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Surface unmanned multipurpose research marine vehicle: SUNMARE project

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Autonomous vehicles represent the new frontier in the marine ecosystem's analysis and monitoringas they extend human abilities at sea. Their capabilities are strictly related to:
• the algorithms that provide their autonomy;
• the complex and detailed CONOPS needed to be developed and defined in order to comply with all the operative and environmental scenarios to which the platform will be faced with
• the innovative and holistic design process for defining robust and reliable data acquisition/transfer, intelligent systems-of-systems for self-diagnostics for operational safety and interactive deep learning processes.
This paper presents the preliminary activities undertaken for the research project called SUNMARE (Surface UNmanned multipurpose research MARine vEhicle) which aims at the development of an innovative fully autonomous platform for marine, oceanographic, lacustrine, and submerged/semi-submerged cultural heritage monitoring/measurements.
SUNMARE is a modular ship comprising of a mother unmanned ship and a smaller Autonomous Underwater Vehicle (AUV). The AUV can detach and reconnect autonomously to the mother ship to perform independent tasks. Some of the innovation relies on two fundamental characteristics:
(i) both vehicles can be easily disassembled and transported in standard ISO containers, to increase their field of use;
(ii) the AUV is launched and recovered with a LARS, which ensures the success of the operation in complete safety.
The mother shipmust possess the following fundamental design requirements:
• modularity and disassembly of the vehicle
• possibility of embarking an ISO10 container dedicated to scientific and technological research
• an innovative and sophisticated LARS.
The general architecture of SUNMARE is presented with the innovative high efficiency propulsive solutions selected, as well as a detailed risk analysis, the definition of the requirements and technologies dedicated to the "autonomization" of the vehicle and the preliminary numerical simulations concerning the "autonomous self-drived dynamic connection" of the vehicles and the basic operation of the LARS system controlled by an ad-hoc designed control algorithm.

Primary authors: Dr LAURENZA, Maicol (University of Rome "Sapienza", Mechanical and Aerospace Eng. Dept. (DIMA)); Dr MALITO, Alec (CNR-INM (Italian National Research Council – Institute for Marine Eng.); Dr MEZZANI, Federica (University of Rome "Sapienza", Mechanical and Aerospace Eng. Dept. (DIMA)); Dr DE LAURO, Massimo (CNR-INM (Italian National Research Council – Institute for Marine Eng.)); Dr PEPE, Gianluca (University of Rome "Sapienza", Mechanical and Aerospace Eng. Dept. (DIMA)); Dr MAURO, Salvatore (CNR-INM (Italian National Research Council – Institute for Marine Eng.)); Prof. CARCATERRA, Antonio (University of Rome "Sapienza", Mechanical and Aerospace Eng. Dept. (DIMA); Prof. CULLA, Antonio (University of Rome "Sapienza", Mechanical and Aerospace Eng. Dept. (DIMA)

Presenter: Dr MALITO, Alec (CNR-INM (Italian National Research Council – Institute for Marine Eng.)

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