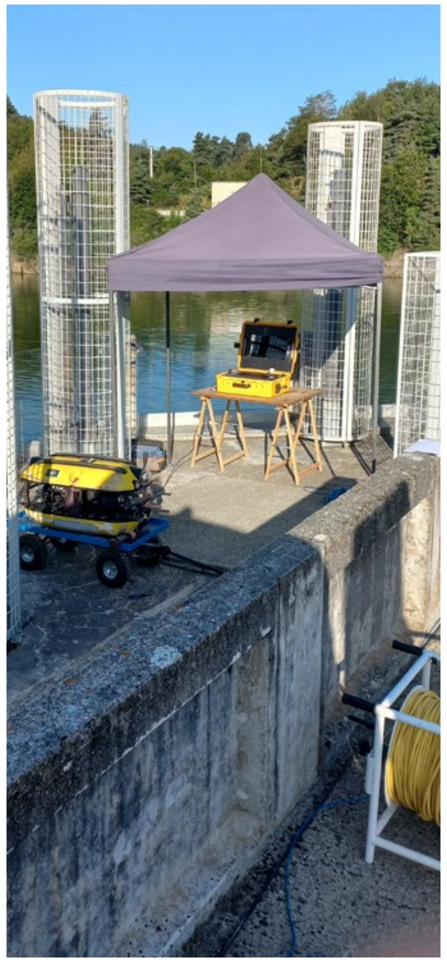
Norbit iWBMS Multibeam Sounder
Compact, high resolution bathymetric systemspecially designed for small fundraising.

UNDERWATER INSPECTIONS

The second team was responsible for carrying out underwater inspections of all the water parts of the dam by ispection ROV and Mini-ROV, as well as the empty confined areas by a motorized rolling skid.

Objectives:

- Underwater inspection of the upstream wall
- Underwater inspection and thickness measurement of discharge pipes
- Underwater inspection of dissipation basin
- Underwater inspection and roundness monitoring of the temporary bypass
- Inspection of the high level alarm well
- Air line inspection



Equipment

ROV Tortuga
Inspection ROV operable up to 500m. It is equipped with 4 horizontal thrusters with azimuthal control, each delivering a maximum thrust of 17 kgf.

Video control
Ultra compact underwater video system.

Mini-ROV Guardian
Ultra-portable inspection ROV, operable to a depth of 150m and equipped with 4 longitudinal and 1 vertical thrusters.

Imagenex profiling sonar
Tool for measuring the internal diameter of pipes. Allows ovality and deformation control.

Measuring probe thickness Cygnus
Measuring probe operating on the pulse echo principle.

USBL Seatrac
Underwater positioning system allowing real-time vehicle position tracking.

Oculus multi-beam sonar
2D multibeam sonar used for navigation and inspection in reduced visibility conditions.

CANADA

CAT-Surveyor : remotely controlled vessel for water sampling at 350 m depth

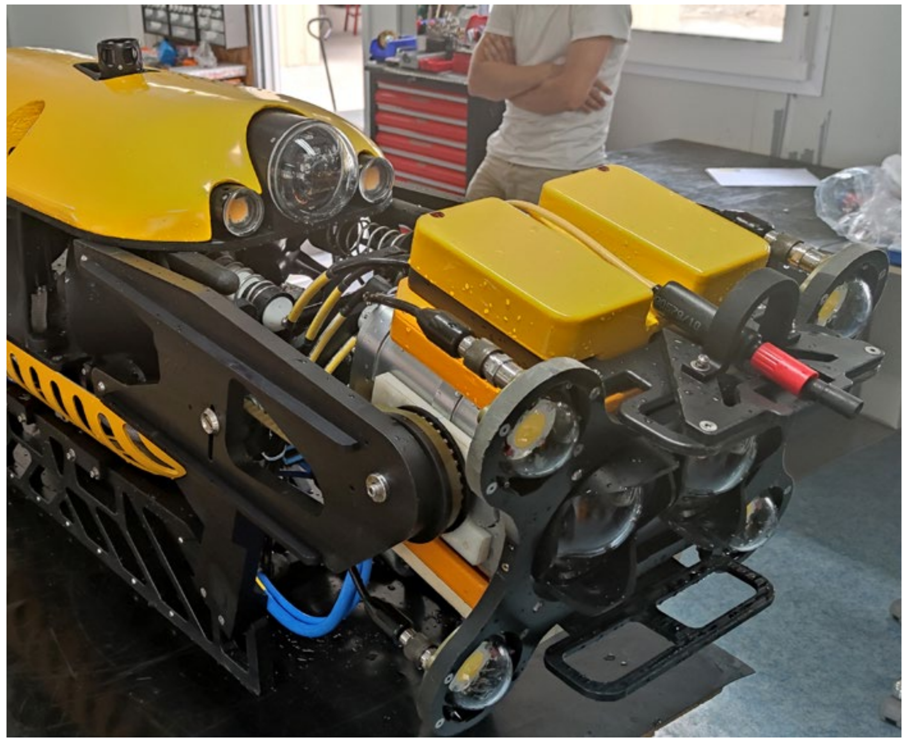
What is yellow and black and takes water samples from the surface to 350 m depth, with no operator on board? The answer is... the R.O.V.E.R. This is the name given by BHP to the CAT-Surveyor specially developed and manufactured by Subsea Tech for their water quality monitoring operations at the Island Copper pit lake in Canada. Located in the northern part of the Vancouver Island (BC), this former mine has been under environmental monitoring by BHP since its closure. After years of conducting sampling operations and measuring physico-chemical parameters from a light boat, BHP recently decided to equip itself with a remotely controlled system to eliminate the need for personnel to work on water.
As a reminder, the CAT-Surveyor is a surface drone developed by Subsea Tech in 2014 for surveillance missions in harbour and coastal areas.

After being awarded the contract, Subsea Tech worked for 18 months alongside BHP to develop and deliver a modified version of the CAT-Surveyor to meet their needs. The result is a catamaran of L3.9 m x W1.6 m for a 500 kg total weight, equipped with 2 sampling rosettes deployed by electric winch and located at the front and rear of the USV. Each rosette holds 6 bottles that are opened automatically at a given depth or manually by the operator. A CTD probe (conductivity, depth, temperature) and a dissolved oxygen sensor are also integrated on the rosettes to monitor these physico-chemical parameters in parallel.
The possibility of collecting all the samples during a single mission significantly increases the efficiency of operations. In addition, the automatic navigation software offers the possibility to carry out semi-autonomous missions thus reducing the number of personnel required for operations. ■

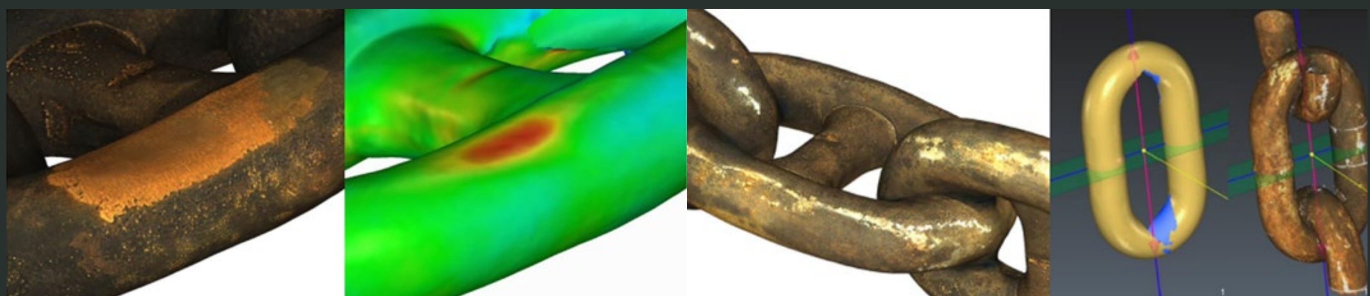
Sampling bottles on rear rosette

NIGERIA

3D underwater photogrammetry associated with the Tortuga ROV



After having acquired a mini-ROV Guardian in 2018, Atlantic Marine and Oilfield Services upgraded in 2021 to a Tortuga inspection-class ROV.
Equipped with numerous options, it can perform NDT inspections, cleaning operations and measurements on offshore infrastructures. The main technological achievement was to integrate the ORUS300 3D underwater photogrammetry system into the ROV in order to perform very high resolution dimensioning, particularly on mooring chain links. As the ORUS system offers real-time 3D rendering on the surface, it was necessary to significantly increase the bandwidth of the umbilical in order to pass a large quantity of data without latency. This was made possible by the use of a fibre optic umbilical between the ROV and the surface. In addition to the standard accessories and sensors such as imaging sonar, USBL, thickness measurement probe and CP probe, the Tortuga was equipped with a cavitation lance and rotor for surface cleaning prior to measurements. This system, powered by a high-pressure surface pump (190 bars), removes most marine concretions without damaging the structure or its coating. ■

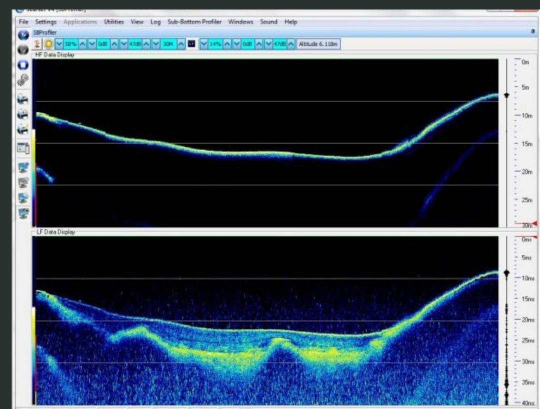


Mooring chain inspection with the ORUS300 3D photogrammetry system. © IVM Technologies

PORTUGAL

A Tortuga ROV for sediment survey

Topping off this year, the Portuguese Hydrographic Institute of Portugal chose the Tortuga XP4 (an extended version of the Tortuga, for integration of large and bulky payloads, up to 30kg) as part of a public contract won by Subsea Tech, in partnership with Casco Antiguo Portugal.
The main challenge was to integrate on the ROV a Sub-Bottom Profiler Tritech Seaking, a dual-frequency sonar used to sound the sediments and to highlight structural differences hidden from conventional sonars. This type of sounder is particularly useful when carrying out site or route surveys to reveal buried objects such as pipelines, cables, wrecks, ammunition, rocks or to understand the composition of the sub-bottom layers.
The Super SeaPrince 360° sonar was also one of the new sensors included in this sale. Training for the Hydrographic Institute's staff was held in Lisbon in December in collaboration with our local partner. ■



Ground inspection with the SBP SeaKing Split-Head © Tritech

SLEEKSHIP
Spectral Imaging Powered Ship Hull Biofouling Detection and Cleaning

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 950854.

AN INNOVATIVE SOLUTION FOR THE INSPECTION AND CLEANING OF BIOFOULING ON SHIPS

Subsea Tech is one of the partner companies in the European project SleekShip. As for this project, Subsea Tech has specially designed a semi-autonomous underwater vehicle (SAUV): the Mini TORTUGA *(see p.4)*.

SleekShip redefines the management of biofouling on ships' hulls by allowing inspection and cleaning at early stages.

The accumulation of biofouling on hulls significantly alters the hydrodynamics of ships, while increasing drag, fuel consumption and CO2 emissions, and favours the transport of invasive species. There is currently no effective way of assessing accurately the fouling level while the ship is in the water, and dry-docking results a costly downtime for the operators. Furthermore, if a vessel is not regularly taken out of the water for inspection, the likelihood of biofouling development increases, requiring more aggressive cleaning methods that can damage the hull coating. The solution developed under Sleekship will quantify the state of biofouling development while targeting the areas to be cleaned by combining a semi-autonomous underwater robot, a new cavitation cleaning tool, and a hyperspectral imaging system. The latter takes over from video inspection, which is insufficient for effective pre-assessment due to the backscattering of light caused by suspended particles in the water of the ponds. By enabling service providers to reliably detect the early stages of biofouling development in contaminated harbors, SleekShip is expected to generate savings of more than €3 billion over five years after launch in the global shipping industry. ■

www.sleekship.eu

INNOVATIVE
SleekShip combines hyperspectral imaging and cavitation cleaning.

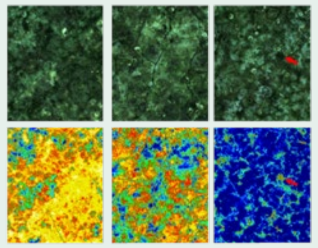
ECONOMIC
SleekShip reduces cleaning costs by up to 2 times compared to conventional methods.

SAFETY AND EFFICIENCY
By using a semi-autonomous robot, SleekShip significantly reduces the risks for operators while increasing the daily working time

SIMPLE AND INTUITIVE
User-friendly, the Sleekship solution has been designed for operators to ensure mission efficiency

THE COMPLETE EQUIPMENT OF THE MINI TORTUGA

THE MINI TORTUGA
This semi-autonomous underwater vehicle has 4 horizontal and 2 vertical thrusters for optimal manoeuvrability. Equipped with an underwater acoustic positioning system, the ROV can locate itself with an accuracy of less than 5cm. An intelligent navigation system, combining the positioning data with that of the ROV's other sensors, automatically regulates the ROV's trajectory around the vessel.



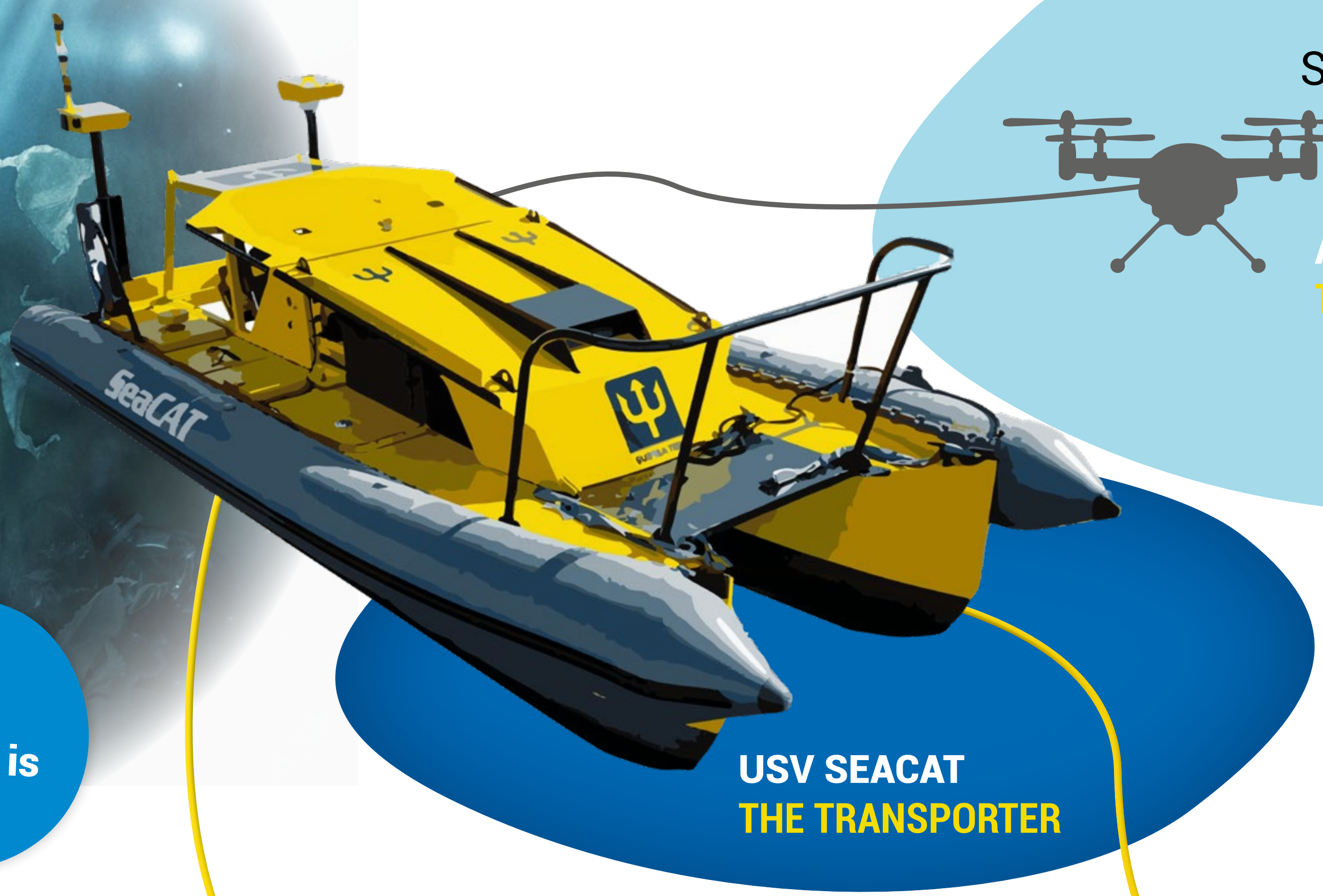
HYPERSPECTRAL CAMERA
Underwater conditions cause a loss of contrast and colour, as well as light absorption, that are not managed by conventional cameras. Hyperspectral imaging addresses these three challenges. It is a technology that uses spectral colour bands to identify objects and materials in an image.

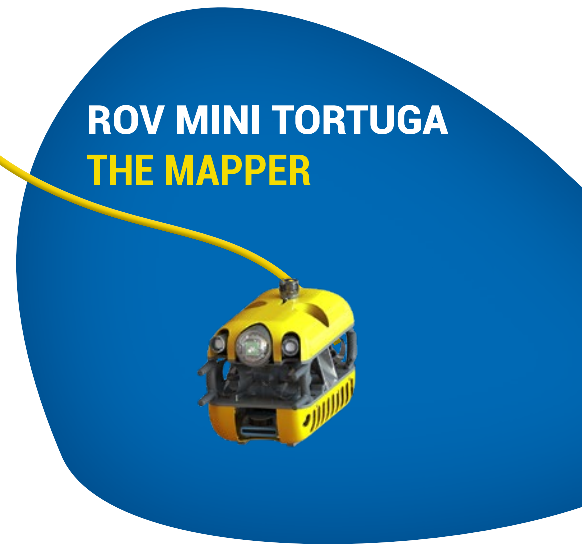
CAVITATION CLEANING TOOL
Unlike high pressure jetting, cavitation cleaning does not damage the hull coating. The ROV is equipped with a bell jar containing a double nozzle rotor that allows cleaning of large areas while confining the debris, which is collected by an integrated suction system. Thus, it is possible to carry out cleaning in harbour areas even under strict regulatory conditions.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 871295.

THE ULTIMATE ROBOTIC SOLUTION FOR SEABED WASTE REMOVAL

The oceans today contain 26 to 66 million tons of waste, about 94% of which is deposited on the sea floor.





The SeaClear project aims at automating the process of searching, identifying and collecting marine litter, using a pack of autonomous robots working together.

Underwater mapping by surface drone

Developed by Subsea Tech, the USV SeaCAT, equipped with a multibeam echosounder, scans the seabed in order to produce a 3D bathymetric chart which will be used as a base map for the waste-related data collected by the 2 ROVs and the aerial drone. This map will also be used to add all the other information on waste transmitted by the other drones. The most voluminous debris are detected directly thanks to the bathymetry.

The SeaCat also serves as a "mother ship": it deploys and reintegrates the other robots once their mission is completed. These robots are powered and communicate with the USV via cables. They are all driven via a single control interface. The computing resources required for the detection, control and artificial intelligence components are also hosted by the SeaCat.

Airborne scanning

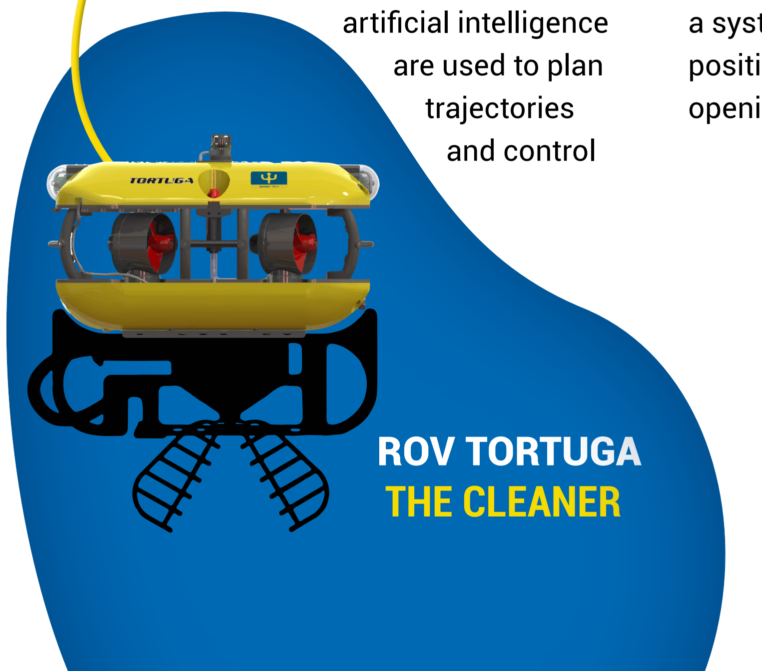
In shallow areas and when visibility allows it, an aerial drone (UAV) searches for waste from the sky. Larger accumulations of litter can be identified and used as a base for the more detailed search by the underwater robot in the next step. A correlation between surface and underwater trash accumulations is also studied. In turbid waters, the drone remains useful by scanning the surroundings for obstacle avoidance.

Underwater inspection robot

A Mini TORTUGA ROV is deployed from the USV and inspects the seafloor for smaller debris. It uses a multibeam imaging camera and sonar, as well as possibly other sensors such as a metal detector. The identified litter is then located on the reference map. Debris are identified using artificial intelligence and deep-learning object recognition techniques. These systems are programmed to differentiate trash from marine species and thus ensure that the system does not miss the target.

Underwater collection robot

A larger ROV, the Tortuga, is equipped with a gripper specially designed for this mission and collects each piece of waste marked on the map. The gripper is equipped with a suction device that allows the garbage to be picked up in difficult circumstances, such as when it is among the underwater flora. The detritus is precisely grasped and then picked up. Here too, deep-learning and artificial intelligence are used to plan trajectories and control the movement of the collection ROV.



Trash bin

A collection basket is deployed from the USV and then progressively filled with the waste collected by the Tortuga ROV. The opening of the basket is specially designed to ensure an efficient interface with the grapple and to prevent floating waste from escaping. The basket is also equipped with a system allowing the ROV to position itself in relation to the opening. ■

www.seaclear.eu

WHERE TO MEET US THIS YEAR

15-17 MARCH 2022 | LONDON (UK)

Oi oceanology international 2022
15-17 MARCH 2022
LONDON, EXCEL

28-30 JUNE 2022 | MARSEILLE (FR)

em euromaritime
THE EUROMEDITERRANEAN
BLUE GROWTH
EXHIBITION

18-21 OCTOBER 2022 | PARIS (FR)

EURONAVAL
18 > 21 OCTOBER 2022
PARIS LE BOURGET

An open house of the new Subsea Tech premises will be organized in May 2022.

The date will be announced on our website and our networks. **Stay tuned!**

www.subsea-tech.com

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NEW TEAM MEMBERS

Bastien DUBEGNY
Hydrographic Engineer

Melvin SERIE
Mechanical Draughtsman

Leïla DAVID
Marketing and Communication Manager

OUR NEW OFFICES

The workshop

The design office

The administration

RENEWAL OF THE SUBSEA TECH FLEET

Album

SUBSEA TECH