

Invited Conferences

Marine Technology in Spain: a Challenge to Achieve High Quality Research in Marine Sciences

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1. Introduction

The CSIC decided in December 2000 to encourage marine science & technology taking advantage of the existence service UGBO, with the aim to reorganize and lead the marine technology within the CSIC with a vision of assuring a more competitive service and to establish new technological developments in marine technology. Although limited manpower resources were provided at short term, but to overcome this complicatedness, the CSIC promised an attempt during the next coming years to open several structural positions, in competition, to consolidate the UTM. The UTM subscribes in 2002 a cooperative agreement with the SARTI-UPC Group to start up this challenge. The added value of the UTM-SARTI is of high significance in the frame of the National Marine Science & Technology due to the strong involvement to support the National Oceanographic Research Vessels and the Antarctic stations, affecting a scientific community of thousands of researchers. Moreover, the UTM represents now in our country the natural link between research and technology in marine sciences.

The area of research of the UTM-SARTI Group is of the maximum interest for a country, with more than 7500 km of coast, and two large archipelagos. The marine activities as coastal zones management, industry, natural resources, tourism and leisure, fisheries, defense, etc., generate at the national economy level up to 10% of the Gross National Product. There is a strong pressure on the ecosystems and habitats of the coastal zones, by all means, and Spanish society is progressively demanding a sustainable use of the coastal zone areas, as denote by growing attention of the National, Autonomic, and local administrations in a sustainable management of them. To attempt measures to this demand it is necessary a solid knowledge on the process, and implementation of the proper marine technology, and it is where UTM-SARTI Group can play a driving force providing support to the different administrations, maritime

professions and other scientific, technical and economic bodies, establishing links between societal demands and science and technology as permanent basis and also for assessment in case of accidental catastrophes, such as we did for the sinking of the oil-tanker .Prestige in 2003.

2. Technical developments

In this first International workshop, the different working groups belonging to the UTM-CSIC and SARTI-UPC Group together with Public University of Navarra, ICM-CSIC, IMEDEA-CSIC, as well as other invited groups will present the state of funded and/or future technological research projects in marine technology. The variety of research projects are broad and range from specific measurements instruments to study ocean turbulence or marine seismicity, to design of AUV's or software development dedicated to seafloor mapping, implementations of a network system to control and management of marine sensors, as far as the technical specifications requirements for the construction of a new oceanographic vessel, RV Sarmiento de Gamboa.

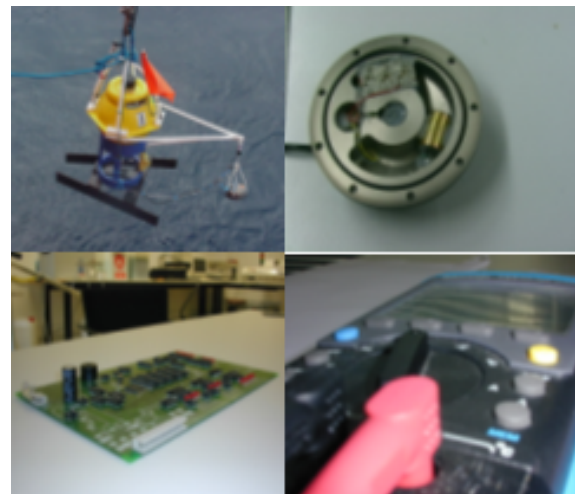


Figure 1. Examples of technological developments: sensors and electronic components

3. The future

Today the main challenge faced by marine science and technology is to predict the future for the purposes of sustainable marine management. The need is now for global 3D and 4D datasets of the oceans to understand the dynamics of the processes, hence a significant strategic change in the way we conduct our science. The development of e-marine science, which requires the pooling of large resources, is a prerequisite to progress beyond the current stage of marine research and has a high European added value. Sea technology is thus very fast developing and innovative subject, with potential users in science, industry, and coastal management. Especially the development of Autonomous Underwater Vehicles (AUV) and Remotely Operated Vehicles (ROV) provided very powerful mobile underwater vehicles suitable for carrying a multitude of payloads. This includes multibeam techniques, subbottom profilers, sidescan sonars, chemical sensors, sediment/rock and biological samplers, high-definition video imagery, and even underwater element analyzers. The UTM-SARTI Group will focus on more efficient underwater vehicles

such as AUV and ROV and advanced payloads sensor systems to settle the operational requirements to “survey” the ocean, which is more constraining in terms of access to the infrastructure than the last decades “discovering” phenomena. These systems are very expensive and require well trained operators, mother-ships for deployment and recovery, support from science and engineering, and strong bounds within multi-disciplinary teams and cruises, and it is strongly recommended to follow the interoperability procedures suggested by the European Science Foundation [1,2], as a powerful mechanism to keep Europe as a worldwide leading in marine research.

4. References

[1] ESF-Marine Board, “Navigating the Future: Towards a Marine European Research Area”, Position Paper 3, 2001, 14 pp.

[2] ESF-Marine Board, “Integrating Marine Science in Europe”, Position Paper 5, 2002, 150 pp.

Mission and Vehicle Control of Marine and Aerial Vehicles

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The last decade has witnessed tremendous progress in the development of marine and aerial technologies that can provide scientists with advanced equipment and methods for autonomous exploration and exploitation different earth environments. Recent advances in marine and aerial robotics, sensors, computers, communications, and information systems are being applied to develop sophisticated technologies that will lead to safer, faster, and far more efficient ways of exploring the environment frontier, especially in hazardous conditions. As part of this trend, there has been a surge of interest worldwide in the development of autonomous marine robots capable of roaming the environment freely, collecting data at the surface of the ocean and underwater at an unprecedented scale. Representative examples include autonomous surface craft (ASC) and autonomous underwater vehicles (AUVs). The mission scenarios envisioned call for the control of single or multiple ASCs and AUVs acting in cooperation to execute challenging tasks without close supervision of human operators. Regarding aerial robotics Unmanned Air Vehicles (UAVs) present nowadays high degree of robustness and reliability and are able of operate in challenging and uncertain mission scenarios.

Unlike fixed-wing aircraft, helicopters were designed to execute vertical flight maneuvers, including hovering, and vertical take-off and landing (VTOL). Moreover, their ability to perform agile maneuvers both at high and low speeds does not undermine the good flying qualities displayed in fast forward flight. The trade-off for such maneuverability is an inherent complexity that translates into a highly nonlinear and unstable dynamical system with wide parameter variations over the vehicle's flight envelope. In this context, the development of mission and vehicle control systems constitutes both a challenge and a fundamental requirement for the accomplishment of high performance autonomous flight. Thus the need to push forward the development of methods for reliable vehicle and mission control of single and multiple autonomous robots.

The present talk addresses the topics of marine and aerial vehicle control and mission control from both a theoretical and a practical point of view. The presentation is rooted in the practical developments and experiments carried out with the Delfim ASC the Infante AUV, and the Autonomous Helicopter developed at ISR/IST.