



IFAC Workshop on Navigation, Guidance
and Control of Underwater Vehicles

GIRONA 28-30 APRIL 2015



www.ngcuv.org

Hosted by:





WELCOME

to the 4th International IFAC Workshop on Navigation, Guidance and Control of Underwater Vehicles (NGCUV'2015).

NGCUV goal is to show the latest investigations in Unmanned Underwater Vehicles as well as to promote the exchange of information and perspectives on the field's current research. The Workshop brings together a diverse set of researchers who are jointly committed to foster the research and innovation in underwater robotics. The event series was initiated in 2003 and has been held in Newport (UK), Limerick (IR) and Porto (PT) since then. The present edition is co-organized by the *Universitat de Girona* and the *Universidade do Porto*, and is taking place on April 28th-30th 2015. Girona offers a great combination of cultural, gastronomical and sightseeing attractions that make it one of the most visited regions in Spain.

NGCUV 2015 will bring together 49 contributions, which will be presented orally in two parallel sessions categorized in 8 different topics: *"Underwater Manipulation"*; *"Mapping and SLAM"*; *"Navigation, Control and Planning"*; *"Tracking and Localization"*; *"Operations"*; *"Vehicle Modeling & Design"*; *"EU Projects"* and *"Multiple Vehicle Systems"*.

The workshop will feature 6 invited plenary sessions given by leading research scientists around the world: 1) *"The future of AUV technologies"* by James G. Bellingham (Woods Hole Oceanographic Institution, USA); 2) *"An innovative vehicle concept for ocean science: Ifremer's hybrid ROV first sea trial experience"* by Jan Operderbecke (Underwater Systems Unit, IFREMER, France); 3) *"Towards Integrated Autonomous Underwater Operations"* by Asgeir J. Sørensen and Martin Ludvigsen (Centre for Autonomous Marine Operations and Systems –AMOS–, Trondheim Norway); 4) *"Opportunities for Underwater Robotics in H2020"* by Michel Brochard, (European Commission, DG Connect A2 Robotics); 5) *"The role of AUV's in the Oil & Gas Industry"* by Hugh Ferguson (Subsea7, Aberdeenshire – United Kingdom) and 6) *"Reflections on a decade of Autonomous Underwater Vehicles for Marine Survey"* by Stefan B. Williams (Australian Centre for Field Robotics Sydney, Australia).

In addition, an interesting tutorial session entitled *"ROS for AUVs"* will be given by Dr. Narcís Palomeras (UdG, Spain). Besides the technical sessions, there will be an exhibitor area where 6 companies and institutions will showcase their products, services and projects.

I would like to thank all authors and people attending at NGCUV Workshop 2015 for their interest and collaboration. I hope you find the meeting fruitful and you have a pleasant time in Girona. I would like also to thank the organizing committee from the Underwater Vision and Robotics Research Centre (CIRS - VICOROB) of the *Universitat de Girona* and the *Laboratório de Sistemas e Tecnologias Subaquáticas (LSTS)* from the *Universidade do Porto* for their support and effort in the organization of this successful event.

Yours sincerely,

Pere Ridao

IFAC NGCUV 2015 Chair

PROGRAMME AGENDA AT-A-GLANCE

Monday 27/04/2015	Tuesday 28/04/2015	Wednesday 29/04/2015	Thursday 30/04/2015
8:30 - 17:30 ROS Tutorial @CIRS Lab	8:00 - 9:00 Registration @Hotel Carlemany		
	9:00 - 9:30 Welcome speech and opening remarks		
	9:30 - 10:30 Opening session James Bellingham: "The future of AUV technologies"	9:30 - 10:30 Keynote Speaker 3 Dr. Asgeir J. Sørensen Dr. Martin Ludvigsen: "Towards Integrated Autonomous Underwater Operations"	9:30 - 10:30 Keynote Speaker 5 Hugh Ferguson: "The role of AUV's in the Oil & Gas Industry"
	10:30 - 11:00 Coffee break		
	11:00-12:00 Underwater manipulation I	11:00-12:00 Mapping & SLAM I	11:00-12:00 Tracking and localization II
	12:00-13:00 Underwater manipulation II	12:00-13:00 Navigation, control & planning I	12:00-13:00 EU projects I
		12:00-13:00 Mapping & SLAM II	12:00 - 13:00 Keynote Speaker 6 Stefan Williams: "Reflections on a decade of Autonomous Underwater Vehicles for Marine Survey"
	13:00 - 14:30 Lunch break		
			13:00-13:15 Closing remarks 13:15-14:30 Farewell lunch
	14:30 - 15:30 Keynote Speaker 2 Jan Opderbeke: "An innovative vehicle concept for ocean science: Ifremer's hybrid ROV first sea trial experience"	14:30 - 15:30 Keynote Speaker 4 Michel Brochard: "Opportunities for Underwater Robotics in H2020"	
18:00 - 20:00 Welcome reception @UdG old Campus	15:30 -16:30 Tracking and localization I	15:30 -16:30 Operations	15:30-16:30 EU projects II
			15:30 -16:30 Navigation, control & planning II
	16:30 - 17:00 Coffee break		
	17:00 - 18:30 Networking event @Hotel Carlemany	17:00 18:20 EU projects III	17:00 -18:00 Multiple vehicle systems
		20:00 - 00:00 Conference Dinner @Mas Marroch	

CONFERENCE INFORMATION

Keynote Speakers



Dr James G. Bellingham
Woods Hole Oceanographic Institution,
U.S.A.

James G. Bellingham is the founding Director of the Center for Marine Robotics at the Woods Hole Oceanographic Institution. Dr. Bellingham was formerly Chief Technologist and earlier Director of Engineering at the Monterey Bay Aquarium Research Institute. He was founder and manager of the Autonomous Underwater Vehicle Laboratory at the Massachusetts Institute of Technology (MIT) and cofounder of Bluefin Robotics, a Massachusetts-based company that develops, builds, and operates autonomous underwater vehicles, which has since been acquired by Battelle. He was a member of the Naval Research Advisory Committee for seven years, including serving as Chair. Dr. Bellingham has also served on a variety of National Academies studies including the Committee on An Ocean Infrastructure Strategy for US Ocean Research in 2030, the Committee on Distributed Remote Sensing for Naval Undersea Warfare, and the Committee on Seafloor Observatories: Challenges and Opportunities. His awards include the Lockheed Martin Award for Ocean Science and Engineering and the MIT Fourteenth Robert Bruce Wallace lecturer. He holds an SB, an SM, and a PhD from MIT.



Dr Jan Opderbecke
Underwater Systems Unit, IFREMER,
Toulon – France

Jan Opderbecke is an electrical engineer with a PhD in Signal Processing. Head of a team for Underwater Robotics, Acoustics and Optics at Ifremer, the French Institute for Ocean Research, he is interested in deep water intervention vehicles, and in particular in seafloor observation and mapping with optical and acoustic sensors. He has led the Institute's AUV program since 2004, and he has participated or conducted numerous technical and scientific cruises at sea. He contributes in several national and european projects.



**Dr. Asgeir J. Sørensen and
Dr. Martin Ludvigsen**
Centre for Autonomous Marine Operations
and Systems (AMOS),
Trondheim-Norway

Professor Asgeir J. Sørensen obtained MSc degree in Marine Technology in 1988 at NTNU, and PhD degree in Engineering Cybernetics at NTNU in 1993. In 1989-1992 Sørensen was employed at MARINTEK as Research Scientist. In 1993 Sørensen was employed as Research Scientist at ABB Corporate Research Norway. In 1994 he became R&D Coordinator/Project Manager at ABB Industri. In 1996 he was appointed to Manager of Positioning Systems in ABB Industri. From 1998 to 2001 Sørensen was Technical Manager in the Business Area Automation Marine and Turbochargers, ABB Automation. In December 2002

Sørensen and 5 partners founded the company, Marine Cybernetics AS, where he was acting as President and Chief Executive Officer (CEO) until June 2010. DNV GL acquired Marine Cybernetics in May 2014. In 2012 Sørensen became a co-founder of the NTNU spin-off company Ecotone AS. Since 1999 Sørensen has held the position of Professor of Marine Control Systems at the Department of Marine Technology, NTNU. He is currently acting as the Director of the Centre for Autonomous Marine Operations and Systems (AMOS) at the Departments of Marine Technology and Engineering Cybernetics, NTNU.



Michel Brochard
*DG Connect A2 Robotics
European Commission*

Michel Brochard is an electronic engineer and worked 9 years in the telecommunications sector at Alcatel Bell before joining the European Commission in 1995. Since then, he worked for DG Connect (former DG INFSO & DG XIII) as Project Officer, supervising research and non-research co-financed projects in different areas such as electronic publishing, HRI or robotics.



Dr Hugh Ferguson
*Subsea 7, Aberdeenshire
United Kingdom*

Hugh Ferguson has been working in the Offshore Oil and Gas industry worldwide for 30 years. Originally as a Geophysicist his career path has taken him through Offshore Surveying and Subsea Engineering. Culminating in managing large scale EPCI deep water subsea and pipeline trunk line installation projects.

More recently he has moved back into the sensing, inspection, repair and maintenance phases of the offshore Oil and Gas life cycle. He currently works for Subsea 7, a global first tier Subsea Engineering and Installation company, as the Technical Director for Life of Field Operations. Part of his role is to oversee the development program for Subsea 7's Autonomous Inspection vehicle.



Dr. Stefan B. Williams
*Australian Centre for Field Robotics
Sydney, Australia*

Stefan B. Williams is an Associate Professor at the University of Sydney's School of Aerospace, Mechanical and Mechatronic Engineering. He is a member of the Australian Centre for Field Robotics where he leads the Marine Robotics group. He is also the head of Australia's Integrated Marine Observing System Autonomous Underwater Vehicle Facility. His research interests include Simultaneous Localisation and Mapping in unstructured underwater environments using visual and acoustic sensing, autonomous navigation and control and classification and clustering of large volumes of data collected by robotic systems. He received his PhD from the University of Sydney in 2002 and completed a Bachelor of Applied Science in Systems Design Engineering at the University of Waterloo, Canada in 1997.

CONFERENCE PROGRAMME AGENDA

DAY 1 Tuesday April 28, 2015

TIME

SESSION

9:00 - 9:30. **Welcome speech and opening remarks, Room Àtrium**

9:30 - 10:30. **Opening session, Room Àtrium.** Chair: Joao Sousa

James G. Bellingham, *Woods Hole Oceanographic Institution, USA.*
The future of AUV technologies

11:00 - 12:00. **Tu1A - Underwater Manipulation I, Room Àtrium**
Chair: Pedro J. Sanz • Co-chair: Giuseppe Casalino

11:00 - 11:20. Cooperative Underwater Manipulation Systems: Control Developments within the MARIS project

Giuseppe Casalino, *Enrico Simetti, Ninad Manerikar, Alessandro Sperinde, Sandro Torelli, Francesco Wanderlingh*

11:20 - 11:40. A Benchmarking Perspective of Underwater Intervention Systems

P.J. Sanz, *Javier Pérez, Jorge Sales, Antonio Peñalver, J. Javier Fernández, David Fornas, Raul Marin, Juan Carlos García Sánchez*

11:40 - 12:00. Underwater Robot Development for Manipulation Task and Their Uses in Biwa Lake

Sadao Kawamura

11:00 - 12:00. **Tu1B - Mapping and SLAM I, Room Carlemany**
Chair: Stefan Williams • Co-chair: Nuno Gracias

11:00 - 11:20. Global Alignment of a Multiple-Robot Photomosaic Using Opto-Acoustic Constraints

Ricard Campos, *Nuno Gracias, Albert Palomer, Pere Ridao*

11:20 - 11:40. AUV Single Beacon Range-Only SLAM with a SOG Filter

Guillem Vallicrosa, *Pere Ridao, David Ribas*

11:40 - 12:00. Real-time Mosaicing of Large Scale Areas with Forward Looking Sonar

Fausto Ferreira, *Vladimir Djapic, Massimo Caccia*

12:00 - 13:00. **Tu2A - Underwater Manipulation II, Room Àtrium**
Chair: Pedro J. Sanz • Co-chair: Giuseppe Casalino

12:00 - 12:20. Free-Floating Intervention by Means of Learning by Demonstration

Arnau Carrera Viñas, *Narcis Palomeras, Natàlia Hurtós Vilarnau, Marc Carreras*

12:20 - 12:40. Underwater Manipulation: an industry perspective

Yvan Petillot, *Corina Barbalata*

12:40 - 13:00. Reduction of the Dynamic Coupling in an Underwater Vehicle-Manipulator System Using an Inverse Dynamic Model Approach

Corina Barbalata, Matthew W. Dunnigan, Yvan Petillot

12:00 - 13:00. Tu2B - Navigation, Control and Planning I, Room Carlemany

Chair: Benedetto Allotta • Co-chair: Marc Carreras

12:00 - 12:20. On-Line 3D Path Planning for Close-Proximity Surveying with AUVs*Juan David Hernández, Guillem Vallicrosa, Éric Pairet Artau, **Marc Carreras**, Pere Ridao***12:20 - 12:40. Longitudinal Motion Instability of a Cruising AUV flying over a Steep Terrain*****Kangsoo Kim*****12:40 - 13:00. Navigation State Estimation for AUVs through Unscented Kalman Filter*****Benedetto Allotta**, Andrea Caiti, Luigi Chisci, Riccardo Costanzi, Francesco Di Corato, Claudio Fantacci, Davide Fenucci, Enrico Meli, Alessandro Ridolfi***14:30 - 15:30. Keynote Speaker 2, Room Àtrium. Chair: Pere Ridao*****Jan Opderbecke**, Underwater Systems Unit, IFREMER**"An innovative vehicle concept for ocean science: Ifremer's hybrid ROV first sea trial experience"***15:30 - 16:30. Tu3A - Tracking and Localization I, Room Àtrium**

Chair: Yvan Petillot • Co-chair: Biel Oliver

15:30 - 15:50. Pose Estimation for Underwater Vehicles using Light Beacons***Nuno Gracias**, Josep Bosch, Mohammad Karim***15:50 - 16:10. GPU-Accelerated Monte Carlo Localization for Underwater Robots*****Rodrigo Telles da Silva Vale**, Ettore de Barros, Thiago de Castro Martins***16:10 - 16:30. Outlier Rejection in Underwater Acoustic Position Measurements Based on Prediction Errors***Anastasios Lekkas, **Mauro Candeloro**, Ingrid Schjølberg***15:30 - 16:30. Tu3B - Operations, Room Carlemany**

Chair: Jan Opderbecke • Co-chair: Jörg Kalwa

15:30 - 15:50. UUV's in Maritime Spill Response Exercise Cathach***Gerard Dooly**, Edin Omerdic, Joseph Coleman, William Miller, José Braga, Filipe Ferreira, James Hayes, Hugh Conlon, Joao Sousa, Daniel Toal***15:50 - 16:10. Mixed-Initiative Interaction for Tracking of Ocean Sunfish*****Jose Pinto**, Paulo Dias, João Pereira, Renato Caldas, Tiago Rodrigues, Joao Sousa***16:10 - 16:30. An Approach for Planning a Safe Mission Begin and End for Teams of Marine Robots***Thomas Glotzbach, **Sebastian Eckstein**, Christoph Ament*

DAY 2

Wednesday April 29, 2015

TIME

SESSION

9:30 - 10:30. **Keynote Speaker 3, Room Àtrium.** Chair: Antonio Pascoal

Dr. Asgeir J. Sørensen and Dr. Martin Ludvigsen,
Centre for Autonomous Marine Operations and Systems (AMOS)
Towards Integrated Autonomous Underwater Operations

11:00 - 12:00. **We1A - Tracking & Localization II, Room Àtrium**

Chair: Biel Oliver • Co-chair: Yvan Petillot

11:00 - 11:20. Tracking Underwater Target Using Extremum Seeking

Filip Mandić, Nikola Miskovic

11:20 - 11:40. Underwater Single-Beacon Localization: Optimal Trajectory Planning and Minimum-Energy Estimation

Margarida Pedro, David Moreno-Salinas, Naveena Crasta,

Antonio M. Pascoal

11:40 - 12:00. Combined Multiuser Acoustic Communication and Localisation System for μ AUVs Operating in Confined Underwater Environments

Alexander Dikarev, ARRON GRIFFITHS, Simon Watson, Barry Lennox,
Peter Green

11:00 - 12:00. **We1B - Vehicle Modeling & Design I, Room Carlemany**

Chair: James Bellingham • Co-chair: David Ribas

11:00 - 11:20. Measurements of Hydrodynamic Parameters and Control of an Underwater Torpedo-Shaped Vehicle

Francisco J. Velasco, **Elías Revestido Herrero,** Francisco J. Lastra Santos, Jose Maria Riola Rodríguez, Juan Jesús Díaz Hernández, Luis M. Vega Antolín

11:20 - 11:40. Research on Next Autonomous Underwater Vehicle for Longer Distance Cruising

Ikuo Yamamoto

11:40 - 12:00. Performance and Sealing Material Evaluation in 6-Axis Force/Torque Sensors for Underwater Robotics

Gianluca Palli, Lorenzo Moriello, Claudio Melchiorri

12:00 - 13:00. **We2A - EU Projects I, Room Àtrium**

Chair: Nikola Miskovic • Co-chair: Benedetto Allotta

12:00 - 12:20. Towards Autonomy in ROV Operations

Ingrid Schjølberg

12:20 - 12:40. Navigation, Guidance and Control of Underwater Vehicles within the Widely scalable Mobile Underwater Sonar Technology (WiMUST) Project: an overview

Habib Al-Khatib, Gianluca Antonelli, Andrea Caffaz, Andrea Caiti, **Giuseppe Casalino,** Ivan Bielic de Jong, Henrique Duarte, Giovanni Indiveri, Sergio Jesus, Konstantin Kebkal, Antonio M. Pascoal, Daniel Polani

12:40 - 13:00. The ARROWS Project: Adapting and Developing Robotics Technologies for Underwater Archaeology
Benedetto Allotta, Riccardo Costanzi, Alessandro Ridolfi, Carlo Colombo, Marco Fanfani, Fabio Bellavia, Ovidio Salvetti, Marco Reggiannini, Maarja Kruusmaa, Taavi Salumae, Gordon Frost, Nikolaos Tsiogkas, David M. Lane, Michele Cocco, Lavinio Gualdesi, Daniel Roig, Hilal Gundogdu, Can Dede, Steven Baines, Sebastiano Tusa, Stefano Zangara, Urmas Dresen, Priit Latti, Walter Daviddi

12:00 - 13:00. We2B - Mapping & SLAM II, Room Carlemany
 Chair: Nuno Gracias • Co-chair: Stefan Williams

12:00 - 12:20. Stereo Graph-SLAM for Robust Navigation of the AUV SPARUS II
 Francisco Jesús Bonin-Font, **Pep Lluís Negre Carrasco**, Miquel Massot Campos, Gabriel Oliver

12:20 - 12:40. Underwater Photogrammetric Mapping of an Intact Standing Steel Wreck with ROV

Stein M. Nornes, Martin Ludvigsen, Øyvind Ødegård, Asgeir Soerensen

12:40 - 13:00. An Open-Source Bio-Inspired Solution to Underwater SLAM

Luan Silveira, Felipe Guth, Paulo Drews Jr, Pedro Ballester, Matheus Machado, Felipe Codevilla, Nelson Duarte Filho, **Silvia Botelho**

14:30 - 15:30. Keynote Speaker 4, Room Àtrium. Chair: Maarja Kruusmaa

Michel Brochard, European Commission, DG Connect A2 Robotics Opportunities for Underwater Robotics in H2020

15:30 - 16:30. We3A - EU Projects II, Room Àtrium
 Chair: Nikola Miskovic • Co-chair: Maarja Kruusmaa

15:30 - 15:50. ROBOCADEMY – European Academy for Marine and Underwater Robotics
Maarja Kruusmaa, Thomas Vögele, David M. Lane

15:50 - 16:10. EU Project MORPH: Current Status after 3 Years of Cooperation under and above Water

Joerg Kalwa, Antonio M. Pascoal, Pere Ridao, Thomas Glotzbach, Lorenzo Brignone, Marco Bibuli, Joao Alves

16:10 - 16:30. CADDY Project, Year 1: Overview of Technological Developments and Cooperative Behaviours

Nikola Miskovic, Antonio M. Pascoal, Marco Bibuli, Massimo Caccia, Jeffrey Neasham, Andreas Birk, Murat Egi, Karl Grammer, Alessandro Marroni, Antonio Vasiljevic, Zoran Vukic

15:30 - 16:30. We3B - Navigation, Control & Planning II, Room Carlemany
 Chair: Marc Carreras • Co-chair: Benedetto Allotta

15:30 - 15:50. Accuracy Enhancement of Position Stabilization of the Tethered Submersible Vehicle

Sergey Gayvoronskiy, Tatiana Ezangina

15:50 - 16:10. AUV Terrain-Aided Navigation Using a Doppler Velocity Logger

Francisco Teixeira, João Quintas, Antonio M. Pascoal

16:10 - 16:30. An Inside Perspective on LAUV Control and Localization Layers

José Braga, Pedro Calado, Joao Sousa

17:00 - 18:20. We4A - EU Projects III, Room Àtrium

Chair: Nikola Miskovic • Co-chair: Alessio Turetta

17:00 - 17:20. DexROV: Dexterous Undersea Inspection and Maintenance in Presence of Communication Latencies

Jeremi Gancet, Peter Weiss, Gianluca Antonelli, Andreas Birk, Sylvain Calinon, Alessio Turetta, Cees Walen

17:20 - 17:40. Performance Measures to Improve Evaluation of Teams in the Eurathlon 2014 Sea Robotics Competition

Yvan Petillot, Fausto Ferreira, Gabriele Ferri

17:40 - 18:00. The NOPTILUS Project Overview: A Fully-Autonomous Navigation System of Teams of AUVs for Static/dynamic Underwater Map Construction

Athanasios Kapoutsis, Georgios Salavasidis, Savvakis Chatzichristofis, José Braga, Jose Pinto, Joao Sousa, Elias Kosmatopoulos

18:00 - 18:20. PANDORA - Persistent Autonomy Through Learning, Adaptation, Observation and Replanning

David M. Lane, Francesco Maurelli, Petar Kormushev, Marc Carreras, Maria Fox, Kostas J. Kyriakopoulos

17:00 - 18:00. We4B - Multiple Vehicle Systems, Room Carlemany

Chair: Antonio Pascoal • Co-chair: Asger Sorensen

17:00 - 17:20. Formation Control in the scope of the MORPH project. Part I: Theoretical Foundations

Pedro Caldeira Abreu, Antonio M. Pascoal

17:20 - 17:40. Formation Control in the scope of the MORPH project. Part II: Implementation and Results

Pedro Caldeira Abreu, Mohammadreza Bayat, Antonio M. Pascoal

17:40 - 18:00. Towards Programmable Coordination of Unmanned Vehicle Networks

Eduardo R. B. Marques, Manuel Ribeiro, **Jose Pinto**, Joao Sousa, Francisco Martins

DAY 3 Thursday April 29, 2015

TIME SESSION

9:30 - 10:30. **Keynote Speaker 5, Room Àtrium.** Chair: David Lane

Hugh Ferguson, Subsea7

The role of AUV's in the Oil & Gas Industry

11:00 - 12:00. **Thu1A - Navigation, Control & Planning III, Room Àtrium**

Chair: Marc Carreras • Co-chair: Benedetto Allotta

11:00 - 11:20. Artificial Intelligence Planning for AUV Mission Control

Michael Cashmore, Maria Fox, Derek Long, Daniele Magazzeni, Bram Ridder

11:20 - 11:40. Fuzzy Controller for the Yaw and Velocity Control of the Guanay II AUV

Julián González Agudelo, Spartacus Gomáriz, Carles Batlle, **César Galarza**

11:40 - 12:00. **Pool testing of AUV visual servoing for autonomous inspection**
*Szymon Krupinski, Rémi Desouche, **Narcis Palomeras**, Guillaume Allibert, Minh-Duc Hua*

11:00 - 12:00. **Thu1B - Vehicle Modeling & Design II, Room Carlemany**
Chair: David Ribas • Co-chair: James Bellingham

11:00 - 11:20. **Combined Gas-Fluid Buoyancy System for Improved Attitude and Maneuverability Control for Application in Underwater Gliders**
Javier Busquets-Mataix, *Jose Vicente Busquets-Mataix, David Busquets-Mataix*

11:20 - 11:40. **Wireless Image Compression and Transmission for Underwater Robotic Applications**
*Moscoso Rubino Eduardo, Diego Centelles, **Jorge Sales**, Jose Vicente Marti, Raul Marin, P.J. Sanz*

11:40 - 12:00. **Design and Construction of a Robot Hand Prototype for Underwater Applications**
Francesco Spadafora, *Maurizio Muzzupappa, Fabio Bruno, David Ribas, Pere Ridao*

12:00 - 13:00. **Keynote Speaker 6, Room Àtrium.** Chair: Rafael Gacia

Stefan Williams, *Australian Centre for Field Robotics*
Reflections on a decade of Autonomous Underwater Vehicles for Marine Survey



EXHIBITION LIST



OceanScan is an European manufacturer of man-portable Autonomous Underwater Vehicles – the LAUV.

This tool is targeted for cost-effective underwater surveys. OceanScan-MST has an extensive experience in state-of-the art technologies and systems engineering to deliver innovative advanced engineering services and operational support for ocean systems.

The LAUV system was developed in cooperation with the Laboratório de Sistemas e Tecnologia Subaquática from Universidade do Porto Faculdade Engenharia

Polo do Mar do UPTEC
Avenida da Liberdade
4450-718 Matosinhos, Portugal



SIDMAR Estudios y Servicios Oceanográficos, focused their career in the field of Marine Science and Technology.

We highlight the following lines:

Representation and sale of oceanographic instrumentation

Comprehensive oceanographic services I + D + i

The represented brands in NGCUV will be:



Pol. Indus. "La Pedrera"
C/ Watt nº9
Valencia, Spain



Teledyne RD Instruments, Inc., located in San Diego, CA, specializes in the design and manufacture of underwater acoustic Doppler products for a wide array of current profiling and precision navigation applications.

1049 Camino Dos Rios
Thousand Oaks, CA 91360
805-373-4545, USA



GRAAL Tech Engineering Services for robotic system and underwater applications Graal Tech has been established in 1998 by a team of researchers from University of Genoa with the intent of transferring competencies and know-how from academy to industry.

Via Ruffini,
16128 Genova, Italia



CIRS is the Underwater Vision and Robotics Research Centre at the University of Girona (UdG). The CIRS is part of the Institute of Computer Vision and Robotics (ViCOROB) and member of TECNIO network of Excellence in Catalonia region. We are located in Scientific and Technological Park of the UdG.

Parc Científic i Tecnològic (CIRS)
C/Pic de Peguera, 13
17003 Girona

CONFERENCE SOCIAL EVENTS



Welcome reception

(Campus Barri Vell, Claustre de Lletres)
27/04/2015 at 18:00h

The reception will take place in University of Girona old square campus. The Gothic cloister of the ancient Dominican convent (1253) constitutes one of the city's most historically and artistically valuable sites.

In the reception you will have the chance to enjoy a Catalan human tower performance by Els Xoriguers de la UdG. A reception cocktail will be offered to all the attendees. No badge necessary for having access to the event.

Networking Event

(Exhibition Area, Hotel Carlemany)
28/04/2015 at 17:00h

In the afternoon, a snack will be offered in the Exhibition Area to all the participants, courtesy of the Exhibitors. It will be a great opportunity for you to meet them and try to make business. You will need your badge to enter the Exhibition Area.



Conference dinner

Mas Marroch

29/04/2015
at 20:00h

The conference dinner will take place in Mas Marroch, a typical Catalan masia run by the owners of El Celler de Can Roca - best world restaurant 2013.

How to arrive:

A bus will pick you up in front of Hotel Carlemany at 19:30h. Alternatively, you can pick a taxi which will cost you around 20 €.

How to come back:

After dinner, two buses will leave from Mas Marroch to leave you back in Hotel Carlemany. The first bus will leave at 23:30 and a second bus will leave at 00:30h. Alternatively, you can pick a taxi which will cost you around 20 €.

Dress code: Smart Casual.

Practicalities:

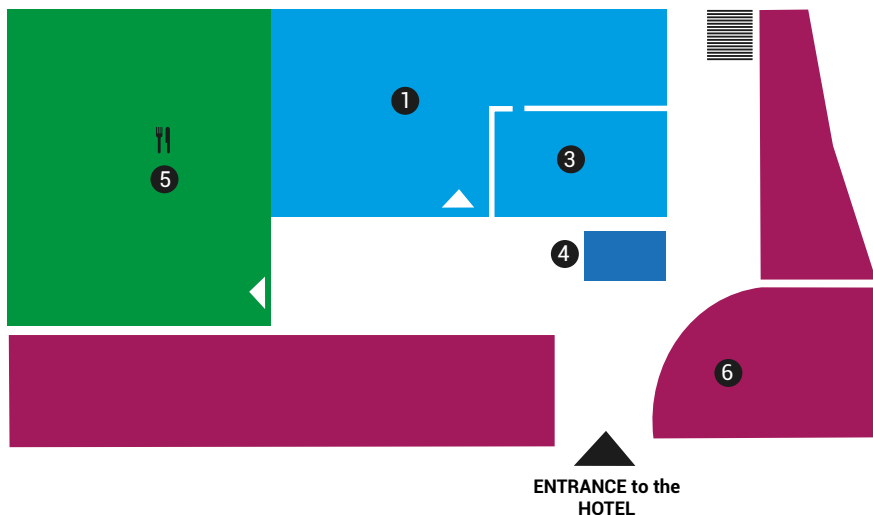
The dinner will be restricted to the Conference Participants and Guests. You will be requested to give your ticket upon arrival.



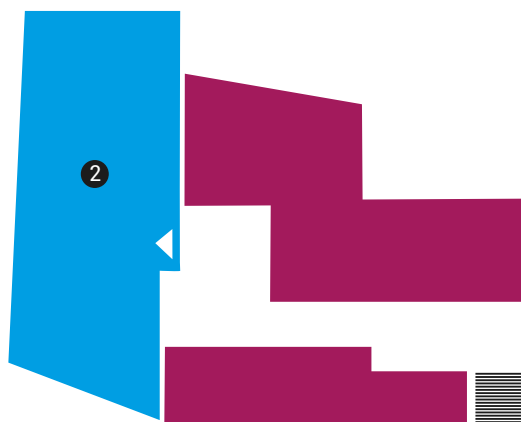
TAXI TELEPHONE NUMBER: +34 972 222 323

FLOOR PLAN

GROUND FLOOR



1st FLOOR



- 1 EXHIBITION AREA
EUROPEAN PROJECT CORNER
- 2 ROOM ÀTRIUM
- 3 ROOM CARLEMANY
- 4 REGISTRATION DESK
- 5 ROOM PATI VERD
LUNCHES
- 6 HOTEL RECEPTION

SPONSORS & PARTNERS

SUPPORTING SPONSORS



SUPPORTING PARTNERS



HOSTED BY:



National Organizing Committee

Chair

Pere Ridao Rodriguez
Underwater Robotics Research Center (CIRS)
Computer Vision & Robotics Research Group

Scientific & Technological Park of the University of Girona
CIRS Building
Girona – Catalonia – (Spain)
E-mail: pere@eia.udg.edu
Telephone: +34 972 419871

www.ngcuv.org