SESSIONS

Mini AUV, a platform for future use on marine research for the Spanish Research Council?

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1. Introduction

Since the launch of the first AUV (Autonomous Underwater Vehicle) during mid 60's until our days, Unmanned Underwater Vehicles (UUV) technology has experienced an spectacular development. Keys factors on such development has been the great interest taken by the military and the big exploration companies on vehicles capable to perform inspection duties on deep waters without physical link with surface support vessels. In 2001 USN planned to expend 34 M$ between FY 2002 and FY2005 on R&D on this specific area [1]. Also, in year 2000 Shell estimated that the use of AUV on exploration operation could have a cost operations savings of about 30 M$,

Despite this interest and the high number of experimental vehicles developed by universities and governmental agencies, few of them reached a "commercial" status. Price and size has been two of the main factors that have restricted the use of this first generation of AUV to a few operators worldwide.

During the last decade a new generation of AUV have been developed; they are lighter, modular, they can carry a great variety of instruments and are cheaper (to an order of magnitude) than the previous generation and thus, more suitable for specific research tasks.

We will present a brief summary of the main AUV types, payloads and the potential of use on the frame of the Spanish Marine Science Program.

2 State of the art

AUV´s (Autonomous Underwater Vehicle) are a small part of the broad UUV (Unmanned Underwater Vehicles) family that includes the more popular ROV's (Remote Operated Vehicle).

An AUV is a submerged platform, or vehicle, able to carry different instruments in order to perform different tasks, untethered from any surface support vessel, following a preplanned survey route, gather information, store it (for a post mission processing) and, in some cases, send it to surface on real time for data quality assessment. They are not instruments by themselves.

Types of AUV's

For our purposes we can consider the following classification, attending their capabilities, weight, size and payload:

Micro-AUV

Tiny vehicles that weights less that 5 kg. Developed to deploy one specific sensor at time. Collaboration algorithms are being developed to have these vehicles working on a cooperativ mode.

Mini-AUV

These vehicles are less than 2 m. long and weight less than 100 kg. They could be easily deployed from a rubber boat between two persons.

Image 1. Mini AUV REMUS

Instrument manufacturers has started to develop specific instrument suites for this class of vehicles, this means less power and higher frequencies, which makes this class of vehicles more suitable for local and high resolution studies.

This class of vehicles are becoming very popular on the market, mainly because:

- They require a reduced operation and maintenance cost compared with the sea going AUV class.
- Interest of the military sector on this vehicles that has favoured the R&D on this class of vehicles and is pushing the market toward them.

Sea-going AUV

These vehicles are longer than 2m. and can weight up to several tones. The payload can excess 100 kg and are rated from 600m (Maridian 600) down to 3.000 m (HUGIN 3000) even 6000 m. (REMUS 6000).
They are big vehicles, with complicated logistics and maintenance and control systems installed on separate containers; technical crew use to

be of more than 4 technicians. Autonomy can be greater than 48 h and need medium-size support ships.

Given the size and payload capabilities of these vehicles they can have installed high performance instrumentation on board. Typical configurations include MF (200-300 Khz) multibeams and sidescan sonar, seismic profilers (parametric or 3.5 Khz), gravitimeters, CTD, TV cameras, navigation sensors, etc.

HAUV (Hovering AUV)

Vehicles of relatively big size (3 – 4 m.) that have a unique propulsion configuration that permits them to hover on a given location as a ROV. This ability makes them an ideal tool for inspection and intervention tasks, that the conventional AUV´s can not achieve. There are few models on the market and currently they are on the latest operational trials.

They can carry a heavy payload (up to 200 kg) but have the same operational constraints as the big AUV.

SAUV (Surface AUV)

These vehicles, usually of big capacity and autonomy sail semi-submerged with a surfacing mast containing communications and beacons . They carry a limited payload, usually very specific and have some operational security problems related with their sailing mode.

Gliders

Although they have limited navigational and payload capacities, they can be considered also as UUV as they sail extremely long ranges / periods of time gathering oceanographic data. They only need external support for deployment and recovery. Payload and operational requirements limits seriously the field of application.

3. AUV's on the CSIC

In 2004 16% of the National and EU funded projects developed by CSIC Institutes were done at Institutes of the Natural Resources Area, and 30% (Aprox.) of them where developed by Marine Science Institutes[3].

Marine environment is complex, and its study extremely expensive; latests trends on marine research drives to multidisciplinary studies that, more than often, involve several institutions and research specialties.

On the latest years big multipurpose research vessels has been built in Spain, but they are expensive and have a complicated logistics; AUV´s can be a cheap option to these platforms, specifically on shallow water and high resolution surveys.

As high resolution marine research platform, AUV should be small, mobile, with a reasonable scientific payload and simple logistics. All these factors will favour its use by different research institutions on different environments (open seas, coastal areas, lakes, dams, etc), acting as effort multiplier on areas where the use bigger platforms is not possible or restricted.

We do consider that small AUV´s could be on a near future an ideal platform for coastal and high resolution marine research, they will open new research opportunities to become a milestone on the Spanish marine research and marine technological R&D.. On the long run, they could be also the base for the local development and/or operation of bigger and more complex vehicles.

6. References

[1]. Robert L. Vernelli. Low cost UUV's for milityary applications: Is the technology ready?. Pacon 2001 Conference proceedings.
[2]. John Westwood. What the future holds for ROV and AUV's. Underwater Magazine. June 2000
[3] 2004 CSIC Activity Report.