

Operational AUVs for oceanography, and new concepts of autonomous hybrid systems for the offshore applications

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In the context of deep water technologies, numerous projects have been conducted recently by Ifremer with European partners for offshore applications. This effort started with the development of the supervised AUV *Sirene* in 1995 that was designed for accurate launch and deployment of a benthic station.. The technology developed in *Sirene* was then in 1998 applied to the *Swimmer* research and development project in collaboration with Cybernetix company for the offshore industry. This hybrid AUV, which was based on a classical ROV, carries a classical ROV and was designed to dock on a pre-installed bottom-station linked by a permanent umbilical to the surface.

The successful development of *Swimmer* was followed by an ambitious prototype *Alive* AUV that was built in collaboration with Cybernetix, Hitec-Horten and Herriot Watt University in 2002. The *Alive* intervention AUV, is the first AUV fitted with manipulators and design for autonomous docking and telemanipulation on underwater equipment. This project had demonstrated innovative robust optical and acoustical dynamic positioning and sensor based docking, proven at sea in real conditions.

Beyond these technological advances, the need for a more classical survey AUV has arisen within Ifremer scientific programs, mainly dedicated to environmental survey, in the field of physics, chemical analysis, living resources survey or risk assessments for geophysics (slope instabilities and seismic surveys). This has led to the set-up and launch of an operational program for a fleet of coastal survey AUVs, mirror to offshore references survey AUVs as Hugin, but with an objective to reduce the cost of operation below 6k€ (without ship) per day of operation on a basis of 50 to 100 days per year on 10 years.

With operational AUVs we are still on a learning curve. Developments are permanently underway to reach higher levels of autonomy and behavioural robustness at sea. For example new high level programming mission preparation systems, named Mimosa® and PSE® are being designed for mission building and high level, fault tolerant control. To reach our needs new payload developments are also underway, taking into account the needed instrumental modularity on the system e.g. new Chirp Sediment Sounder, In situ Spectrometer. In addition the scientific requests to use *Aster^X* are very high (220 Days at sea requested for 2006), and with the experiences gained during the last 18 months a second coastal AUV (Fig 6) has been launched, with several optimisations based on the validated *Aster^X* Concept.

The presentation will focus on systems, innovative functions and system of systems integration, and will get operational feedback and new research trends.