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.