ID4- SMART AND NETWORKING UNDERWATER ROBOTS IN COOPERATION MESHES - THE SWARMS ECSEL-H2020 PROJECT

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Abstract— The work presented on this paper is aimed to explain the role that unmanned underwater vehicles (AUVs/ROVs) plays in the ECSEL-H2020 SWARMS project. The main goal of the project is to reduce the operational cost and increase the safety of tasks assigned to divers in these operations. This will be achieved enabling the AUVs/ROVs to work in a cooperative mesh. The challenge is to design and develop an integrated platform (a set of Software/Hardware components), incorporated into the current generation of underwater vehicles in order to improve autonomy, cooperation, robustness, cost-effectiveness, and reliability of the offshore operations. The first demonstration of the project will be performed at PLOCAN (Oceanic Platform of the Canary Islands) where these technologies will be validated on its first stage.

Keywords— unmanned, marine, vehicle, AUV, robots.

1. INTRODUCTION

In the near future the oceans will supply a substantial part of human and industrial needs: the oil and gas industry will move to ever deeper waters and renewable energy will be harvested from the seas in offshore wind farms and with tidal, current and wave energy converters. Furthermore minerals such as cobalt, nickel, and copper, rare earths, silver and gold will be mined from the seafloor (deep sea mining). To this end, new offshore and port infrastructure will need to be built, maintained and repaired. The seas, including the oceans, cover approximately 72% of the surface of the earth. This unique habitat is home to almost 90% of all the life known to us. Given the magnitude of these figures, the importance of the seas is obvious from the perspective of both maintaining a healthy ecosystem and generating sustainable resources for the future. In the near future, these resources may cover a considerable part of human and industrial needs alike. New businesses founded on maritime economy, in e.g. food, energy, and transportation, will not only generate new jobs; they will probably enrich the world economy in a way that will facilitate emergence of disruptive innovations. The major part of marine offshore operations is done by divers. These missions often result risky and dangerous for them. Also, since their number is limited, the dependency on their work represents a real threat to the offshore industry. The extended use of unmanned underwater vehicles (AUVs/ROVs) could solve this problem but, even today, the Daniel A. Real-Arce, Tania Morales, C. Barrera, J. Hernández and O. Llinás are with the Oceanic Platform of the Canary Islands –PLOCAN Carretera de Taliarte s/n. 35214. Telde. Las Palmas. Spain (email: info@plocan.eu). commercial Autonomous Underwater Vehicles/Remotely Operated Vehicles (AUVs/ROVs) solutions are primarily ad-hoc, configured to address a specific need without any possibility to guarantee reuse. Consequently, cost-efficiency, from a broader perspective, is not possible to achieve. As in other complex technologies, robustness and reliability depend heavily on the budget.

II. THE SWARMS PROJECT

The ongoing H2020-ECSEL SWARMs project is aimed to expand the use of AUVs/ROVs and facilitate the creation, planning and execution of maritime and offshore operations. The main goal of the project is to reduce the operational cost and increase the safety of tasks assigned to divers in these operations. This will be achieved enabling the AUVs/ROVs to work in a cooperative mesh. This cooperation mode will enrich marine applications and will ensure re-usability as no specialized vehicles will be needed. Instead heterogeneous standard vehicles can combine their capabilities to achieve a global goal. This way the autonomy and usability of these marine robots will be also improved. In order to achieve the goals of the project, the approach is to design and develop an integrated platform (a set of Software/Hardware components), incorporated into the current generation of underwater vehicles in order to improve autonomy, cooperation, robustness, cost-effectiveness, and reliability of the offshore operations. The SWARMs project aims to be able to coordinate a swarm of underwater vehicles (AUVs, ROVs) together with other support robots (USVs) and vessels to facilitate the creation, planning and execution of maritime and offshore operations (Fig. 1). Therefore, the expected elements involved in the SWARMS project are autonomous underwater vehicles (AUVs), remotely operated vehicle (ROVs), vessels, USVs and/or buoy and an ashore control station. One of the biggest challenges of the project is the design of a trustful software middleware that provides reliable control of the different vehicles. The communications between the vehicles are also a critical point that has to be well defined. In a swarm mesh of autonomous marine vehicles that have to coordinate themselves, the communication system is a key factor. During the first demonstration stage in PLOCAN the communication functionalities of all segments are going to be verified. An overlay network will be designed and developed for the exchange of information among cooperating networked Smart and Networking UnderWAter Robots in Cooperation Meshes - The SWARMs ECSEL-H2020 Project Daniel A. Real-Arce, Tania Morales, C. Barrera, J. Hernández and O. Llinás SWARMs (AUVs/ROVs) and other network nodes such as base station. SWARMS is an industry-led project. Big technology companies collaborate with subsea specialized SMEs, robotics and communication companies, universities and research institutions. SWARMs' achievements will be demonstrated in three field tests carried out in different scenarios (Gran Canaria, Black Sea and Norway) along the lifetime of the project. The first of these demonstrations is going to be performed in PLOCAN Marine and Maritime Test Site in Gran Canaria. This will be a critical stage in order to test the developments made during this early stage of the project.
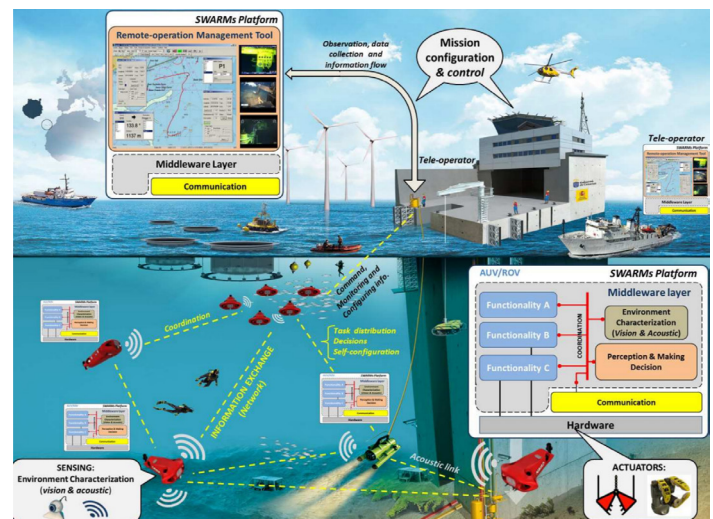
Fig. 1: The SWARMS concept