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In focus: CETUS the Royal Navy's next XLUUV | Navy Lookout

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9–11 Minuten

Following trials with the experimental MANTA extra large uncrewed underwater vehicle (XLUUV), CETUS the RN's next advanced technology demonstrator has entered the manufacturing phase. Here we provide some more details of the project.

Background

MANTA (S2O1) built by MSubs of Plymouth and delivered in March 2020 is the first XLUUV technology demonstrator utilised by the RN although, her builders retain ownership. In order to gain experience with this novel type of vehicle, a 3-phase approach was adopted. Phase 1 covered delivery, basic seaworthiness and autonomy tests. Phase 2 began mission testing of gradually increasing complexity. Phase 3 is underway now the submarine is more closely integrated with the navy MARCAP (Maritime Capability) team and conducting trials that relate more directly to the operational environment and de-risk future technologies. During October 2023, MANTA was used to run a 'D-Day demonstration' conducting reconnaissance and surveys off a Cornish beach, simulating the kind of pre-assault tasks conducted by special forces and crewed mini-submarines in 1944. The intelligence gathered

was sent ashore via satellite to a containerised Portable Operations Centre (POC) which could potentially be sited anywhere in the world or embarked on a ship at sea.

S201 will be returned to MSubs for refit and possible sale to another navy. In order to de-risk some of the technologies that will go into CETUS, a second vessel S202 has been constructed by MSubs. The company is also creating new jobs and investing in a new facility at South Yard in Devonport, much closer to the waterfront than their existing factory in Estover on the outskirts of Plymouth.

The competition for an 8-12m XLUUV was started in early 2022¹ and MSubs were awarded the £21.5 million contract for CETUS in November last year. The craft is now in the manufacturing phase before she begins sea trials in November 2024. MANTA was based on an existing and proven submersible design but CETUS is being designed and built from scratch and will be the first XLUUV owned and operated by the RN under the auspices of the Submarine Delivery Agency's Autonomy Unit (SDA-AU). Overall this project will span 6 years and following delivery, the Navy intends to employ her on trials and experimentation until at least 2027.

The RN's project [SPEARHEAD](#) has multiple strands across the board to improve its anti-submarine warfare capability. Concept Studies for SSN(R), (now SSN-AUKUS) found that there would be great value in augmenting crewed submarines with autonomous systems. The RN needs to increase its underwater mass and a large number of Autonomous Underwater Vehicles will be needed by 2040. The autonomy unit of SPEARHEAD includes CETUS (Annex H) and CHARYBDIS (Annex F) – the development of a system of systems for anti-submarine warfare. (We will look at CHARYBDIS in more detail in a future article). The lessons derived from MANTA and CETUS will

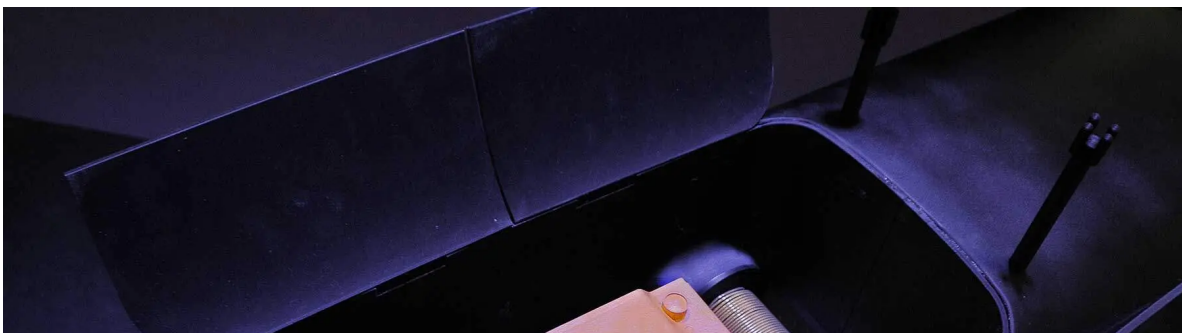
contribute to the RN's plans for the Integrated Review due in 2025 and the RN's Develop Directorate is also considering if there are systems that show sufficient promise to be adopted quickly for frontline use.

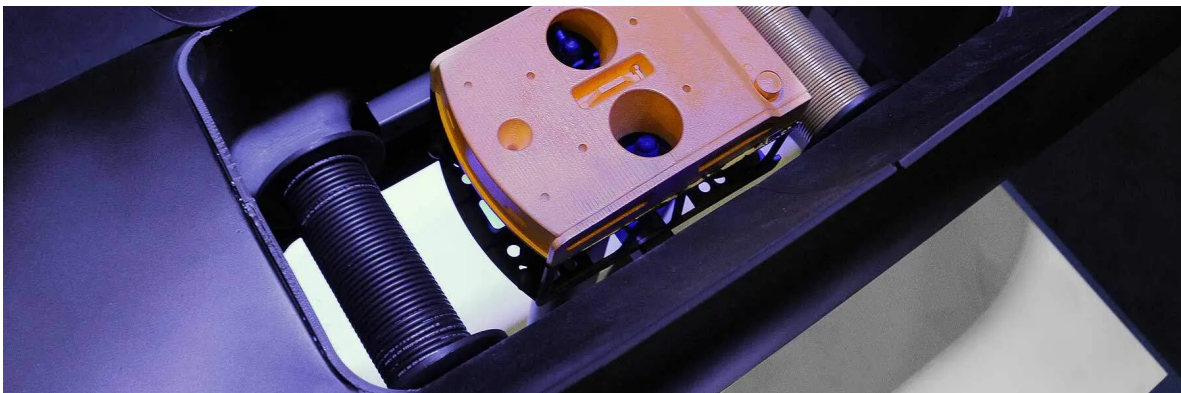
- [Arrangement](#)
- [Payload](#)
- [Extend](#)
- [AUGV](#)
- [Model](#)
- [X-Tail](#)
- [Manta](#)



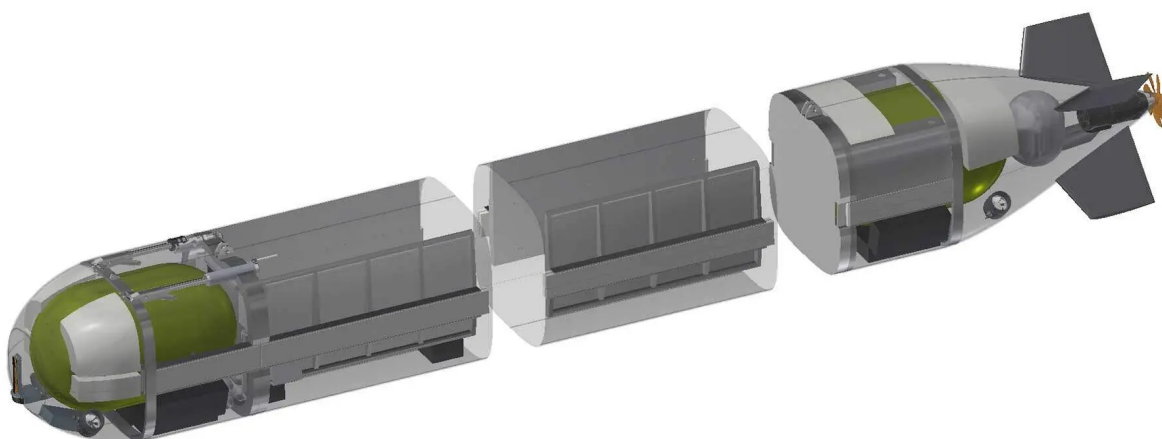
- CETUS is a modular XLUUV featuring two pressure vessels separated by a central (flooding) payload bay.

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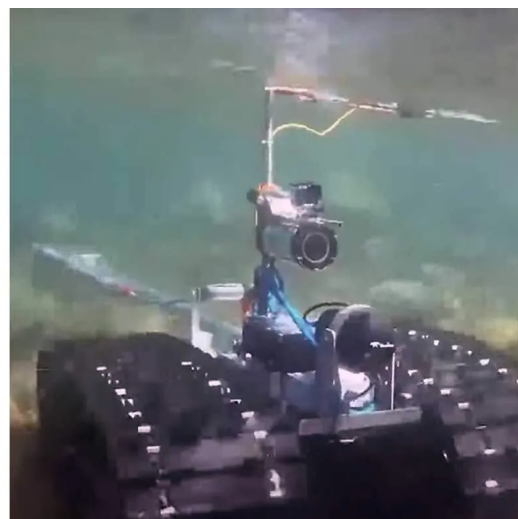
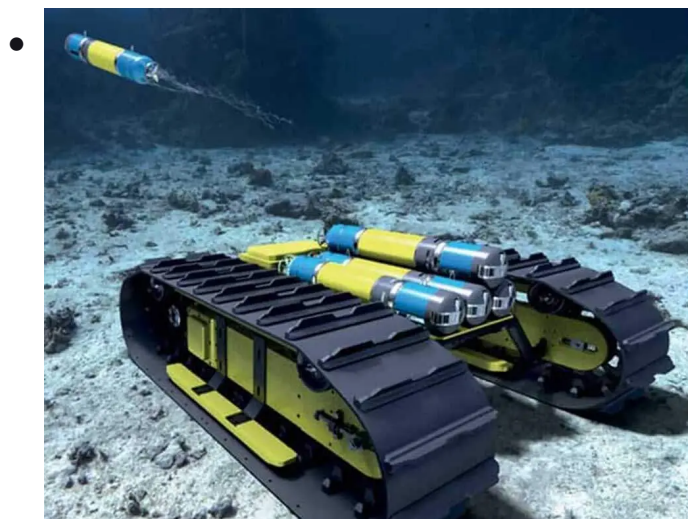


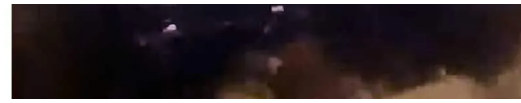


The payload bay is designed to accommodate all kinds of equipment. In the mock-up here, an ROV is in the centre of the bay with its umbilical line on the reel forward. The reel aft is for a towed array sonar (Photo: Navy Lookout).



- CETUS with additional payload module insert.

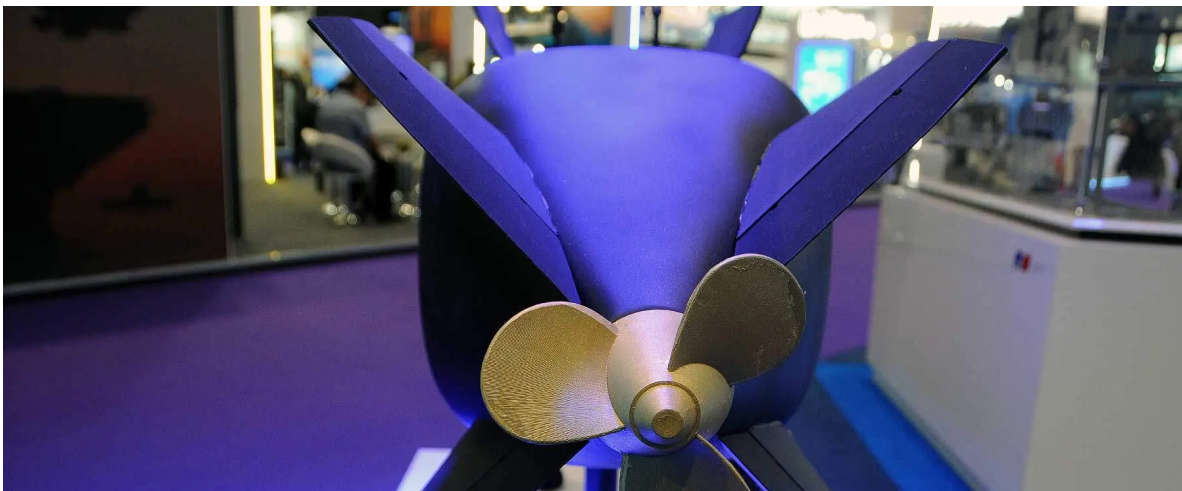


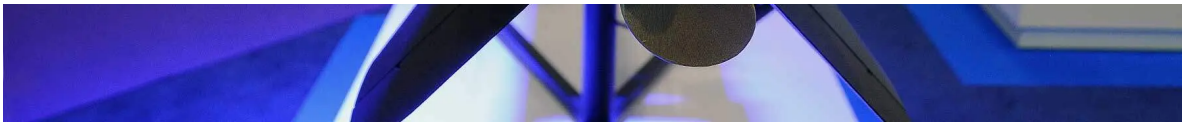


The Bayonet 250 is an Autonomous Underwater Ground Vehicle. AUGVs were primarily designed for survey operations in the surf zone but the RN envisages these and could be lowered onto the seabed from an XLUUV payload bay and carry out missions including reconnaissance or minelaying (Images: Greensea IQ).

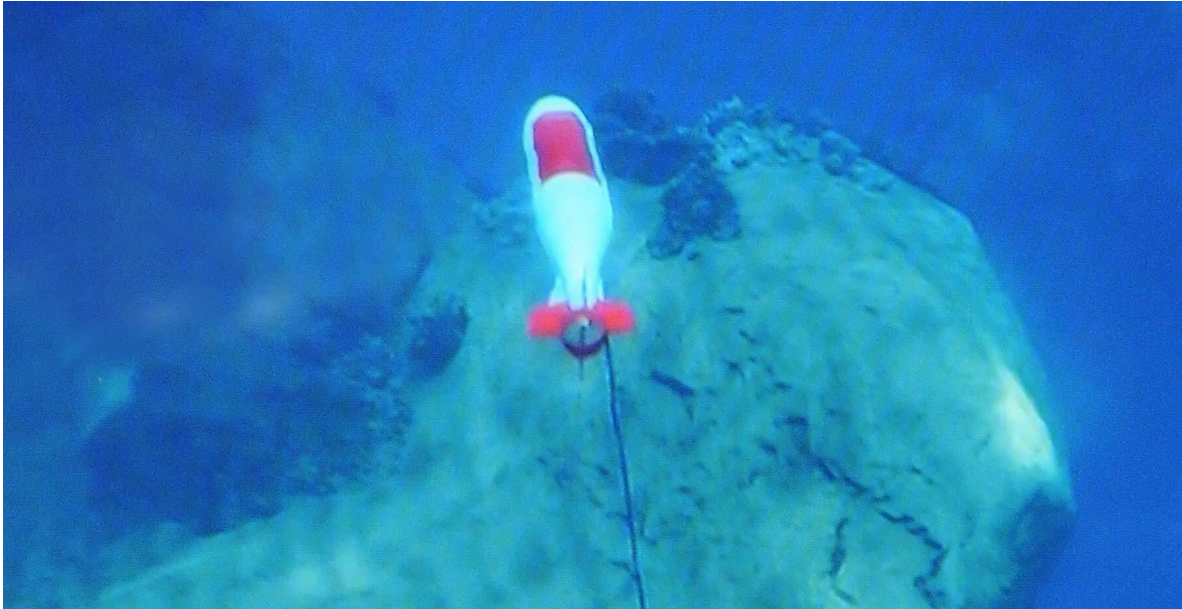


- 1/10th scale CETUS model on display under moody lighting on the Royal Navy stand at DSEI 2023. Initial images showed the two communications and sensor masts folding forward but recent imagery suggests they will retract vertically like a traditional periscope. Video Ray Mission Specialist Defender ROV model below (Photo: Navy Lookout).





Every self-respecting submersible has an X-tail these days (Photo: Navy Lookout).



- Manta with towed array.

Demonstrator

CETUS will be the largest and most complex uncrewed submersible operated by any European navy. It is officially described as “*A representative large-scale AUV demonstrator to build trust in long endurance autonomous operations and be an adaptable testbed for mission payloads*”. The 17-tonne submarine will be 12 metres long and 2.1 metres in diameter. Although an FEU can be loaded into a Type 26 Frigate Mission Bay, CETUS is too heavy for the ship's mission bay handling system, precluding it from being offloaded at sea. It would be less of a problem for handling by ‘motherships’ with powerful cranes (such as [RFA Proteus](#) for example).

Notably, the vessel will be able to dive deeper than any vessel in the

current submarine fleet and endurance is described vaguely as 'several days'. It is a modular design with an optional payload section that can be added to double the capacity of the vessel while endurance can be increased by installing additional batteries. For the sake of simplicity, cost and weight it does not feature diesel generators for re-charging but the power density of batteries continues to improve. The potential fire hazards posed by high-powered batteries, when embarked on ships, will be a fire-fighting and damage control mitigation challenge.

Like most XLUUV designs in development worldwide, the standard size CETUS version will fit inside a 40-foot container (FEU) which is a manageable standard size for road transportation and shipping. The standard Main Payload Space (MPS) in the centre module is 2m x 2m x 2m and there are small Secondary payload spaces in the upper fore-end and lower aft end, likely to be occupied by sensors.

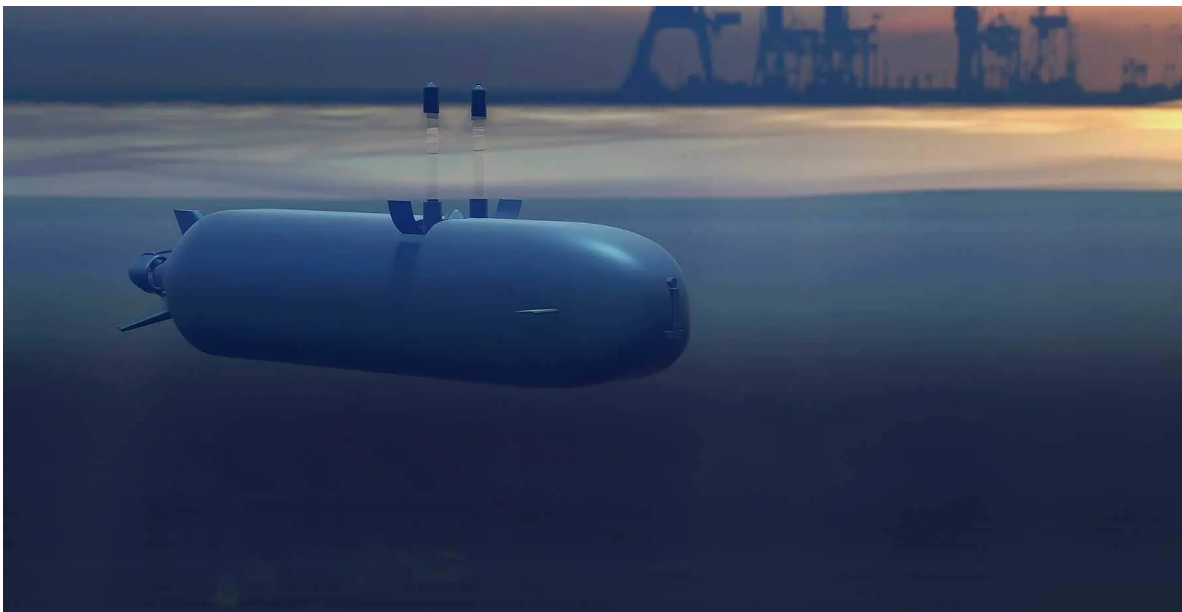
The RN is interested in proposals from industry for potential payloads that can be rapidly switched in and out for trial purposes and eventual mission flexibility. The MPS has doors top and bottom that allow items to be loaded in from above and to exit from the underside of the craft when deployed underwater. Examples of potential payloads on display at DSEI included an ROV deployed on an umbilical from the mission bay and an Autonomous Underwater Ground Vehicle (AUGV) that can be lowered to transit across the seabed.

Beyond CETUS

BAE Systems bid unsuccessfully for CETUS but continues to develop HERNE, their self-funded XLUUV solution. A first public demonstration of HERNE at sea will be conducted in September 2024 from Portland, configured initially for ISR missions. Herne is not specifically aimed at the RN and is intended to have worldwide export potential with the protection

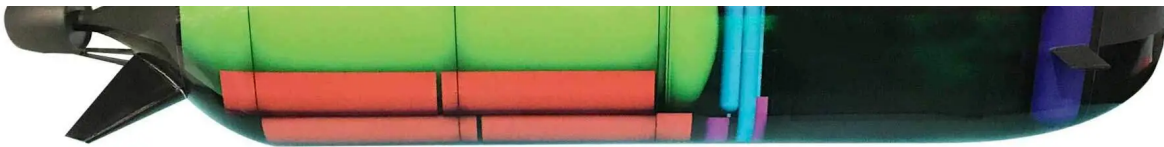
of underwater Critical National Infrastructure (CUI) capabilities as a key selling point. The vessel is approximately the same size as CETUS and has a similar modular design philosophy but its layout is different with its payload bay placed forward and the propulsion module aft with a small shrouded propulsor.

- [Herne Video](#)
- [ISR](#)
- [Model](#)
- [Side door](#)
- [Bottom door](#)
- [Solus XR-2](#)
- BAE Systems Herne XLUAV concept

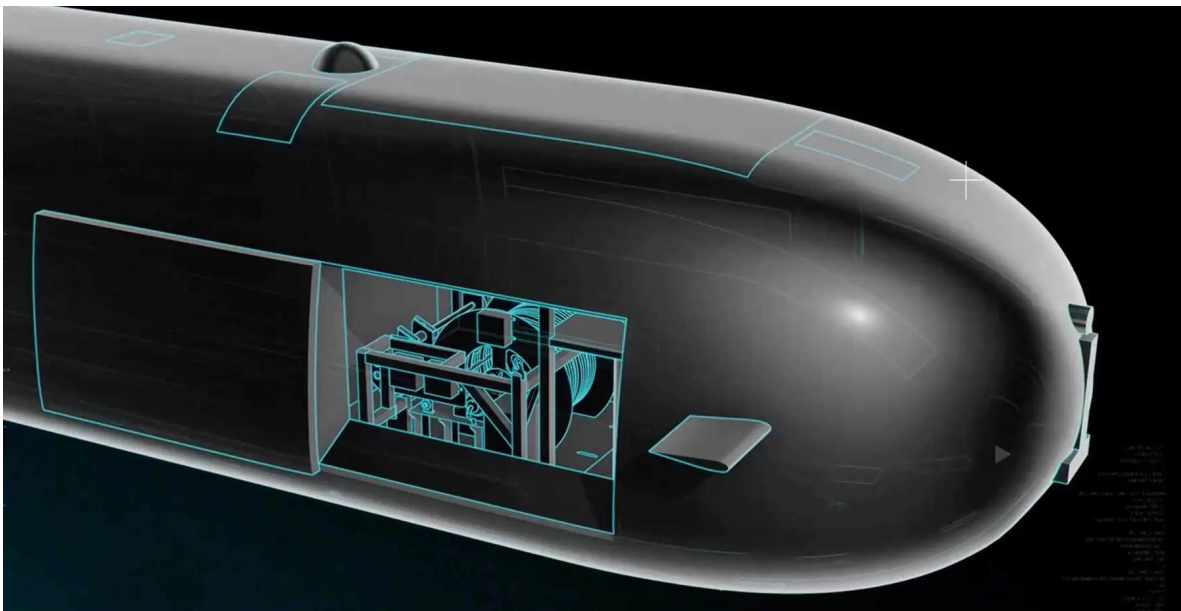


- Sensor masts raised during ISR operations (CGI: BAE Systems).
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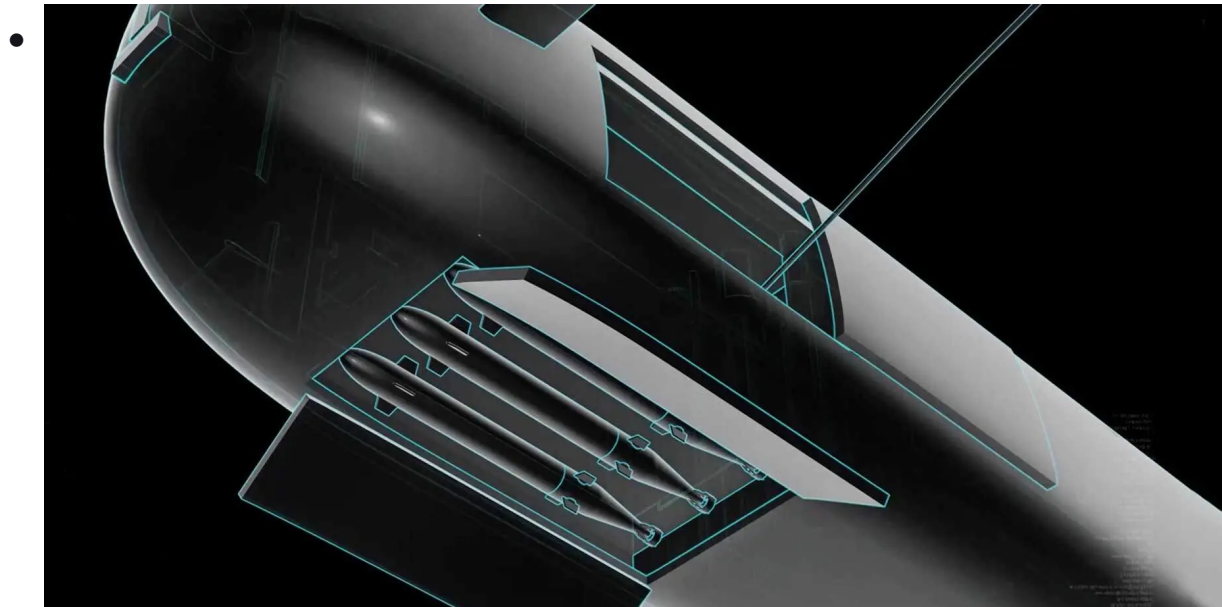




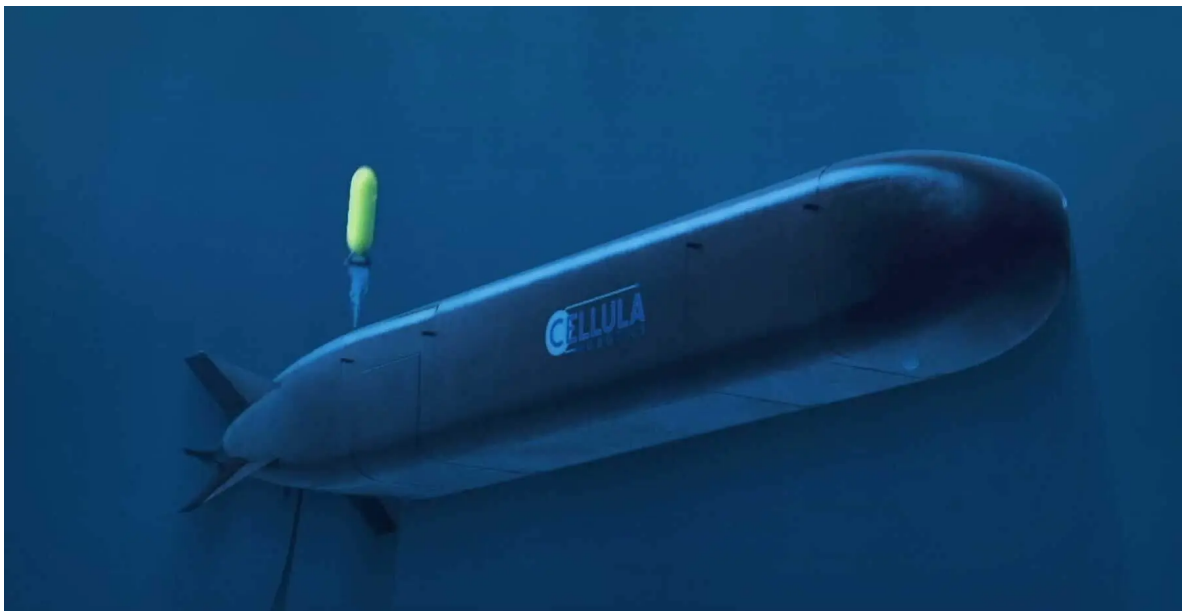
Basic model shows the positioning of the propulsion module (green), batteries (orange) sensor masts (blue) trim and depth control (purple).



- The forward bay has side doors for the main payloads.



There are doors top and bottom of the payload bay for small UUVs or weapons.



- The Canadian Cellula Solus XR-2 is powered by hydrogen fuel cells providing a submerged range of over 5,000 km at 3 knots. It was designed with under-ice operations in the Arctic in mind (CGI: Cellula).

While developing HERNE, BAES has partnered with a Canadian company [Cellula Robotics](#), which considerable underwater autonomy expertise, and their Solus-XR XLAUV has already begun sea trials. HERNE's command chain design is also underpinned by BAES' seven years of experience with autonomous surface craft and their new software is being tested on one of Cellula's vehicles. Every component of HERNE has been designed to have a low signature and utilises proven autonomous navigation and collision avoidance technology. The software has been designed for rapid reconfiguration depending on the mission, having robust and secure communication with host platforms either at sea or ashore.

Assuming the RN plans to acquire a fleet of operational XLUUVs following on from CETUS, BAE Systems would be well placed to build the next generation. It is possible there could be a collaboration with

MSubs, with BAES able to provide the high-end integration expertise and manufacturing scale needed. In the meantime, CETUS is an important step on the road to adding mass and more diversity of capabilities for the Royal Navy in the increasingly contested underwater battlespace.