Unmanned Maritime Vehicles activities by «Campus Mondial de la Mer»: *Few examples*

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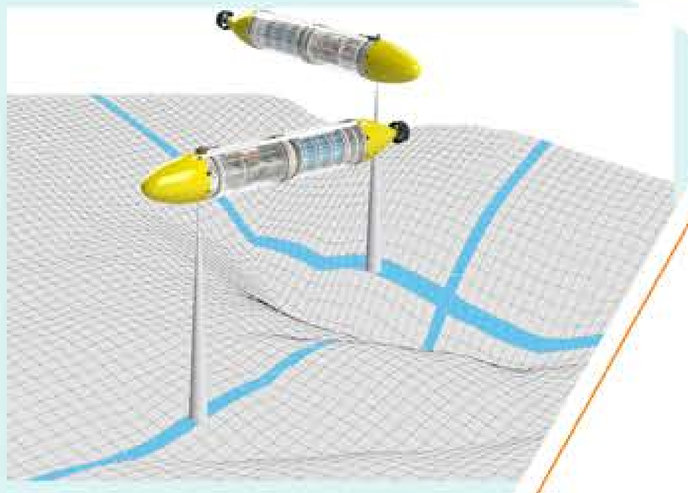

An autonomous underwater vehicle performing a loop. The blue line represents the bathymetry sensed along the path. © Simon Robou, Lab-STICC, ENSTA Bretagne

Autonomous systems | underwater robot | localization | environment perception

Localisation of underwater robots

The localisation of underwater robots remains a challenging issue. Usual sensors such as Global Navigation Satellite System receivers cannot be used under the sea and all inertial systems suffer from strong integration drift. On top of that, the seabed is generally uniform and unstructured, making it difficult to apply usual Simultaneous Localisation and Mapping methods to perform a localisation.

Hence, innovative methods have to be studied. This study considers the localisation of one or several robots evolving in unstructured underwater environments. The common thread of this work is the use of inter-temporal measurements (such as bathymetry from a single-beam echosounder, see figure) raising new opportunities of localisation, under-exploited until now.

This PhD study is performed in the framework of the new Lab-STICC team: PRASYS (Perception, Robotics, Autonomous SYStems), which aims to develop the algorithms for the perception of mobile autonomous systems in the real world environment.

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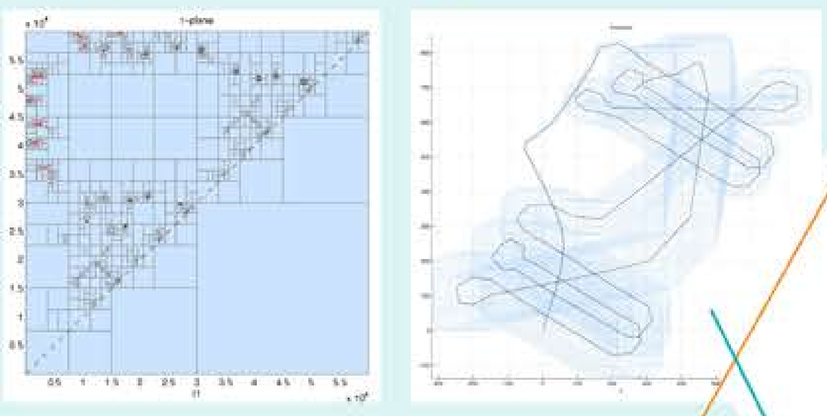

Results of LOOP algorithm on Redermor data. Left: t-plane, right: trajectory of the robot. ©Clément Aubry

underwater robot | localization | loop detection

Proprioceptive measurements to improve underwater localization

When moving in a harsh and unknown environment, robots have to deal with the Simultaneous Localisation And Mapping (SLAM) problem. In this context, robots can rely on two kinds of information : exteroceptive data which are relative to the environment and proprioceptive data that are information about the robot evolution itself without being referenced in any kind of map. A well known drawback of underwater navigation is that position accuracy increase with the duration of the mission. An information that could help the SLAM problem is to know when the robot came trough some place it already visits. Those researches focus on a method that automatically find loops in a robot trajectory where only exteroceptive data (speed from DVL) and state equations of the robot are known. This method is totally independent from the SLAM problems that it is generally coupled with. The results of the true data algorithm, derived from an experiment carried out underwater, are very satisfactory and made it possible to prove the existence and uniqueness of more than half of the loops observed in the trajectory of the robot. Those results are guaranteed by the use of interval analysis.

Aubry, C., Desmare, R., & Jaulin, L. (2013). Loop detection of mobile robots using interval analysis. Automatica, 49(2), 463-470.

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DRELIO drone
© Jérôme Ammann

coastal oceanography | photogrammetry | hyperspectral imagery

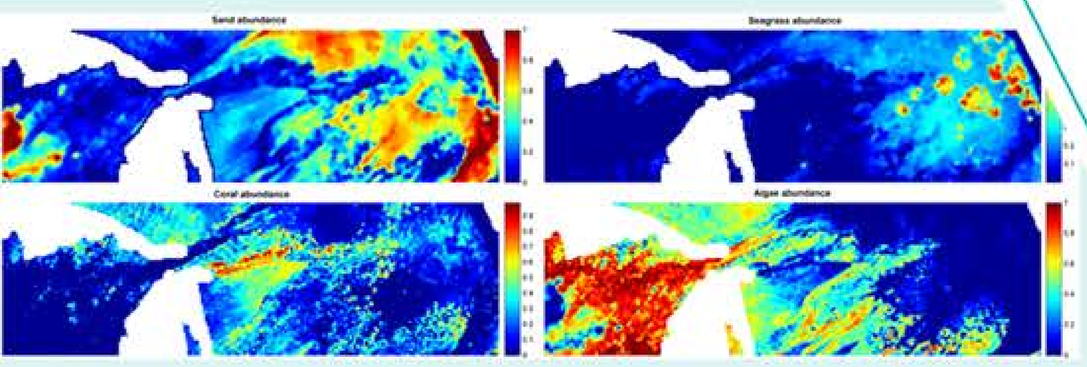
DRELIO drone applications for coastal monitoring

DRELIO drone activity is developed at the Geosciences Ocean Lab at IUEM in collaboration with the Claude Bernard University (Lyon), for the survey of coastal areas. Drones are particularly suitable for repeated acquisitions and study of specific phenomena (e.g. tides). They can be operated on sites, where access is difficult and with respect for public space. In addition, they resist to coastal conditions (salt air, wind, spray...).

Applications:

UAV DRELIO_10 for photogrammetry: diachronic morphodynamic monitoring in various coastal contexts (beach, cliff and mudflat);

UAV Hyper-DRELIO for hyperspectral imagery: bathymetry inversion, identification and classification of bottom-type, optical parameters of water column, phytoplankton monitoring (algal blooms), water quality and detection of marine pollution.



Bottom classification from hyperspectral data (Reunion island)
© IFREMER-Dyneco and Geosciences Ocean Lab (UMR 6538)

Geosciences Ocean Lab (UMR 6538) | IUEM | UBO | CNRS

Partners: UCBL Lyon, EPFL

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High resolution picture of wrack obtained by synthetic aperture sonar ©THALES

underwater system | sonar arrays

ASEMAR

Initiated in 2005 by Pole Mer Bretagne Atlantique and ended in 2011, the Asemar program led by THALES has paved the way to new unmanned system technologies including high resolution long range synthetic aperture sonar arrays. Based on this first step, the industry partners pursed R&D programs and won the OCCAR Maritime Mine Counter Measure (MCM) competition aimed at developing the future FR-UK unmanned MCM system.

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autonomous system

WAVES

WAVES (Water Autonomous Vehicles and Embedded Systems) is a new common laboratory between THALES and nine research partners including two major defense R&D academies : ENSTA Bretagne and Ecole Navale. The laboratory aims at developing new technologies regarding Maritime Autonomous Systems.

THALES | Ecole Navale / IRENAV | ENSTA Bretagne | Lab-STICC | ISEN Ouest

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AUV at the surface ©THALES

UAV at sea: a need of rules? Feedbacks on the Sea Tech Week workshop (Oct. 2016)

legal framework | regulation | Brest Business School | Pôle Mer Bretagne Atlantique

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Deploy drones at sea? Why not, the technology exists and is used more and more often. However, be careful not to overlook the risks entailed (damage to people and the environment, conflicts of uses in the areas, threats to the security of the State,...)! The objective of the workshop was to identify the legal issues raised by the use of drones at sea and consider the associated legal framework.

Due to the evolution of technology, drones are more diversified regarding both their form and their functions. With the drones, the range of human activities extends and new forms of exploitation of maritime areas appear. However, if innovation is at the heart of the strategy of companies, maritime actors need legal stability that meets a risk prevention approach.

In terms of sea drones, there is no real legal vacuum. They can benefit, in some measure, of regulations established for vehicles traditionally used at sea (ships, aircrafts and submarines), including, for example, authorisation mechanisms. Nevertheless regulations have sometimes been negotiated at a time during which drones were not the concern of the States. Regulation is thus not always sufficiently adapted to the specificities of the drones at sea (training required, liability in case of damages issued by always more autonomous drones or hybrids,...).

Even if the time for legal reflexion is not always the time of technological innovation, the legal framework of the drones at sea should therefore be strengthened in order to adapt the law to a scalable technology.