

# Safe and sustainable hydrographic surveying

**NEW CONCEPT** Remote and autonomous technology is integral to the safety and efficiency of hydrographic surveying. A new concept developed by UK-based Sea-Kit, and soon to be adopted by Fugro, is set to deliver a much-needed boost towards uncovering the 80% of ocean floor that is yet to be surveyed, writes freelance journalist Saul Trewern.



The Sea-Kit 12m X-class USV

Source: Sonardyne International

How do you launch and recover a 6.5m autonomous underwater vehicle (AUV) featuring an industry-standard hydrographic survey payload using an uncrewed, remotely operated unmanned surface vehicle (USV), with nobody around for hundreds of miles in any direction to help?

This was the question posed to UK boat builder Hushcraft by the Gebco Nippon Foundation (Gebco-NF) Alumni team, at the start of its journey in the USD 7 million Shell Ocean Discovery XPRIZE, a global competition to advance ocean technologies for rapid, uncrewed and high-resolution ocean exploration and discovery. Hushcraft established a new subsidiary called Sea-Kit in 2017, with the singular focus of designing and building the vessel that would help the Gebco-NF Alumni team win the competition, which it ultimately did in May 2019.

“The conundrum that was put to us by Gebco-NF years ago was how the vessel design first came about. Our approach focused on the safety aspects of transferring the payload – in this case a Hugin AUV – into the water and back on board. The answer was to use ballast and a conveyor-belt system combined with CCTV monitoring and data feedback from the AUV and USV to the operators at our remote operations centre in Tollesbury, Essex,” said Ash Skett, Operations director at Sea-Kit.

Christened *USV Maxlimer*, the first Sea-Kit X-Class USV was integral to the Gebco-NF team’s XPRIZE success, impressing the independent judging panel in concept and performance during field testing in Kalamata, Greece, where teams had up to 24 hours to map at least 250km<sup>2</sup> of the ocean floor at 5m horizontal resolution or higher.

*USV Maxlimer* has since proven its ability to match the quality and yield of data pro-

duced by crewed survey vessels, during a 22-day uncrewed trans-Atlantic survey (UTAS) co-funded by the UK Space Agency through the European Space Agency’s Business Application programme. Sea-Kit worked collaboratively with industry partners on the UTAS project, including Fugro, Global Marine Group, Map the Gaps, Teledyne CARIS, Woods Hole Group and The Nippon Foundation-Gebco Seabed 2030 project.

“One of the main objectives of the UTAS mission was to prove our endurance capabilities over the horizon, as this is what sets the Sea-Kit concept apart,” explained Skett. “We achieved this by operating offshore for 22 days in varied sea states and wind conditions, ultimately mapping over 1,000km<sup>2</sup> of ocean while using just a fraction of the fuel that a crewed survey vessel would.”

The UTAS started in late July, with *USV Maxlimer* leaving Plymouth and

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transiting to the mission area some 460km to the south-west in the Celtic Sea. On return to Plymouth, it still had 1,300 litres of fuel remaining, enough to operate for at least another ten days.

Neil Tinmouth, Sea-Kit's COO is confident that the fuel savings can transform hydrographic survey operations. "A typical ocean-going survey vessel can easily consume 10 to 30m<sup>3</sup> of fuel daily whereas during the UTAS mission we were consuming less than 100 litres per day, We were running about 1% fuel consumption of a typical crewed operation."

Sea-Kit uses a hybrid electric design to enable even more fuel efficiency.

"Because it's a hybrid electric vessel the duration heavily depends on how the thrusters are used. Endurance would suffer at maximum thrust constantly, but as it's uncrewed we are not so constrained by time. We don't need to get crew home or resupply, so we could effectively send Sea-Kit out for months on end. With the integrated solar power, and efficient managing of thrusters and batteries, the hard limit on duration is actually the service interval on the machinery on board," said Skett.

## Commercial operations

Fugro's position as a partner on the project provided a deep insight into the operation of what will soon be the newest additions to its survey vessel fleet. The global geo-data specialist cemented its 'uncrewed evolution strategy' with an order for two Sea-Kit X Class USVs in August, the first of many 12m and 24m units planned for Fugro as part of a partnership with Sea-Kit.

The first 12m X Class Sea-Kit USV is due to be delivered to Fugro in Perth, Australia, in late 2020 and will feature remotely operated vehicle (ROV) and AUV launch-and-recovery systems with integrated station-keeping capabilities. The vessel will be used to conduct completely uncrewed ROV pipeline inspections in water depths of up to 450m on Australia's North West Shelf. The second will have a similar specification and is scheduled for delivery to Fugro in Aberdeen in the first quarter of 2021.

"The UTAS mission has shown that we can have confidence in the Sea-Kit USV concept as a basis for our remote and autonomous operations. It showed that we can sail out of a port with an uncrewed vessel and successfully deliver projects out at sea for weeks at a time and return safely

after completing the mission," said Ivar de Josselin de Jong, global solutions director for Remote Inspections, Fugro.

For Fugro, it is an exciting time in terms of remote and autonomous developments with de Josselin de Jong confident that these solutions are undoubtedly the future of the industry for three key reasons. "The first, and most important, is safety," he said. "Autonomous and remote solutions generate a significant reduction in total HSSE exposure. Whereas before, crews would be exposed to harsh and sometimes unpredictable marine environments, now we have the capabilities for the most difficult tasks to be conducted remotely, hugely decreasing the risk to personnel.

"Secondly, there are significant environmental benefits. With small and hybrid vessels, we can reduce fuel consumption by over 95%, which in turn means a large reduction in the overall carbon footprint of our operations.

"Finally, there is the data collection itself. The new capabilities allow for faster and better-quality insights. Better quality insights mean more effective decision-making because data acquired remotely are available in near real-time." >



Fugro's remote operations centre in Aberdeen

Source: Fugro

## Taking control

For the UTAS this summer, *USV Maxlimer* was operated by two teams of three expert operators on a twelve-hour shift basis from Sea-Kit's Essex facility. When Fugro starts operations, its own operators will take charge from its already established network of remote operations centres around the world, benefiting from the deep sensor and systems integration work already completed by Sea-Kit and further developed within the partnership.

"We take all the situational awareness features you'd have on a ship's bridge and recreate that bridge on shore," explained Skett. "We stream 360-degree CCTV and thermal imaging and have a full real-time navigation package and vessel control sys-

tem, along with constantly updated health status including battery data such as voltage and temperature. Importantly, we also stream live audio from the vessel, which helps to increase immersiveness as well as acting as an early warning system should any of the mechanical equipment start to fail."

At Sea-Kit's remote operations centre, the whole operation is fully redundant with a back-up power generator and 4G connectivity, ensuring that operators can stay in control in the event of a power cut or terrestrial communications outage. Likewise, the satcom link that makes remote control and survey data transmission from the vessel possible, is fully redundant.

*USV Maxlimer* features an array of communication channels. The primary chan-

nel, Ku-band VSAT, was chosen for its global availability and relatively high speed. This runs through a 60cm antenna system, the smallest used for reliable commercial operations. Alternative satcom channels come from Iridium and Inmarsat while 4G connectivity and direct line-of-sight communication using Kongsberg's Maritime Broadband Radio system are also available.

Jorge Calvin, a senior account manager from Sea-Kit's communications partner OmniAccess explains that ensuring a link is always available for the most important systems regardless of conditions is the most important aspect of their work. "We define the quality of service for the different instruments and systems on board and manage the priority of the traffic depending on the source.

"For instance, the cameras used for local awareness and the navigation command systems will take top priority to ensure that core functionality is always available at the remote operations centre. Of equal importance to the network configuration is having a qualified network operation centre with fast reaction times, should expert attention be needed."

According to Calvin, the integration of different communications systems and the use of 'traffic steering' allow for more effective operations as well as redundancy, "While we have a robust failover and optimum data loads system, we can send traffic to different channels based on the priority we assign for each of them. Depending on what is available at the time and location, you can always have the critical systems, i.e., command and control going through the VSAT, and less priority traffic going through other means like 4G if near shore. This is all automatic and concurrent."

While the design choices made by Sea-Kit and the Gebco-NF team in the early phases are what positions this vessel at the forefront of innovation, the onshore systems and communications infrastructure are vital ingredients.

"These operations require good connectivity between the offshore vessels and the control centres. Fugro's onshore facilities are operating with optimised and dedicated ship-to-shore connectivity and maximised bandwidth, low latency and high uptime, making for an efficient and reliable operation. It helps Fugro deliver more and more project work via remote and autonomous solutions and the aim is to expand this practice going forward as the industry adapts," concluded de Josselin de Jong.