

M5 SIRENA: AUTONOMOUS INTEGRATED SYSTEM FOR NAVAL RECOGNITION AND EXPLORATION

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Abstract

This article outlines the initiative of some students from the Polytechnic University of Cartagena to create an AUV (Autonomous Underwater Vehicle) which will be powered by solar energy. The idea stems from the awareness of the tactical and economic difficulties involved in the deployment and withdrawal of large AUVs, as well as the current limited operability of such devices. SIRENA attempts to solve these problems, providing military and/or civilian research units with a system capable of performing for prolonged periods without direct human intervention and under adverse conditions. SIRENA is a project carried out exclusively by students. After a period of one year and three months it has received support from Navantia.

INTRODUCTION

Carrying out maritime expeditions, patrolling, or just about any other activity requiring naval operations these days involves high costs as well as a considerable amount of risk. Costs become more relevant if the operation is solely limited to the displacement of a boat for AUV deployment, since the only function of that boat would be transportation. This is becoming more frequent each day because an AUV or ROV can perform certain tasks that a man cannot, or which would be very dangerous.

SIRENA manages to solve these problems thanks to the autonomy it achieves in regards to operation and energy needs, reaching a more convenient solution, with lower costs and no danger associated.

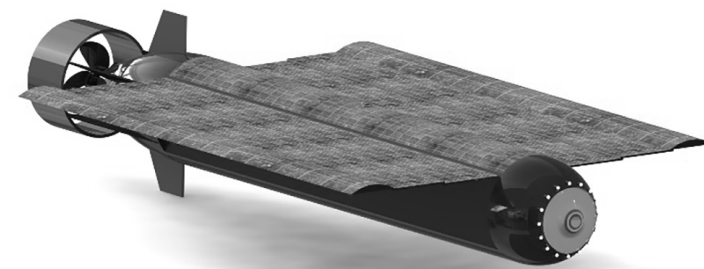


Fig. 1. SIRENA

STRUCTURE

SIRENA has been divided into two hulls: the resistant and the outer hull. The resistant hull is the one that houses the electronic systems, providing them with protection from moisture and other unfavorable parameters. The resistant hull has been designed to withstand a pressure of 500 meters water column without limitations regarding the number of immersions.

On the other hand, the outer hull will support the solar panels and the external systems. The outer hull has been designed so as to minimize drag and ensure the adequate incoming flow of water towards the propeller.

PROPULSION AND MANEUVERABILITY

The propulsion system consists of a DC electric motor and a fixed pitch propeller. This system has been designed so that a maximum speed of 10 Kts submerged and 3 Kts. on surface are achieved. This specific speed range was determined with operability as the main goal. With a speed of 10 Kts, SIRENA would be able to sail up to 12 hours submerged without recharging, covering up to 220 Km, i.e. 120 miles, during this period of time.

In terms of the maneuverability system, it has rudders and elevators located fore of the propeller.

SOLAR PANEL SYSTEM

The solar panels are attached to the outer hull. They are operated through a hydraulic system. While submerged, panels are brought together onto the sides of the cylindrical body so that when they are completely folded, the shape of SIRENA is completely cylindrical with elliptical domes. In contrast, when SIRENA is sailing afloat and the solar panels are deployed, they lean on the water, adopting a shape similar to that of a trimaran.

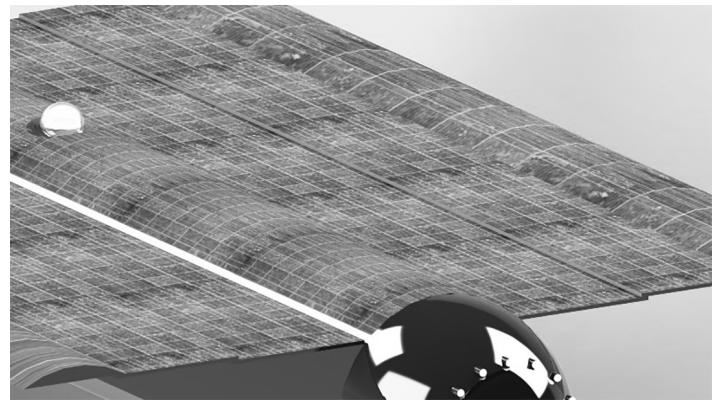


Fig. 2. Solar panels

PERISCOPE SYSTEM

The Periscope is another novelty added. It houses a rotary chamber and different communication antennae. This system allows for data transmission without emerging and is thus suitable for military missions in which it is necessary to remain undetected.

ELECTRONIC SYSTEMS

The Electronic system can be broken down in several subsystems.

1. Energy system. Consisting of solar panels, regulators and batteries.
2. Control system. It incorporates a main CPU and two secondary ones, plus a backup.
3. Self-monitoring and self-protection system. It includes all sensors that inform on indoor and outside weather conditions, as well as the key electrical signal variables.
4. Navigation system. Consisting of a GPS, D-GPS, INS and DVL.
5. Communications system. Wifi, RF, and Iridium communications have been incorporated.
6. Interaction system, consisting of passive sonar, active sonar and sidescan sonar.
7. Visual system. This system consists of the bow camera, the periscope camera and the 3D multibeam sonar.

MISSIONS

This first version of SIRENA has focused on the military sector. Further development may lead SIRENA to carry out tasks in the civil sector or within the field of oceanographic research.

1. Mine clearance missions
2. Surveillance missions
3. Escort missions
4. Search missions