ID35- UNDERWATER ROBOTICS READY FOR OIL SPILL, AN EU PROJECT

J. Gilabert[104], F. Lopez-Castejon[102], A. Guerrero[125], J. C. Molina[107], A. Vasilijevic[199], P. Calado[19], D. Hayes[169], N. Stilinovic[202], D. Nad[200], F. Mandic[201], P. Dias[20], J. Gomes[17], N. Miskovic[197], Z. Vukic[198], J. Sousa[18], G. Georgiou[170]

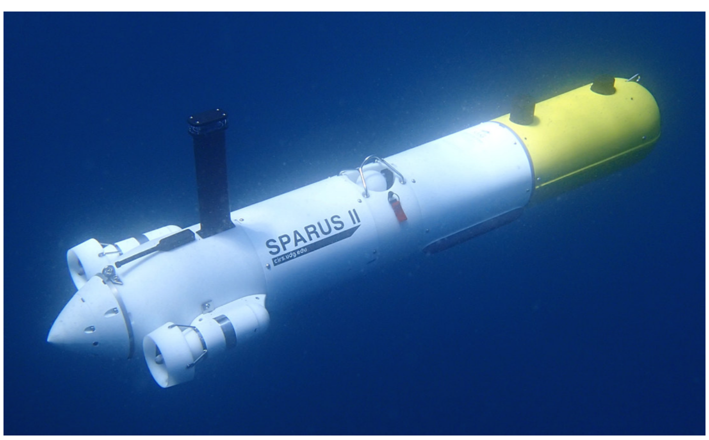
Underwater Robotics ready for Oil Spill (URready4OS) is an european proyect aimed to set up an heterogeneous robotic system of unmanned vehicles: autonomous underwater vehicle (AUV), unmanned surface vehicle (USV) and unmanned aerial vehicle (UAV) extended with the oil spill numerical modeling, visualisation and decision support capabilities. The first experiment within the project, using oil spill simulated with Rhodamine WT, was held in Croatia during the early autumn 2014.

The objectives of this experiment were to test: effectiveness of the system for underwater detection of hydrocarbons, multi-vehicle collaborative navigation and communication and visualisation of the system agents and mission results.

In June 2015 another expriment was carried out in waters off Cartagena on board of the Clara campoamor Vessel (Spanish Maritime Safety Agency, SASEMAR). Several missions were designed and performed. Here we will show the main results achieved, the advantages and benefits from this fleet of vehicles and the steps forward to be fully operative in emergencies at sea.

ID36- TESTING SPARUS II AUV, AN OPEN PLATFORM FOR INDUSTRIAL, SCIENTIFIC AND ACADEMIC APPLICATIONS

Marc Carreras[148], Carles Candela[143], David Ribas[144], Narcís Palomeras[149], Lluís Magí[147], Angelos Mallios [142], Eduard Vidal[145], Èric Vidal[146] and Pere Ridao[150]



Abstract – This paper describes the experience of preparing and testing the SPARUS II AUV in different applications. The AUV was designed as a lightweight vehicle combining the classical torpedo-shape features with the hovering capability. The robot has a payload area to allow the integration of different equipment depending on the devices and systems. Its flexibility, easy operation and openness makes the SPARUS II AUV a multipurpose platform that can adapt to industrial, scientific and academic applications. Five units were developed in 2014, and different teams used and adapted the platform for different applications. The paper describes some of the experiences in preparing and testing this open platform to different applications.

Keywords – Autonomous Underwater Vehicle, vehicle design, hovering Unmanned Underwater Vehicle.

I. INTRODUCTION

Commercial AUVs are mainly conceived to surveying applications in which large areas must be covered and the vehicle follows safe paths at safe altitudes. However, new advances in sonar technology, image processing, mapping and robotics will allow more complex missions, in which the AUV will be able to navigate at a closer distance from the seabed, it will react to the 3D shape of the environment, and it will even perform some autonomous intervention tasks. In this context, the Underwater Robotics Research Centre of the University of Girona has been developing several AUV prototypes during more than 15 years to achieve these new capabilities. The SPARUS Autonomous Underwater Vehicle (AUV) was conceived in the Underwater Robotics Research Centre (CIRS) of the University of Girona (Spain). The first version was designed in 2010 to participate in the European Student AUV competition, organized by CMRE in La Spezia (Italy). The robot won the competition and, since then, it has collaborated in several research projects. In 2013, a new version of the robot, SPARUS II AUV (Figure 1), was designed and 5 units were developed in 2014 for several research institutions. Three of them were specially developed for the euRathlon competition, in which teams learned the operation of the robot and adapted its use to the competition. This paper describes the experiences after more than one year testing the platforms and adapting them to different applications.

II. SPARUS II DESIGN

SPARUS II AUV (see Figure 2) is a lightweight hovering vehicle with mission-specific payload area and efficient hydrodynamics for long autonomy in shallow water (200 meters). It combines torpedo-shape performance with hovering capability. It is easy to deploy and to operate. The payload area can be customized by the end-user and it uses an open software architecture, based on ROS, for mission programming. Its flexibility, easy operation and openness makes the SPARUS II AUV a multipurpose platform that can adapt to industrial, scientific and academic applications. The key points of the vehicle are: a) torpedo-shape movement with efficient hydrodynamics and long autonomy; b) hovering capability for high maneuverability; c) lightweight vehicle, similar weight and size than underwater gliders; d) easy operation, which can be operated by 2 persons from any small boat; e) mission specific payload: open hardware for equipment integration; f) software architecture based on ROS: open software available for download.

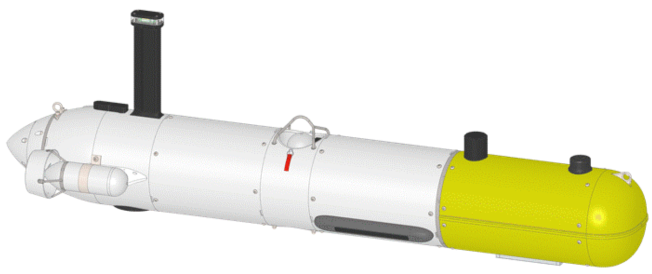
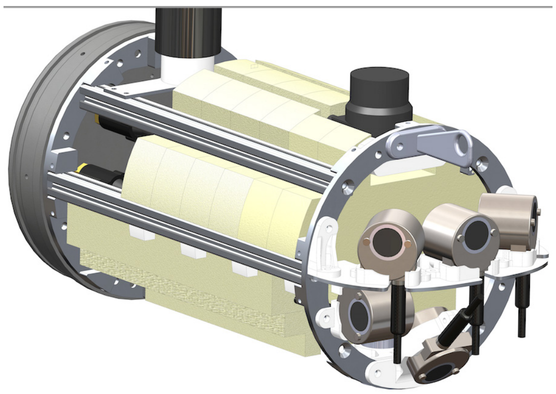


Figure 2. CAD design of Sparus II AUV.

The AUV has three thrusters (two horizontal and one vertical) and can be actuated in surge, heave and yaw degrees of freedom (DOF). The vehicle is equipped with a navigation sensor suite including a pressure sensor, a doppler velocity log (DVL), an inertial measurement unit (IMU) and a GPS to receive fixes while at surface. Application specific equipment is installed in the payload area, having also space inside the main hull for internal electronics. Regulated 12V (max power 40W) and 24V (max power 100W) and Ethernet and RS232 serial communication is available for new equipment. Connections are done using underwater connectors (Subconn compatible), which can be used for any required need. The payload can have up to eight connectors. The payload area can integrate any equipment having a maximum volume of 8 liters and a maximum weight of 7 kg. The non-required volume or weight is filled by foam and lead to maintain a constant total volume and weight, which is approximately 52 liters and 52 kg in air. Figure 3 shows an example of a real sonar and vision payload with the following equipment: Imagenex Delta T multibeam profiler sonar, down-looking HD FireWire Video Camera, 5 Imagenex echo-sounders for obstacle avoidance, Imagenex Side Scan Sonar, Tritech Micron Imaging Sonar and Evologics acoustic modem with USBL. Figure 4 shows the data obtained with the side scan sonar in a real trajectory.



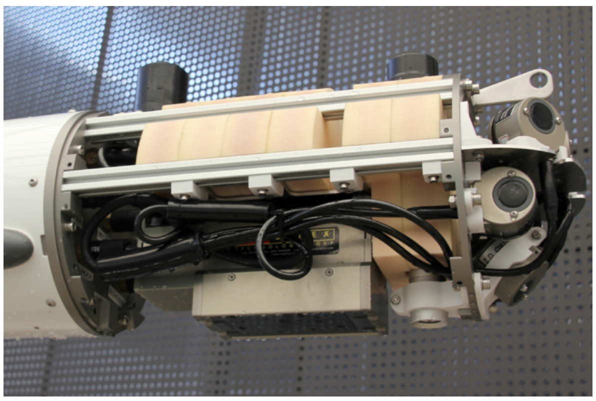


Figure 3. Design and picture of a complete sonar and video payload.

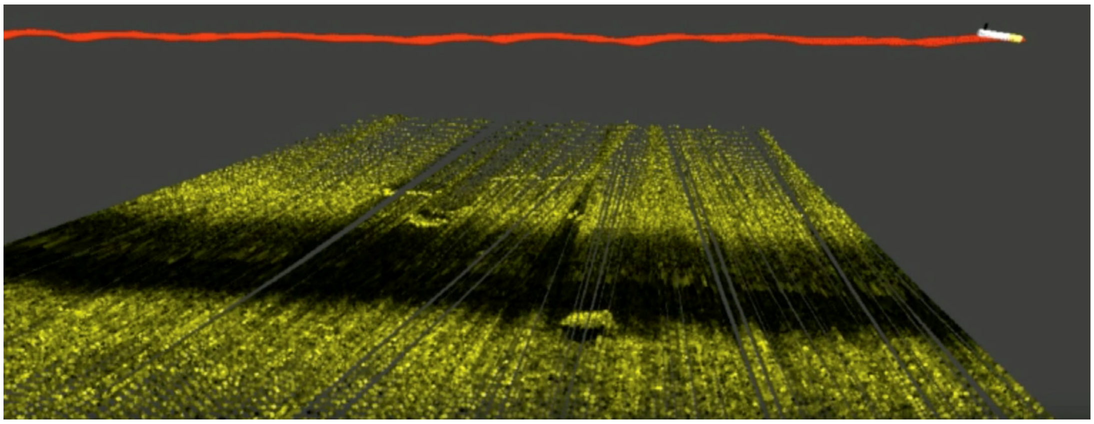


Figure 4. Example of side scan sonar data plotted according the navigation of the Sparus II AUV.

III. CONCLUSIONS

This paper has presented the SPARUS II AUV as an open platform for integrating equipment and software for multipurpose applications. Five platforms were developed in 2014 and tested by 5 different teams with different payloads. The University of Girona was in charge of developing and teaching to the teams the operation of the vehicle and the integration of new hardware and software. The experience was positive and the teams were able to integrate their own equipment and operate the AUV successfully. More details will be included in the final paper.

IV. ACKNOWLEDGEMENTS

This research was sponsored by national (ARCHROV project - DPI2014-57746-C3-3-R) and European projects (MORPH project - FP7-ICT-2011-7-288704 and ROBOCADEMY - FP7-PEOPLE-2013-ITN-608096).