PERSEASTENT - Pioneering Limitless Endurance for Next-Generation Marine Robotics

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The vital role of Earth's aquatic domain in climate control and its concealed resource potential are now more evident than ever:
indeed, the United Nations proclaimed 2021-2030 the "Decade of Ocean Science for Sustainable Development".
Nonetheless, the world's growing population and the industrialisation of coastal areas place increasing pressure on such a delicate ecosystem, igniting the need for innovative solutions for ocean monitoring.
Conventional approaches, such as employing crewed vessels and remotely operated vehicles, are burdened with high costs, high logistics, and substantial human resource requirements. Conversely, Autonomous Marine Robotics arise as a tantalising solution to transcend such limitations. However, these systems still grapple with significant constraints related to power sources that, in turn, confine spatial reach, mission longevity, payload capacity, computational prowess, and communication bandwidth.

The PERSEASTENT project wants to pioneer a path for Next-Generation Marine Robotics by prototyping an original concept of a modular architecture comprising distributed intelligent robots — the Persistent Marine Robotic System (PMRS). The PMRS consists of an Explorer, a fully-equipped Autonomous Underwater Vehicle (AUV); multiple Carriers, micro AUVs serving as swappable storage and battery modules for the Explorer; a Conveyor, a reconfigurable autonomous surface vehicle incorporating systems for long-range transmission, accurate positioning and energy-harvesting. The Explorer performs the monitoring campaign powered by a Carrier to which mission data are backed up. Periodically, one of the fully charged Carriers detaches from the Conveyor and navigates to the Explorer, where it is swapped with the one in use. The used Carrier navigates back to the Conveyor to be recharged, bringing mission data to stream remotely; this repeats in a virtually endless cycle.

PERSEASTENT is a paradigm-shifting endeavour that revolutionises traditional approaches by enabling self-sustainable ocean monitoring campaigns supported by the continuous remote transmission of mission data. Whereas its inherent novelty presents a high level of risk, it also promises groundbreaking benefits, having the potential to reshape the landscape for Next-Generation Marine Robotics.