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TECHNOLOGY SCAN

UNMANNED UNDERWATER VEHICLES

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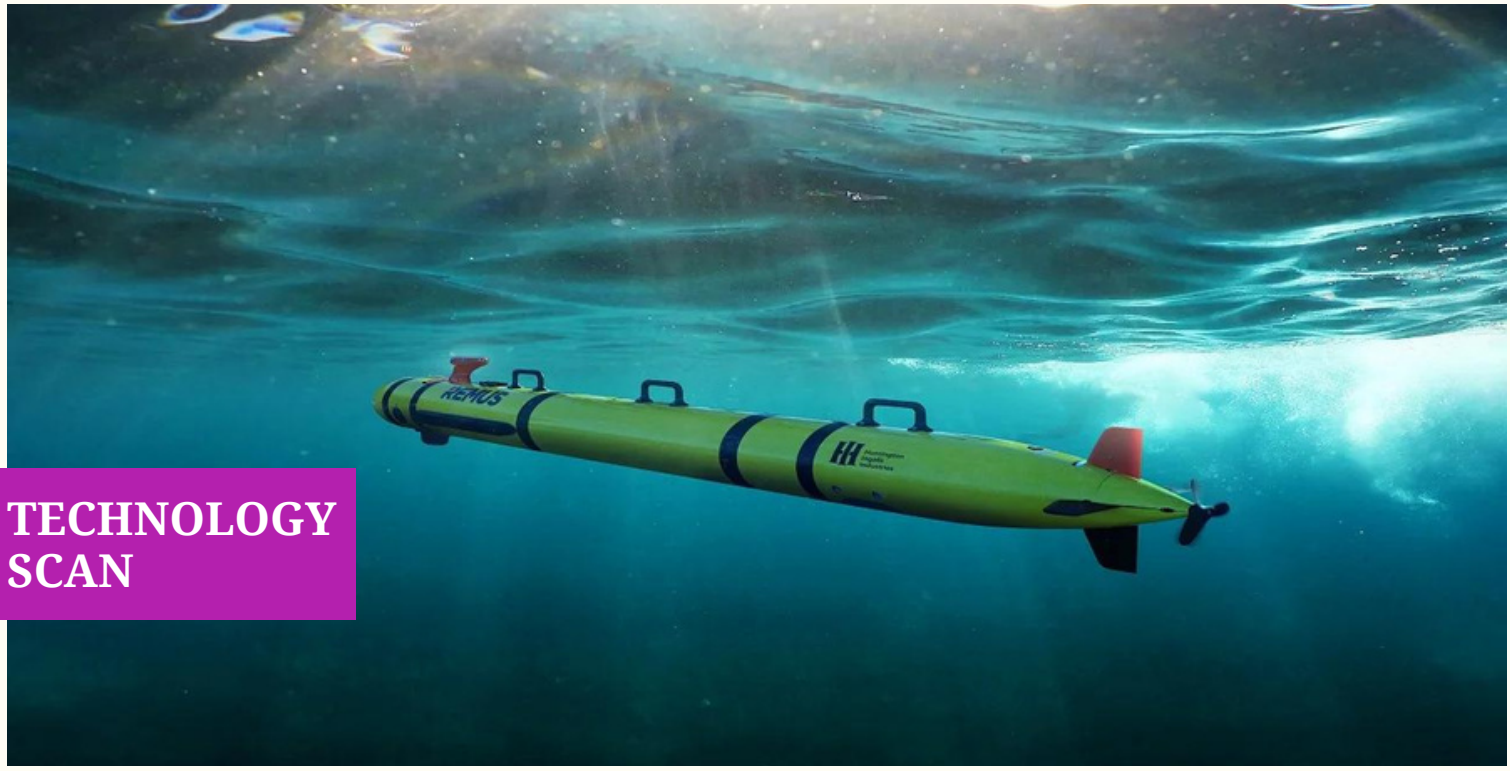


TECHNOLOGY SCAN

UNMANNED UNDERWATER VEHICLES (UUV)

Cdr Naveen Pandita, Senior Fellow

The envisaged role for Unmanned Underwater Vehicles (UUV) across the globe could vary and depending on the intentions of the host nation. The maritime autonomous systems' maintenance costs are not high, and the threat to crew safety is reduced. They have added advantage of higher manoeuvrability, deployability, flexibility, lower implementation costs. Unmanned underwater vehicles, or UUVs, also known as Unmanned Undersea Vehicles, are vehicles that are capable of operating while submerged underwater without the need for a human to be physically occupying the vehicle. They can be divided into two main categories – Remotely Operated Vehicles (ROVs) and Autonomous Underwater Vehicles (AUVs). The most common propulsion methods for AUVs are propeller-based thrusters and Kort nozzles, usually powered by electric motors.

AUVs may also "glide" through the water – by changing buoyancy, underwater gliders are able to alter their depth, and use airfoil wings to convert this movement into forward motion. AUVs are used extensively for surveying by the oil and gas industry and in scientific research. They are also used for Naval Defense applications such as mine detection, payload delivery and surveillance. Military AUVs have been networked with UAVs (unmanned aerial vehicles) to provide a cross-domain ISR (Intelligence, Surveillance and Reconnaissance) solution for the battlefield.

Their improved operational time make them ideal for defensive/ offensive and research utilisation Some of the most likely roles are enumerated below:-

(a)Critical Infrastructure Protection/ Underwater Mine Warfare
(b)Rapid Environment Assessment (REA)
(c)Search and Rescue operations
(d)Intelligence, Surveillance, Reconnaissance (ISR)
(e)Harbour and Costal Surveillance and Protection
(f)Field Development/ FPSO, Rigs/ Subsea Works
(g)Mining/ Bathymetry, Data Acquisition
(h)Deep Water Survey & Inspection

Advancement in technology has resulted in longer endurance and reduction in magnetic signatures of UUV's to remain undetected and undertake both covert and scientific missions. US, China, Russia, France and India have invested in the R&D in the latest technologies of Autonomous under water un manned vehicles specifically designed for carrying multi sensor payload suites and at the same time overcome the limitations of being detected and enhancing the endurance to a great extent. 98 percent of international internet data flows through undersea cables and gathering intelligence using the UUV's or even disrupting the information flow could hamper the nations critical operations. Delivery and retrieval of specific payloads for in specific missions could be yet another task for UUVs.

RT Sys has announced the contract signature with the Slovenian Navy for the supply of one COMET-MCM AUV (Autonomous Underwater Vehicle) and two NEMOSENS micro-AUVs.

UUV for Anti-Submarine Warfare Training

COMET-MCM

Designed to assist EOD divers in operations the COMET-MCM (Mine Counter Measures) AUV, interacts with Surface Communication Modules (SCM) and Positioning & Relay Beacons (PRB), whilst quickly and efficiently covering large underwater areas with high-definition sonar imaging and cameras. Offering extremely accurate real-time tracking and positioning COMET MCM brings its own navigation features (GPS, INS, DVL, swarm mode) and payloads to the mine warfare scene, while acting as relay or LBL positioning beacon.

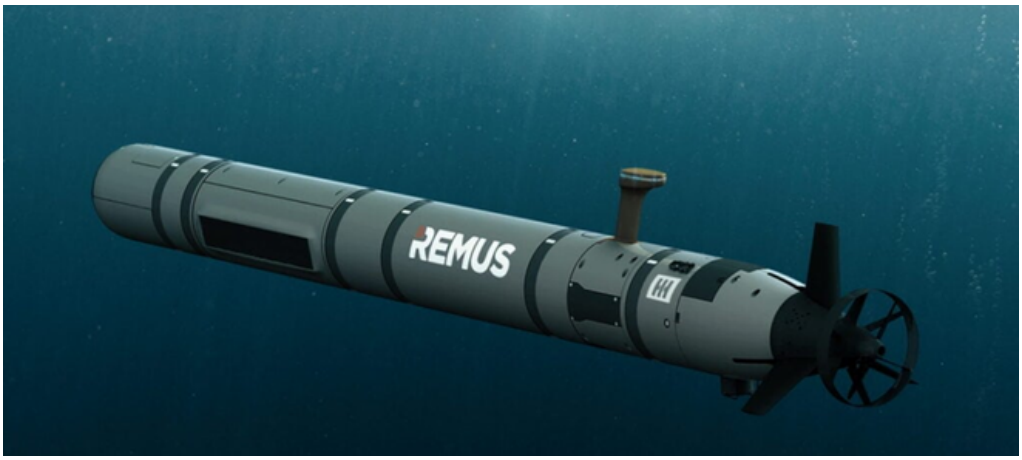
NEMOSENS

The two NEMOSENS micro-AUVs are versatile, man-portable modular underwater vehicles measuring less than 90cm. Offering the same capabilities of live tracking and high accuracy positioning as the COMET, these micro-AUVS are capable of operating in very shallow water (less than 5m) for various operations including Beaching Operations, Rapid Environmental Assessment or identification and localization of underwater mines. Easily deployable and recoverable, the NEMOSENS can be operated from a boat or from the shore, and provides a mission endurance of over 10 hours.

COMMENTS

Autonomous Underwater Vehicles are capable of functioning without real-time control from a human operator. They can be programmed to collect data along a predetermined route, and some are able to make decisions and potentially change their mission parameters according to the received data. It is an AUV designed for various missions: mine counter measure (detection and classification), sea floor survey, hydrographic and oceanographic data acquisition, homeland security (wreck localisation, port and coastal security). All these uses are realized through three separate products, each with equipment and specific features depending on their environments.

REMUS 620



REMUS 620 is the same size and weight of the first and only full-rate production medium UUVs: the MK 18 Mod 2, Littoral Battleship Sensing-Autonomous Undersea Vehicle (LBS-AUV) and LBS-Razorback systems operated by the U.S. Navy's Mine Countermeasure Squadrons, U.S. Naval Oceanographic Office and Submarine Forces, respectively. The new UUV features a modular, open architecture design to facilitate seamless payload integration and HII's Odyssey suite of advanced autonomy solutions for intelligent, robotic platforms. Multiple REMUS 620s operating collaboratively can be deployed from submarines, small manned or unmanned boats, amphibious ships, surface combatants and helicopters. REMUS 620 can also be used as a platform to launch and operate other unmanned vehicles or payloads from beneath the sea.

COMMENTS

Due to the attenuation of radio waves in water, AUVs cannot rely on direct GPS navigation once submerged. Dead reckoning can be used to establish an estimate of position, although errors compound quickly. This positional estimate can be further improved by additional data from underwater acoustic transponders, GPS positions of nearby surface references, or temporary surfacing to establish a GPS fix. Acceleration and velocity estimates can be calculated using an Inertial Measurement Unit, and improved with a Doppler Velocity Log, a device similar to sonar which measures the rate of travel over the sea floor. The increased REMUS battery life enables the UUV to execute a significantly longer route to and from a mission area than previously afforded by medium-class vehicles. The energy modules are swappable, allowing for quick turnaround and incorporation of alternative energy sources as they become available. REMUS 620's standard synthetic aperture sonar payload can be replaced or enhanced for multi-mission capabilities, including intelligence, surveillance and reconnaissance, and cyber and electronic warfare operations. REMUS 620 builds on the success of HII's previous REMUS platforms with delivery of more than 600 UUVs to 30 countries worldwide, including 14

NATO member countries. The REMUS 620 is the first medium UUV designed to accurately deliver this range of advanced above-and-below water effects at long range.

Multi-Domain C2 Software for Deep-Water AUV

SeeByte's SeeTrack v4 software will provide Kongsberg's HUGIN Superior AUV with enhanced operator situational awareness SeeByte has successfully integrated its multi-domain SeeTrack v4 command and control (C2) software with Kongsberg's HUGIN Superior Autonomous Underwater Vehicle (AUV). The HUGIN Superior AUV System is rated to 6000 metres and provides superior data quality and coverage coupled with a state-of-the-art navigation and positioning solution. SeeByte's SeeTrack v4 offers optimal goal-based planning and interoperability with other SeeTrack users. Its open architecture allows integration with different sonars, sensors or behaviours. Combining the software with Kongsberg's advanced AUV results in enhanced operator situational awareness across single- or multi-vehicle operations with optimal planning, monitoring and post-mission analysis results on a single user interface.

COMMENTS

This interoperability between autonomous systems is a great challenge in the underwater domain. It will improve the productivity and effectiveness of the HUGIN family of AUVs. Integrating HUGIN Superior with SeeTrack provides a more cohesive planning and supervision tool for multi-system operations

The Chinese Advancements

- Haishen 6000 (Poseidon 6000): 7.6 meter-long UUV, displacement 3 tonnes, maximum working depth of 6,000 meters, speeds 4 knots, detects mines, carries towed acoustic decoys to deflect active torpedoes.

- EA63: Remotely operated vehicle, operated from surface ships for mine-sweeping, detects and neutralizes marine mines both at depth and on the seabed.

- L30 Watcher: 7.5×2.6 meters unmanned security and patrol vessel, max speed of 35 knots, range 220 nautical miles, undertakes reconnaissance, tracking and warning, anti-terrorism, anti-smuggling, and emergency and rescue operations.

- The M75 Protector: 5.3×1.7 meters, transports supply and conducts patrols along oil pipelines.

- 200-ton class USV: For reconnaissance, surveillance, detection, intelligence collection, precision strike, and special tasks in future naval operations.

- Qianlong III, autonomous underwater vehicle (AUV) and Haiyan glider: Identify enemy submarines, mines, and other UUVs, collect data about enemy submarine acoustics and oceanographic conditions.

The Indian AUV Developed by DRDO

The focus towards Theatre and Strategic ASW is inevitable and vital, advancements in Theatre and Strategic ASW would lead to advantageous outcomes in our favour, allowing us to deploy our capabilities in the right place at the right time . With regard to Naval Operations, underwater domain awareness (UDA) is one of the most critical areas for India. To exploit the potential of unmanned technologies and platforms, the Navy has approved an unmanned road map. The imperative of having an unmanned underwater vehicle can be deciphered from the discovery of Chinese-origin autonomous underwater gliders in the Indonesian waters indicating the extent to which underwater technologies are being harnessed for military advantage. Indian Navy has understood the importance of unmanned solutions and recently envisioned a detailed road map for itself in this realm. It has been decided to adopt Unmanned Underwater Vehicles (UUVs) to cut down on the requirement of minesweepers. As the industry develops UUVs for military purposes, it is imperative to consider their compatibility with the existing manned platforms as a critical deliverable.

Vice Admiral Kumar listed out four categories of UUVs- man-portable Autonomous Unmanned Vehicles (AUVs) with swarm functionality with an endurance of the order of 10 to 20 hours, lightweight AUVs compatible with the existing lightweight torpedo tubes onboard ships and endurance of about two days, heavyweight AUVs compatible with the existing heavyweight tubes and endurance of the order of 3 to 4 days, and high endurance AUVs with a capability of at least 15 days submerged endurance.

COMMENTS

Two major AUV technologies that are attracting the attention of Naval forces globally are Maritime Swarming and Quantum technology. Networked unmanned maritime assets are a key future tool for surveillance, data gathering, decoying, protecting high-value units and ports, minesweeping, detecting submarines and limiting capital ship exposure, as well as neutralising or destroying enemy assets. Metal Shark's new unmanned vessel, the Long Range Unmanned Surface Vessel (LRUSV), for example, will be able to work in clusters, delivering swarms of attack drones to hit targets at sea. Quantum sensors are increasingly receiving funding for navigation purposes, and the use of quantum for navigation has significant military applications. The quantum inertial sensors allow to continuously estimate an objects' position, direction, and speed of movement without a requirement for external references. Global positioning system (GPS) cannot be used in underwater, therefore, submarines and UUVs required a precious inertial navigation system. Quantum navigation could meet this requirement. Quantum sensors can also provide significantly better information about potential Naval threats including mines and Anti-Submarine Warfare (ASW) capabilities. Quantum technology can be used to communicate with submerged objects such as submarines and UUVs securely.

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