

Partner 2 : IST, Instituto Superior Técnico

The Instituto Superior Técnico (IST) is the leading school of engineering in Portugal. The research and development activities to be done in the scope of the present project will be coordinated by IST staff members and carried out at the Institute for Systems and Robotics of IST (ISR/IST). ISR/IST promotes advanced multidisciplinary R&D in the areas of autonomous systems (land, marine, and space vehicles), automation and control, dynamical systems, signal and image processing, communications, computer vision, biomedical engineering, artificial intelligence, manufacturing systems, and aeronautics. ISR/IST has a staff of 30 senior researchers and hired engineers, 50 post-graduate students, and 20 undergraduate students involved in more than 30 R&D national and international projects.

The key objective of the research and development work carried out at ISR/IST in the area of ocean robotics is twofold: i) to contribute to furthering the knowledge in the general area of dynamical system theory, and ii) to apply newly developed analysis and design tools in the fields of navigation, guidance, and control to the construction and operation of robotic ocean vehicles. The development work has led to the construction of the robotic ocean vehicles DELFIM (an autonomous surface Catamaran), INFANTE (an autonomous underwater robot), and CARAVELA (an autonomous oceanographic vessel). Currently, ISR/IST participates in the development of the DREAM ROV (remotely operated vehicle), the miniaturized MAYA AUV (autonomous underwater vehicle), and IRIS (an automatic surveying tool). These vehicles and tools play the dual role of i) advanced test beds, to field test new system theoretical concepts and hardware / software architectures for autonomous vehicle control, and ii) platforms for actual operations at sea, effectively paving the way for a fruitful symbiosis between

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Instituto Superior Técnico

- *Partner number* : 2
- *Type* : Research laboratory
- *Country* : Lisbon, Portugal

marine science and technology. This follows the successful development of MARIUS, the first civilian European autonomous underwater vehicle for coastal oceanography in the scope of a project coordinated by ISR/IST, under the auspices of the Commission of the European Communities (MAST II Program, 1996). The ISR/IST has also played an active role in the design, implementation, and at sea testing of the navigation, guidance, control, and mission control systems of SIRENE, an underwater shuttle for the automatic deployment of benthic laboratories developed in the scope of a European project coordinated by IFREMER, France (MAST II Program, 1997). More recently, ISR/IST was the coordinator of the MAST-III project ASIMOV that brought together specialists from the marine science and technology fields for the development of advanced tools and methodologies for ocean exploration (2000)

Currently, ISR/IST is involved in a number of projects and concerted actions with national and foreign institutions with the objective of advancing engineering methodologies and equipments to the point where they can be used as versatile tools to expand our understanding of the oceans.

Representative institutions include the Naval Postgraduate School of Monterey, CA (USA), the Istituto Automazione Navale, Genova (Italy), the National Institute of Oceanography (NIO), Goa (India), DIST/University of Genova (Italy), and the IMAR/DOP/UAzores-Department of Oceanography and Fisheries of the University of the Azores (Portugal). Especially relevant is the cooperation with the NIO of India, which has led to a joint project sponsored by the Portuguese and Indian governments for the development of a miniaturized AUV (MAYA) for ocean exploration and archaeological studies.

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References

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Key Personnel

Antonio Pascoal	<p style="text-align: center;"><u>Contact</u></p> <p><u>Antonio Pascoal</u></p> <p>PhD in Control Science from the Univ. Minnesota, Minneapolis, MN, USA in 1987. From 1987-88 he was a Research Scientist with Integrated Systems Incorporated, Santa Clara, California where he coordinated the development of advanced robotic systems for the US Navy and Army. He has held visiting positions with the Dept. Electrical Eng., Univ. Michigan, USA, the Dept. Aeronautics and Astronautics, Naval Postgraduate School (NPS), Monterey, California, USA, and the National Institute of Oceanography, Goa, India. He was the coordinator of two EC funded projects (UBC and SOUV) that led to the development of the first civilian autonomous underwater vehicle (AUV) named MARIUS. He has been active in the design, development, and operation of autonomous underwater and surface vehicles - and related instrumentation - for scientific applications, in the scope of several projects funded by the Portuguese Government, the NSF/NPS (USA),</p>
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	<p>and the EC (projects DESIBEL, EXOCET, and ASIMOV).</p> <p>He is an Associate Professor of IST and Coordinator of the Dynamical Systems and Ocean Robotics Lab of ISR/IST. His areas of expertise include: Dynamical Systems Theory, Robotics, Navigation, Guidance, and Control of Autonomous Vehicles, and Coordinated Motion Control of Marine Robots.</p>
<p>Carlos Silvestre</p>	<p style="text-align: right;"><u>Contact</u></p> <p><u>Carlos Silvestre</u></p> <p>Received the Licenciatura degree in Electrical Engineering from the Instituto Superior Técnico (IST) of Lisbon, Portugal, in 1987 and the M.Sc. degree in Electrical Engineering and the Ph.D. degree in Control Science from the same school in 1991 and 2000, respectively.</p> <p>Since 2000, he has been with the Department of Electrical Engineering and Computers of the Instituto Superior Técnico, where he is currently an Assistant Professor of Control and Embedded Architectures for Real Time Control Applications.</p> <p>Over the past years, he has conducted research at the Institute for Systems and Robotics on the subjects of vehicle and mission control of air and underwater robots. His research interests include linear and nonlinear control theory, coordinated control of multiple vehicles, gain scheduled control, integrated design of guidance and control systems, inertial navigation systems, mission control, and real time embedded architectures for complex autonomous systems with applications to unmanned air and underwater vehicles.</p>
<p>Paulo Oliveira</p>	<p>Paulo Oliveira</p> <p>PhD in Electrical Engineering from the Instituto Superior Técnico, Lisbon, Portugal in 2002. He is currently an Assistant Professor with the Department of Electrical Engineering and Computers of the Instituto Superior Técnico.</p> <p>Over the past years, he has conducted research at the Institute for Systems and Robotics on the subjects of</p>

	<p>inertial and landmark-based navigation systems for marine vehicles (including surface and underwater robots), mission control, acoustic communications and positioning, and sensor fusion for marine habitat mapping.</p> <p>His research interests include dynamical systems theory, advanced navigation systems for autonomous vehicles, underwater target positioning and tracking, and techniques for multi-sensor fusion.</p>
<p>Francisco Garcia</p>	<p>Francisco Garcia</p> <p>PhD in Electrical and Computer Engineering from Inst. Sup. Técnico (IST), Lisbon, in 2001. He is a researcher with the Signal Processing Group at Inst. Sist. e Robótica - IST and, since 2001, an Assistant Professor at the ECE Dep. at IST. His research activity is focused on Stochastic Signal Processing and Detection, Classification, and Estimation techniques with applications in the marine environment.</p>
<p>Luis Sebastião</p>	<p>Luis Sebastião</p> <p>Received the Licenciatura degree in Electrical Engineering from the Instituto Superior Técnico (IST) of Lisbon, Portugal, in 1994. He is currently pursuing his M.Sc. degree in Electrical Engineering. In 1994, he joined the research group of IST that worked on the development of the MARIUS autonomous underwater vehicle (AUV). He has been with IST/IST since then.</p> <p>Currently, he holds the position of senior research engineer with IST. In 1997 he was invited by the Dept. Aeronautics and Astronautics, Naval Postgraduate School (NPS), Monterey, California, USA to develop and field test a software package to operate the FROG unmanned aircraft using voice commands.</p> <p>From 1998 to 2004 he has participated in all IST annual missions at the Azores. In 2005 he visited the National Institute of Oceanography, Goa, INDIA and participated in the first gantry trials of the Portuguese/Indian MAYA AUV. Since 1994 has</p>

	<p>been in charge of the mechanical and electromechanical design and construction of systems for robotic vehicles, namely the DELFIM Autonomous Surface Craft, the INFANTE AUV, the IRIS sonar imaging structure (project MEDIRES), and the new MAYA AUV.</p> <p>His work ranges from computer simulations and system designing using 3D CAD tools to manufacture coordination at the workshop. He was also in charge of many field trials of sub-systems that were later integrated in the robotic vehicles of IST.</p> <p>Under the scope of the MEDIRES project he has been developing a software package for sonar processing and integration with GIS. His areas of expertise include Dynamical Systems Theory, Robotics, Navigation, Control, Mechanical Design, Operations at sea, Sonar imaging, and GIS.</p>
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