

# E E L U M I N A T I N G

## ARGEON PLAN TO USE NEW AUV FOR CLEARER AND CHEAPER SURVEYS

Against the backdrop of the Winter Olympics, the concept of a 'Race to be Second' seems quite incongruous, yet this phrase accurately describes underwater technology and the offshore industry. Companies that would otherwise enjoy the advantages of new technology, quickly retreat from being its first adopter, due to the (fear of the ) cost of it failing. It takes a brave company to employ any new technology and especially from a company without a track record

Brave, however, is exactly what underwater data group Argeo have been, with the recent announcement that it would become the first commercial operator of the Eelume AUV. So what do they know and the rest of us don't?

"We are currently seeing a tidal wave of technology coming into the market able to do things they simply couldn't do only two years ago," said Argeo CEO Trond Crantz. "Now is the time to use these tools to drive the cost and efficiency changes we want to see."



## EELUME

The Eelume is a self-propelled autonomous vehicle with a characteristic slender, articulated body that broadly emulates the form of an underwater snake or eel. Uniquely, it provides unique shape-changing capabilities.

The vehicle is hydrodynamic enough to allow it to transit over long distances yet able to work in confined spaces not accessible by conventional underwater vehicles. By use of the thrusters and joints, the vehicle can assume any pose in the water. Importantly, it can hover and manoeuvre even in strong ocean currents.

An important feature of Eelume is its modularity. By combining thruster modules, joints, sensor modules and different payload modules can be mounted anywhere along the flexible body.

It can also achieve a dual-arm configuration by mounting tooling in each end and forming the vehicle body into a U-shape. One end of the arm can grab and hold to fixate the vehicle, while the other end can carry out inspection and intervention tasks. One end of the arm can also provide a perspective camera view of a tool operation carried out at the other end.



The vehicle Eelume is a very good allegory for Argeo itself. Both are lean and agile, relatively small yet hide a huge potential.

Argeo's currency is underwater data. Many companies have entered the underwater inspection market armed with visual imaging techniques such as subsea Lidar laser imaging and photogrammetry. Argeo, however, have travelled along a very different direction.

"Our roots lie in the seismic and geophysical industry and this underpins most of our technology, especially electromagnetics, which, we believe, is grossly undervalued," said Crantz. "We see underwater vehicles simply as delivery systems for this technology."

"We have already invested in classic AUVs. For many years, we have been operating a Kongsberg Hugin and to supplement this, recently ordered a pair of immensely powerful Sea Raptor vehicles from Teledyne."

These fast hydrodynamic torpedo-shape of these AUVs favour linear operations such as pipe and cable tracking, and these can be especially cost-effective over long distances."

There is, however, another quite different underwater market for the close quarter inspection of structures such as jackets and templates as well as revisiting areas of interest on pipelines. This has traditionally been the domain of ROVs and it is this area that Argeo is looking to disrupt.

"One important property we were looking for in a new vehicle was that it should hover," said Crantz. "This is universal in ROVs and allows them to carry out a variety of tasks that we see as crucial to our requirements. They are also able to carry out limited intervention tasks such as to open close valves."

"The downside of using ROVs however, is the cost of support. This typically includes a surface vessel to provide power and control for the underwater operations. At present, these surface vessels are mostly manned and very expensive to operate. Our intention is to go smaller, smarter and be more sustainable."

"Replacing the large labour-intensive surface vessels with small, unmanned surface vehicles, offers the oil and gas and offshore wind industries a way to dramatically reduce the cost of underwater surveying and inspection."

"The use of unmanned surface vessels is becoming increasingly common, but while deploying underwater vehicles from them and retrieving them has been carried out, it is still in its infancy. The prize for doing so, however, can be rewarding. We estimate that 90% of these costs are vessel related."

## DEVELOPMENT

While it is true that the vehicle is 'new', it is underpinned by over 10 years of research," said Crantz. "

Eelume was established in 2015 as a spin-off from the Norwegian University of Science and Technology (NTNU). After a decade of research on snake robots in collaboration with the research organization SINTEF it was decided to further pursue a subsea applications.

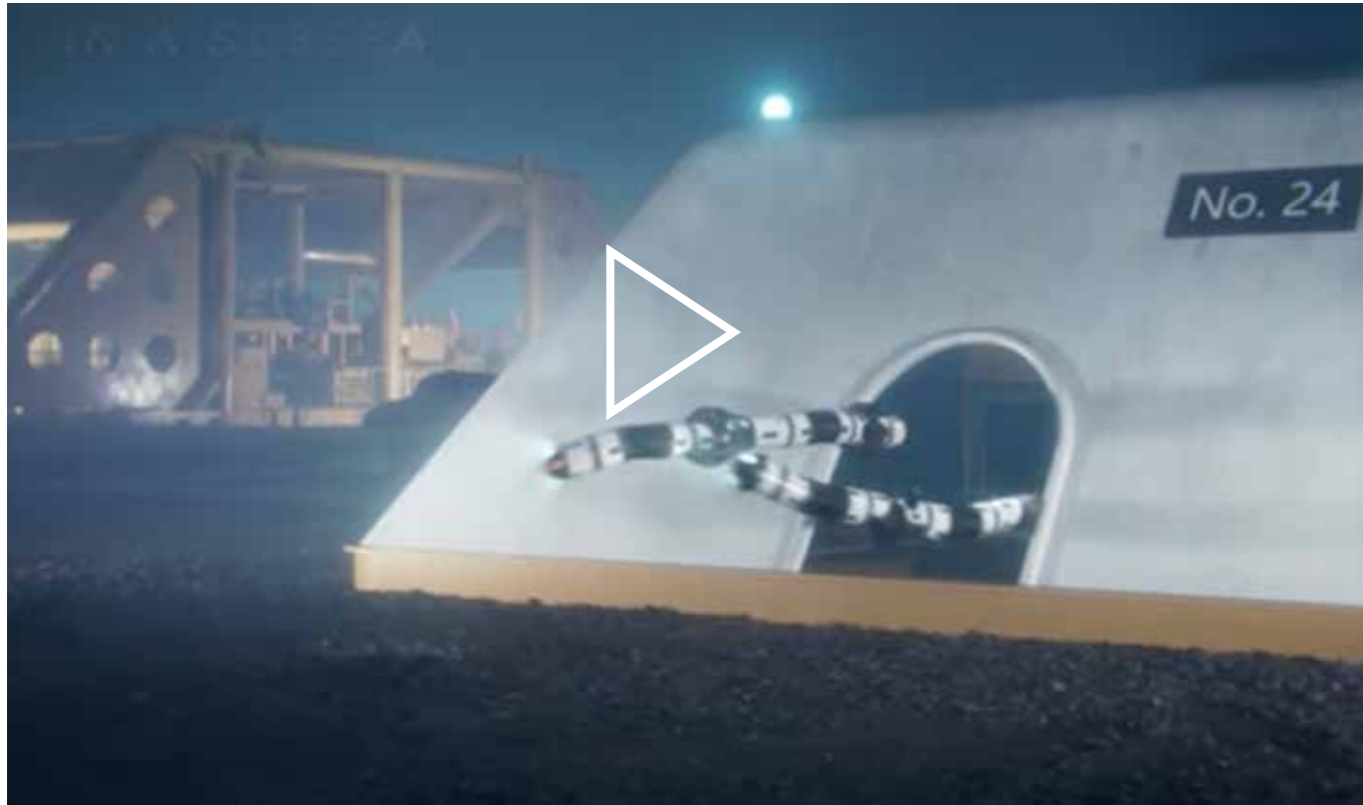


In 2016 Eelume entered into a strategic partnership with Kongsberg Maritime and Equinor. This partnership ensured that the original vision to come into reality yet integrate all the latest technology.

Another direction that some companies have explored to solve this problem, especially for longer duration work programmes, is towards the use seabed residency where the vehicles can be mobilised 24/7 regardless of weather conditions.

"A continuous IMR capability near the subsea installations without the need for surface vessels means





greener, safer and less costly subsea operations," said Crantz. "Eelume can be programmed to 'sleep' on the ocean floor, waiting to be activated at short notice in case of an emergency, although a more suitable subsea habitat would be docking stations.

"A single Eelume system has a range of about 80km<sup>2</sup>."

Equinor, one of the Eelume partners, has been a key investor in supporting a wide range of AUV operations.

One technology it has been actively promoting, is the development of underwater docking stations as a platform to recharge the AUV batteries while allowing them to receive fresh instructions.

"Eelume is fully compatible with this technology. Introducing docking stations in the centre of working circle immediately gives the Eelume a transit range of about 20km from one docking station to the next.

"This means that we can service a number of fields with this system. Some fields are directly powered

from shore while some companies have proposed various micro-charging concepts based in locally-generated renewable energy sources. This gives it a low carbon footprint. We can already control underwater vehicles remotely from our onshore operations room.

"Another useful property of the Eelume is that it is modular. This means that we can always incorporate the correct tool or sensor modules for a given operation and quickly swap them out for the next. The vehicle is, therefore, always at its lightest, leanest and most efficient, and this results in reduced costs.

"Cost reduction is more important than ever, particularly as we transition from hydrocarbons to renewables," said Crantz.

"Offshore wind has a much lower margin than oil gas, but companies still need to pay the same prices for

offshore services. Using lower cost vehicles will help us be competitive, but using innovative sensor systems will also increase efficiency."

The vehicles are, however, nothing, without the tools that they carry. As such, Argeo has been trying to replace traditionally survey activities routinely carried out in the past.

"Typical sensors collect geophysical, hydrographic and geological data to produce uniquely detailed knowledge of the subsurface landscape," said Crantz. "These can be used to assist in the positioning of floating wind turbines, scanning the ocean floor to find the best anchoring points for them. Alternatively, they can be used to inspect oil and gas pipelines to determine if they need servicing.

"One tool we have been recently involved in developing is a high single to noise ratio cathodic protection (CP) system. Indeed, the signal in our

Raptor AUVs is so strong that we can fly 20m pipeline in 4kt speeds service and carry out CP surveys very quickly and cost effectively. We plan to develop this as a module for our Eelume.

"For the offshore wind sector, we have developed an active control source electro magnetic system to look for unexploded ordnance (UXO). Most systems are presently based on passive sensors but we are looking, at active systems which permit a much more accurate mapping with larger footprints.

Over time the integrity of the equipment decreases. So, we need to know exactly when to do maintenance and repair, neither too early nor too late. Our inspection robots provide the data needed to perform this just-in-time maintenance, based on the actual condition of the equipment. Such an approach saves cost.

## SEA RAPTOR AWARD

Argeo has successfully won a contract for ultra deep-water work for an undisclosed customer. The project will commence in March 2022 with an estimated completion in April. Argeo will use the 6000m-rated Teledyne AUV SeaRaptor "Alpha" The project will prove the SeaRaptor very near the limits of its build specification while making use of all the high-quality sensors integrated into the vehicle.

The SeaRaptor is a survey grade deep water autonomous underwater vehicle (AUV) designed to operate at abyssal depths. It will be equipped with the latest Kraken MinSAS 120 Synthetic Aperture Sonar (Kraken Robotics, Canada) providing large swath area coverage and high-resolution imagery and bathymetry data collection.



The vehicles will also be fitted with Teledyne Reason T50-S Multi-Beam dual frequency 200/400 kHz Echo Sounders, Teledyne Benthos Chirp III Sub Bottom Profilers, iXblue PHINS 6000 INSs coupled to Teledyne RDI Tasman DVLS, and CathX high resolution camera, laser scanning, and strobes in its Hunter Camera Systems.

All data collected will be processed onboard using Teledyne Caris OnBoard postprocessing and mosaicking software to allow quick turnaround during missions.

The AUVs are also fitted with a large variety of scientific sensors from RBR which will take Conductivity, Temperature, Pressure, Turbidity, pH, Dissolved Oxygen, Redox, CH<sub>4</sub> and Magnetic measurements to provide valuable water column data which will contribute to better ocean basin characterisations.