

The *MARES* AUV, A Modular Autonomous Robot for Environment Sampling

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Vehicle Overview

Length	1.5m
Diameter	20 cm
Weight in air	32 kg
Depth rating	100 m
Propulsion	2 h + 2 v thrusters
Horizontal velocity	0—2 m/s, variable
Energy	600 Wh Li-ion batts
Endurance	~ 10 hrs
Range	~ 40 km
Payload	CTD, Turbidity, Fluorescence, sonar...



Scientific Missions

- **Payload Integration**
 - Machining of a new mechanical section
 - Interfacing with onboard electronics
 - Development of dedicated software driver
- **Mission Support Equipment**
 - Acoustic beacons for navigation and mission supervision
 - Mission control station based on a laptop
- **Mission Programming and Supervision**
 - Automatic mission planning
 - AUV diagnostics before launch
 - AUV tracking during mission
 - Graphical display of information
- **Typical Mission**
 - Deployment and test of acoustic navigation network
 - Mission configuration, vehicle diagnosis and launch
 - Data logging on vehicle computer
 - Vehicle recovery and scientific data upload



Innovation

- **Mechanical Structure**
 - Simple revolution 3D shape machined from POM
 - Single watertight cylinder
 - Interchangeable middle sections
 - Synthactic foam inserts to adjust buoyancy
- **Propulsion**
 - Highly maneuverable vehicle
 - All propulsion provided by thrusters, no control surfaces
- **Navigation and Control**
 - On board navigation sensors: Digital compass, pressure and tilt.
 - External acoustic beacons for triangulation
 - On board realtime fusion
 - Independent controllers for vertical and horizontal motion
- **Safety Mechanisms**
 - On board monitoring: temperature, voltage/current, leakage
 - External tracking during mission
 - Wireless communications at the surface



Demonstration at Sea

- **Foz do Arelho, November 2007**
 - Sewage outfall, 2km off the Portuguese coast, in ~40 m of water
 - MARES equipped with SeaBird Fastcat 49 CTD
 - Mission control station installed in a small support boat
 - Pre mission analysis of water column indicated no stratification
 - Data collected in rows in the vicinity of the diffuser, during ~1 hr
- **Mission Results**
 - AUV tracked in real time
 - Vehicle emerged at the predetermined position
 - CTD data showed the plume signature
- **Conclusions**
 - MARES AUV showed to be an effective tool to monitor coastal waters
 - The mechanical approach has proved to be adequate and robust
 - The vehicle design incorporated innovations that are proving to be valuable

