

## **Concept Note**

HORIZON Project: “Development of an autonomous vessel with integrated UAVs and ROVs, for inspection and diagnosis of marine infrastructures.”

Topic: **HORIZON-CL5-2024-D3-02-04**: “Critical technologies for the future ocean energy farms”

**Deadline date:** 04 February 2025

### **Challenge and proposed solution:**

The project proposes the design and development of an autonomous mother ship equipped with aerial drones (UAVs) and underwater drones (ROVs) for the inspection and diagnosis of marine infrastructures remotely and autonomously. This integrated system will function as an Unmanned Surface Vehicle (USV), providing a complete solution for preventive and corrective maintenance operations for offshore structures, reducing time and increasing inspection accuracy. These objectives align with the topic HORIZON-CL5-2024-D3-02-04 of the 2023-2025 Work Program (8. Climate, Energy and Mobility), which seeks higher performance of ocean energy technologies with special attention to sustainability, operation and maintenance of these devices, better knowledge on how to operate ocean energy devices, their availability, maintenance, reliability, survivability and sustainability, as well as the reduction of the Levelized Cost of Energy (LCOE).

The scope of this project addresses area 3 indicated in the topic:

Instrumentation for condition monitoring and predictive maintenance of ocean energy devices. Apply recent advances in condition and structural health monitoring from other sectors to ocean energy – particularly those currently developed for offshore wind. Apply latest sensor technology to existing ocean energy deployments. Document and share experience on sensors performance and reliability, and methods for adapting them to the harsh ocean energy environment. Improve transmission or storage of data collected from sensors, such as underwater data transmission.

With this project, we are looking for:

- Technological innovation: development of advanced technology for the integration and management of multiple drones from a centralized platform. This includes automatic launch and recovery systems, as well as advanced control and communication capabilities for the simultaneous operation of multiple aerial and underwater drones.

- Operational efficiency: increase the efficiency of inspection operations by automating and reducing the need for direct human intervention. The mothership allows for the rapid and efficient deployment of drones on various missions, optimizing resources and operation time.

- Safety and sustainability: promote safety in complex operations and in adverse environments. In addition to designing this equipment with materials and technologies that minimize environmental impact, ensuring long-term sustainable operations.

- Achievable objectives: within the timeframe and resources of the project, the proposed work is located at an intermediate point on the R&D maturity spectrum, advancing from the concept phase to practical application. At the beginning of the project, it is at a Technological Maturity Level (TRL) 2, and is expected to reach a TRL 5 upon completion.

- Specific objectives:

- Develop an autonomous mother ship, which functions as an Unmanned Surface Vehicle (UVS).
- Integrate into said vessel, an aerial drone (UAV) and an underwater drone (ROV), both captive, for inspections and diagnoses.
- Apply advances in sensor technology to monitor operating conditions and maintenance inspections.
- Use artificial intelligence and big data to improve the efficiency and effectiveness of inspections and diagnoses.

**Preliminary work-packages structure:**

- **WP1: Project management:** Ensure the correct coordination and administration of the project to guarantee the achievement of objectives within the temporal and economic limits. This task covers the entire time range of the project.
- **WP2: Operations Engineering:** study, description, analysis and documentation of all the operations that the system must perform together and individually, as well as the advanced sensors to carry them out. Ensure compliance with regulations and safety for all O&M operations carried out.
- **WP3: Development of the autonomous mother ship:** adaptation of the design of an autonomous ship that will function as a base platform for drones.
- **WP4: Development of the Aerial Drone (UAV):** Create an aerial drone capable of autonomously carrying out inspections of marine infrastructure.
- **WP5: Integration of the Underwater Drone (ROV):** adaptation of the design of an underwater drone for inspection and maintenance of marine infrastructure.
- **WP6: Integration of the overall system:** Integrate the drones with the mother ship, for centralized operation.
- **WP7: Communication between systems:** establish communication systems between the different drones and with the ground control system.

- **WP8: Tests and Validation:** Validate the prototype by carrying out all the necessary tests for the adequate evaluation of the system as well as its approval and certification according to European regulations.
- **WP9: Offshore wind farm inspection procedure:** Develop the technical inspection procedure with the drone platform developed in this project.
- **WP10: Dissemination, communication and impact analysis plan:** Disseminate the results of the project and carry out retrospective analysis of the results obtained during construction and the tests carried out. Environmental and socioeconomic impact analysis of the prototype.

**Do you want to know more? Get in contact with us!**

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