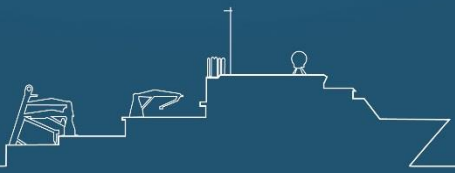
EMRA'19

Workshop on EU-funded MARINE ROBOTICS AND APPLICATIONS



TOULON, France

MAY 15-16, 2019

Hosted by:

Ifremer

Organized within the framework of:

Interreg MARITTIMO-IT FR-MARITIME

This project has received funding from the interregional co-operation programme Ref. 2014TC16RFCB033

EUMR EUMarineRobots Marine robotics research infrastructure network

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731103

www.marinerobotics.eu

ORGANIZING COMMITTEE

Jan Opderbecke
IFREMER (FR)

Nikola Mišković
University of Zagreb (ZR)

Pere Ridao
University of Girona (ES)

Antonio Pascoal
Instituto Superior Tecnico (PT)

Jeff Neasham
Newcastle University (UK)

Edin Omerdic
University of Limerick (IRL)

Massimo Caccia
ISSIA-CNR (IT)

WELCOME BY JAN OPDERBECKE

Head of the Underwater Systems Unit of IFREMER

Welcome to EMRA'19, the 6th EU Marine Robotics and Applications Workshop! The Underwater Systems Unit of IFREMER is hosting the 6th EU-funded Marine Robotics and Applications Workshop (EMRA'19) on 15-16th May 2019 in Toulon, France.

Toulon is a human-sized, dynamic and attractive city, situated between the steep hills and the blue Mediterranean Sea, between Marseille and Nice. It is famous for its naval base, for being the sunniest city in France and for opening out onto one of the most beautiful bays in Europe.

This EMRA edition is organized under EU H2020 projects EuMarineRobots and MATRAC-ACP, and is sponsored by the Regional Maritime Cluster "Pôle Mer". Following the success of previous EMRA workshops, the EMRA'19 will summarize ongoing EU-funded projects in marine robotics and provide a vibrant platform for sharing and discussing existing marine technological challenges and achievements. This multidisciplinary event is an excellent opportunity for networking, dissemination of the ongoing work and cross-fertilization of ideas between marine science and enabling technologies and applications.

I wish you all a very pleasant and fruitful workshop and stay in Toulon, and I hope you will return to your home with great experience and memories.

Yours Sincerely,

Jan Opderbecke

EMRA'19 Organising Committee Chair

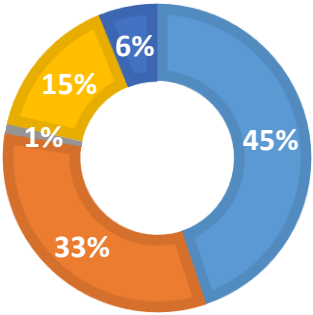
EMRA'19 FACTS AND FIGURES

98 attendees

From 61 organisations

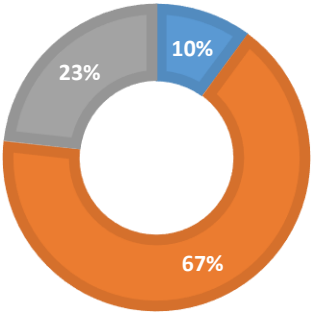
and 15 countries

ATTENDEE PROFILE



- Academia/Research Institution
- Industry
- End User
- Governmental Agency/Body
- Other

MOTIVATION TO ATTEND

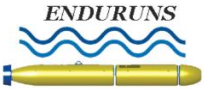


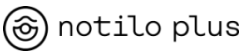
- Knowledge
- Networking
- Presentations

31+ Talks

- EU Project: 15
- Industry: 12
- Infrastructure: 4

WORKSHOP INFORMATION
PRESENTED PROJECTS





WORKSHOP PROGRAMME DAY 1

15th MAY 2019, WEDNESDAY, morning session

8:30	**REGISTRATION –** Good morning coffee
9:00	**WELCOME** Jan Opderbecke, *IFREMER, France*
9:10	**KEYNOTE SPEAKER 1 –** Aquanaut – An autonomous intervention vehicle John Yamokoski, Houston Mechatronics, USA
9:50	TIC-AUV - Towards Intelligent Cognitive AUVs Francesco Maurelli, *Jacobs University Bremen GMBH, Germany*
10:10	Enduruns - first steps Alessio Turetta, *GRAALTECH, Italy*
10:30	CORAL - An industrial partnership for the development of an innovative deep-sea AUV for ocean sciences Jan Opderbecke, *IFREMER, France* & Thomas Roure, *ECA-Robotics, France*
10:50	**COFFEE BREAK**
11:10	OASYS Project - An overview Alfredo Carella, *OsloMet, Norway*
11:30	From Coast to Depths: Strengthening our autonomous presence in the Ocean João Borges de Sousa, *LSTS-FEUP, Portugal*
11:50	EUMarineRobots - One year review of community engagement João Borges de Sousa, *LSTS-FEUP, Portugal*
12:10	Pôle Mer Méditerranée - A regional cluster for blue economy Alain Fidani, *Pôle Mer Méditerranée, France*
12:20	Short company presentations - *Pôle Mer Méditerranée* blue economy cluster *Marine & Submarine Robotics Companies, France*
12:50	**LUNCH BREAK -** Offered by Pôle Mer Méditerranée

15th MAY 2019, WEDNESDAY, afternoon session

14:00	**RoboVaas –** Robotic Vessels as-a-Service Gerard Dooly, *Centre for Robotics & Intelligent Systems, Ireland*
14:20	**H2O Robotics** Nikola Mišković, *University of Zagreb Faculty of Electrical Engineering and Computing; H2O Robotics, Croatia*
14:40	**ROBINS** – Robotics Technology for Inspection of Ships Enrico Carrara, *RINA Services S.p.A., Italy*
15:00	**iBubble -** The world's first autonomous underwater drone that follows you during your dives Solène Guéré, *Notilo Plus, France*
15:20	**Lightning talks** **PLOCAN – Glider School**. Daniel Alcaraz, PLOCAN, Spain **SHIPTEST.** Kyriakos Berketis, *SpectrumNDT, Greece* **Seebyte.** Alexis Urvoy, *SeeByte, UK* **NetTag.** Eduardo Silva, *INESC TEC, Portugal*
15:40	**COFFEE BREAK**
16:00	**Subsea remote docking technologies and resident ROV** Manuel Lopes Mendes, *Forssea-Robotics, France*
16:20	**Miniature flash imaging LiDAR for bathymetry: an experimental proof-of-concept** Christophe Pache, *CSEM, Switzerland*
16:40	**ROBUST -** Ready for sea trials Alessio Turetta, *GRAALTECH, Italy*
17:00	**iXblue -** Precision AUV navigation with sparse LBL Yann Casamajou, *iXblue, France*
17:20	**uSEA Technologies -** The future of subsea survey Felipe Lima, *uSEA Technologies, Norway*
17:40	**END OF DAY ONE**
18:30	**Boat transfer from Toulon to IFREMER, Visit of IFREMER and EMRA Dinner**
22:00	**Boat transfer from IFREMER back to Toulon**

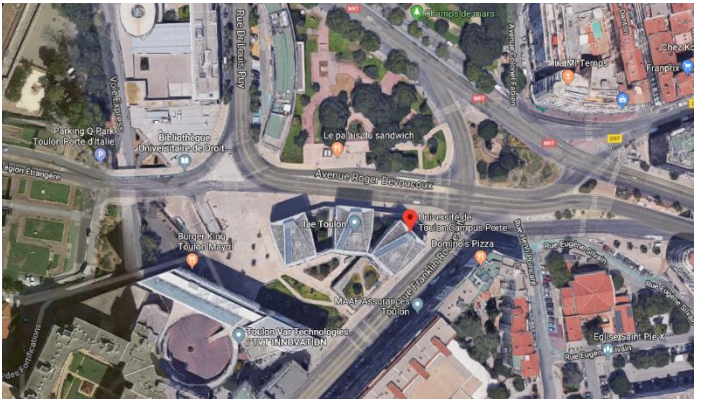
WORKSHOP PROGRAMME DAY 2

16th MAY 2019, TUESDAY

8:45	**GOOD MORNING COFFEE**
9:00	**KEYNOTE SPEAKER 2 -** The Science Junction Box in the KM3NeT, an EMSO ERIC underwater observatory (part 1) & BathyBot – the deep-sea crawler to see the unseen of the NW Mediterranean Sea (part 2) Jennifer Greer, *IFREMER, France* & Christian Tamburini, *MIO-CNRS, France*
9:40	COSMER Lab - Underwater umbilical management between two robots Vincent Hugel, *COSMER Lab, University of Toulon, France*
10:00	OCEANRINGS+ - Making Subsea Complex Tasks Simple Edin Omerdic, *University of Limerick, Ireland*
10:20	ECOBOTICS.SEA - Bio-inspired Technologies for a Sustainable Marine Ecosystem Jorge Lobo, *ISR - University of Coimbra, Portugal*
10:40	subCULTron - Swarm Robotics in the Lagoon of Venice Ronald Thenius, *Karl-Franzens-University, Austria*
11:00	**COFFEE BREAK**
11:20	ROS - A backbone for collaborative robotics software development: an example of system implementation of IFREMER's HROV Lorenzo Brignone, *IFREMER, France*
11:40	MATRAC - Adaptive real time monitoring with automated sampling and measurement Massimo Caccia, *CNR, Italy*
12:00	BLUEMED - Plan, test and coordinate underwater museums, diving parks and knowledge awareness centers Đula Nađ, *University of Zagreb, Faculty of Electrical Engineering and Computing, LABUST, Croatia*
12:20	IQUA Robotics - reconfigurable AUVs for research Joseta Roca and Guillem Vallicrosa, *IQUA Robotics, Spain*
12:40	**ROUND TABLE**
13:15	**LUNCH BREAK**
14:30	**END OF DAY TWO**

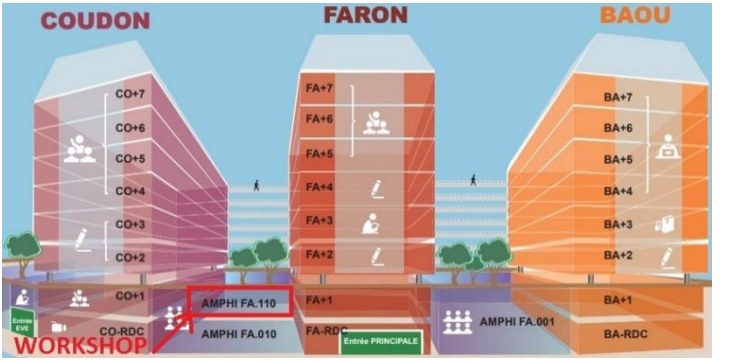
WORKSHOP VENUE

The workshop will take place in the Toulon-Porte d'Italie University campus located on the eastern outskirts of downtown Toulon. 70 Avenue Roger Devoucoux, 83000 Toulon.



University Buildings

Auditorium



The Auditorium in the University Building (AMPHI FA.110) 1st Floor

HOW TO ARRIVE TO TOULON UNIVERSITY

Best way to travel to Toulon from Europe is by plane to Marseille Provence Airport, Toulon – Hyères Airport or Nice Airport.

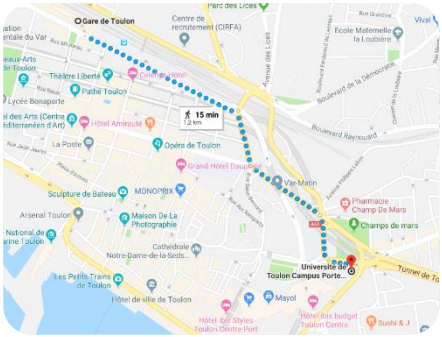
How to arrive from Marseille Provence Airport
By Car/taxi: It is about 69 km in 1 hour
By Train: train with one connection from TER Vitrolles-Aéroport Marseille Station

How to arrive from Toulon-Hyères Airport
By car/taxi: It is about 31 km in 30 min
By bus: bus N°102 will take you to the "Champ de Mars Toulon" station (55 min) + 5/10 min walk

How to arrive from Nice Airport
By car/taxi: It is about 142 km in 1h28
Bus: Flixbus from Nice Airport Terminal 1 or 2 or from Nice Bus Station - 1h45/2h
Train: From Nice Saint-Augustin (Airport) –1h45/2h

How to arrive by Train
Train: OUISNCF OUIGO

The University is walking distance from Toulon Train Station



Useful Website Links:

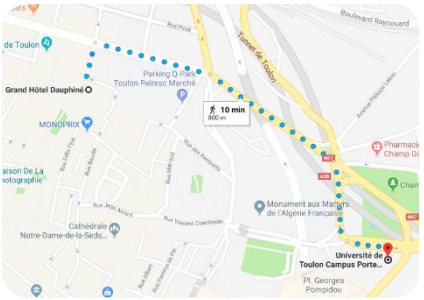
Airports:
Marseille Provence: https://www.marseille.aeroport.fr
Toulon-Hyères: www.toulon-hyeres.aeroport.fr
Nice: https://www.nice.aeroport.fr

Transports:
Train: https://www.oui.sncf
https://www.ouigo.com
Bus: https://www.flixbus.fr
https://www.reseaumistral.com

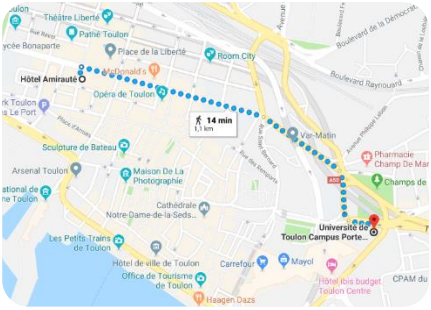
TIPS FOR ACCOMODATION

Because of their location, we suggest you to stay in these four hotels with less than 15min walk from the University.

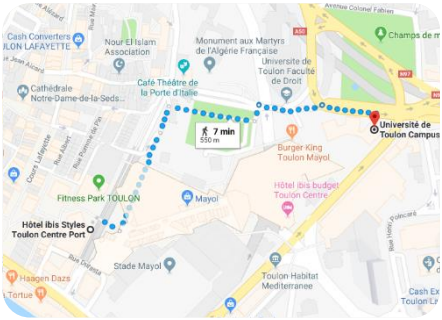
Grand Hotel Dauphiné ***
10 Rue Berthelot
83000 Toulon
Website: http://www.grandhoteldauphine.com/
Phone: +33 4 94 92 20 28
Email: contact@grandhoteldauphine.com



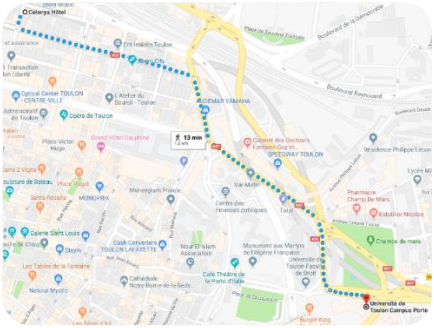
Hotel Amirauté***
4, rue Adolphe Guiol
83000 Toulon
Website: https://www.hotel-toulon-amiraute.com
Phone: +33 4 94 22 19 67
Email: reservation@hotelamiraute.fr



ibis Styles Toulon Centre Port***
Place Besagne
83000 Toulon
Website : https://www.accorhotels.com/fr/hotel-2095-ibis-styles-toulon-centre-port/index.shtml
Phone: +33 4 98 00 81 00
Email: H2095@accor.com



Celenya Hotel**
7 Bis Rue De Chabannes
83000 Toulon
Website: http://www.hotel-celenya-toulon.com
Phone: +33 4 94 92 37 44
Email: celenyahotel@orange.fr



ICE BREAKER

Close to the Mayol Stadium and The University Campus, a Get Together Ice Breaker will be held on the **14th of May 2019** from **7pm to 9pm at the RCT Café, 55 Avenue de Besagne, 83000 Toulon.**

Rugby Club Toulonnais is the famous professional rugby union club based in Toulon.

Drinks and finger food will be available for you to buy.

VISIT OF THE UNDERWATER SYSTEMS UNIT OF IFREMER AND DINNER

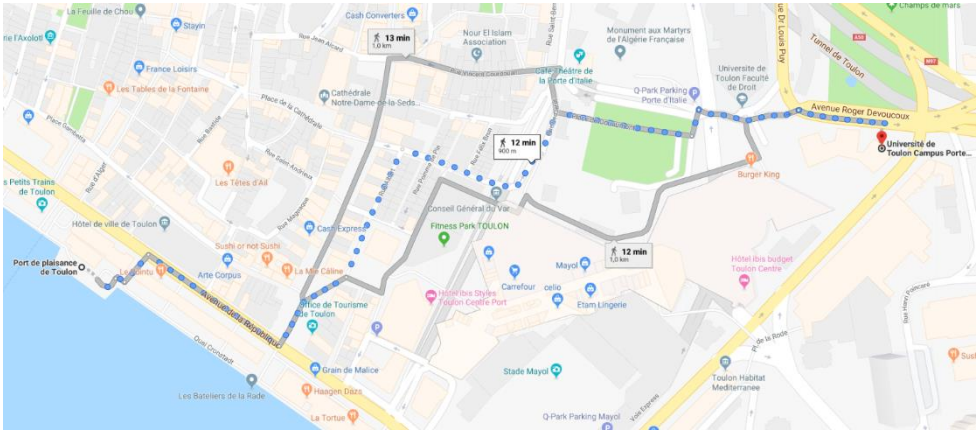
At 6:30pm on the 15th of May 2019, a boat shuttle from Toulon Port will bring you to IFREMER in La Seyne-sur-Mer to visit the Underwater Systems Unit. An informal networking dinner with a Food Truck will be held in the company. The boat will leave IFREMER at 10:00pm and will take you back to Toulon Port. Transfer and dinner will be offered.

Map from the University to the Port of Toulon - Shuttle Boat

If you get lost between the University and the Port, please use this map to help you find your way.

Google Maps Link

GPS “Port de Plaisance de Toulon”: 43°07'13.0"N 5°55'52.9"E



PRESENTATIONS

PRESENTATIONS – Wednesday, 15th May, 9:10-9:50h

Title: Aquanaut - An autonomous intervention vehicle

Speaker: John Yamokoski, *Houston Mechatronics, USA*

John Yamokoski received a B.S. degree in Mechanical Engineering from Purdue University in 1999 and M.S. and PhD. degrees in Mechanical Engineering from University of Florida in 2005 and 2009 respectively. Currently he is the Director of Software Engineering at Houston Mechatronics and actively involved with the research and development efforts for HMI's Aquanaut program. Before joining HMI, he was at NASA's Software, Robotics and Simulation Systems Division at the Johnson Space Center. While at NASA, he was the Controls Lead for NASA's Robonaut 2 project and Lead Software Architect for NASA's Valkyrie program.

HOUSTON MECHATRONICS

KNOW WHAT'S POSSIBLE.

Website: https://www.houstonmechatronics.com/aquanaut/

Houston Mechatronics, Inc. (HMI) has embarked on a significant technology development program referred to as "Aquanaut". The objective of this project is to field a novel subsea robotic platform capable of both long range operation as well as meaningful in-close intervention tasks. The goal is to demonstrate the feasibility of performing complex underwater manipulation tasks without the need for a high capacity link (e.g. data tether) to the robot. This talk will give an overview of Aquanaut's Command and Control architecture, review recent project accomplishments, and outline the vision for Aquanaut's future.

PRESENTATIONS – Wednesday 15th May, 9:50-10:10h

Title: TIC-AUV - Towards Intelligent Cognitive AUVs

Speaker: Francesco Maurelli, *Jacobs University Bremen GMBH, Germany*

Dr. Francesco Maurelli is Professor in Marine Systems and Robotics at Jacobs University Bremen, and chair of the Robotics and Intelligent Systems Bachelor program. After completing his PhD in Edinburgh, at Heriot-Watt University, he moved to Munich at TUM to be the Scientific Manager of one of the largest EU-funded robotics project Echord++, to bring robotics technology closer to the market. He has received an MSCA Individual Fellowship to work one year at MIT, with the return phase in Bremen, at Jacobs University. His research interests are focused on long-term autonomy, robustness and smart decision making.

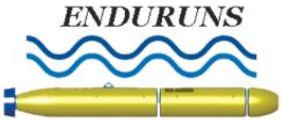
Description: In recent years, long-term autonomy and persistent autonomy have become key areas of interest for marine robotics researchers. The current generation of Autonomous Underwater Vehicles (AUVs) and Autonomous Surface Vessels (ASVs) have generally limited forms of autonomy and understanding of the environment. This project addresses the need of greater autonomy and capabilities, improving the cognitive and intelligent layer of marine robotics.
The presentation will focus on intelligent localisation techniques, both underwater and on surface, aided by semantic world modelling, fed by sensor processing – sonar underwater, lidar on surface. Results in simulation and in field trials will be presented, and the role of active techniques, involving planning, will be highlighted.

PRESENTATIONS – Wednesday, 15th May, 10:10-10:30h

Title: ENDURUNS - first steps

Speaker: Alessio Turetta, *GraalTech, Italy*

Alessio Turetta received the Graduation degree in Software Engineering and the Ph.D. in Robotics from the University of Genova, Italy, in 2000 and 2005, respectively.
After a brief experience as Business Analyst in McKinsey & Co, in 2001, he started the cooperation with Graal Tech, as a Control System Consultant. In parallel, since 2005, he had a scientific and teaching career with the University of Genova, where he got the permanent position of Lecturer and Assistant Professor. During years, his relationship with Graal Tech consolidated, and he became first Director and then Partner. In 2015 he left the University and became Business Development Manager in Graal Tech, taking care of the EU projects and other R&D projects for international customers.
His research interests include swarms of unmanned vehicles, underwater acoustics, systems engineering, and software architectures for multi-vehicle systems.



Description: The ENDURUNS project aims to develop a hybrid AUV powered using hydrogen fuel cell technology. The application of high energy density H2 as fuel will permit extended operation at sea up to several months, enabling multiple missions to be carried out even with a single launch sequence. The ENDURUNS AUV includes communication features which will enable mission data transfer and updates on the fly from the RMCC supervisor, advanced high-accuracy geotagging, optimized controller and data handling hardware and software. ENDURUNS will be able to perform high-resolution seabed mapping within the 100m target specified by the "Seabed 2030" initiative as well as detailed inspection of offshore infrastructure which may requires even higher levels of resolution. The sensor payload will be adaptable to the specific requirements of each mission thanks to the modularity and compatibility offered by the ENDURUNS AUV architectural design. A USV will be used in conjunction with the AUV during operation for geotagging, communication and command transmission from and to the RMCC. To extend operational autonomy the USV will be powered using a hybrid power bank incorporating a hydrogen fuel cell, battery pack and photovoltaic panels. In case of adverse weather conditions the USV will be capable of submerging up to 20m underwater and resurface again, resuming nominal operation when weather has improved sufficiently.

PRESENTATIONS – Wednesday, 15th May, 10:30-10:50h

Title: CORAL - An industrial partnership for the development of an innovative deep-sea AUV for ocean sciences

Speakers: Jan Opderbecke, *IFREMER, France* & Thomas Roure, *ECA-Robotics, France*

Jan Opderbecke is an electrical engineer and holds a PhD in signal processing. After joining the *French Institute for Ocean Research* IFREMER in 1994, he specialized in underwater robotics focusing on navigation, mapping and optical inspection of the deep ocean sea-floors. Since 2014 he is head of the *Unit for Underwater Systems*, which develops and operates underwater vehicles for research within the French Oceanographic Fleet.

Thomas Roure, Coming soon

Website: https://wwz.ifremer.fr/cmsm_eng/Projet-CORAL

Description: The development of a new 6000m AUV has started in 2016 and aims at enlarging the family of deep-sea vehicles in the *French Oceanographic Fleet*. The vehicle development is embedded in a set of industrial partnerships.

The CORAL AUV is designed as a novel AUV for exploration, monitoring and inspection dives in association with the deep-sea intervention vehicles like Victor6000 or Nautile, deployed from full ocean research vessels. It will be capable of diving down to 6000m covering up to 250km track lines in up to 48h per dive, running acoustic bathymetric mapping and sea-floor imagery, and taking optical images for inspection and local 3D mapping while hovering close to the sea-bed. In addition to the generic mapping functions, the vehicle will implement scientific payload modules up to 500W-200kg with specific sensor packages for biological, environmental or geophysical investigations. The AUV will measure 4,5m in length and weigh 2,7T, it is equipped with 28KWh of energy capacity in dry LI batteries.

The development has been led in close cooperation between IFREMER's engineering teams and ECA-Robotics (Toulon-France). As ECA is designing and building the vehicle to IFREMER requirements, the Institute's Underwater Systems Unit develops the ROS-based vehicle controller, mission programming and management software, payload modules as well as support systems for operations at sea. The project is today in the phase of manufacturing, and the vehicle will be integrated during the second half of 2019 before running several trial cruises in 2020.

PRESENTATIONS – Wednesday, 15th May, 11:10-11:30h

Title: OASYS Project - an overview

Speaker: Alfredo Carella, *OsloMet, Norway*

Alfredo Carella is Associate Professor at the Department of Mechanical, Electronics and Chemical Engineering at OsloMet – Oslo Metropolitan University. He holds a Mechanical Engineering degree from Instituto Balseiro, Bariloche, Argentina and a PhD in Industrial Process Engineering from the Norwegian University of Science and Technology (NTNU), Trondheim, Norway. He has worked as Senior Mechanical Engineer at DNV GL Maritime, Norway. Alfredo's research interests include Finite Element Methods, computational fluid mechanics, vibration analysis, and machine learning.

Website: http://www.oasys-project.eu/

Description: The OASYS project will develop and demonstrate an innovative type of fully automated Ocean-Air coordinated robotic operation that has the potential for drastically reducing the cost of ocean observing systems. The project proposes the development of a swarm of low cost Micro Underwater Gliders (MUGs) that can operate autonomously with the support of Unmanned Aerial Vehicles (UAVs) and Unmanned Surface Vessels (USVs) for deployment, recovery, battery charging, and communication relay.

PRESENTATIONS – Wednesday, 15th May, 11:30-11:50h

Title: From Coasts to Depths - Strengthening our autonomous presence in the Ocean

Speaker: João Borges de Sousa, *LSTS-FEUP, Portugal*

João Tasso de Figueiredo Borges de Sousa is with the Electrical and Computer Engineering Department from Porto University in Portugal and he is also the head of LSTS (Underwater Systems and Technologies Laboratory).
His research interests include autonomous underwater, surface and air vehicles, planning and execution control for networked vehicle systems, optimization and control, cyber-physical systems, and applications of networked vehicle systems to the ocean sciences, security and defense.
He has been involved in fostering and growing a world-wide research community in this field with yearly conferences and workshops in the areas of Hybrid Systems, Networked Vehicle Systems and Unmanned Vehicle Systems. He was the chair of the 2013 IFAC Navigation, Guidance and Control Workshop and of 2018 IEEE OES AUV Symposium. He has authored over 400 publications, including 40 journal papers.

Website: https://www.lsts.pt/

Description: Since its inception, more than 20 years ago, the Laboratório de Sistemas e Tecnologia Subaquática (LSTS) at FEUP has been engaging in and coordinating large scale field experiments, with autonomous vehicles, ranging from coastal to high sea regions. This focus on large and diversified deployments, centered on concepts of operation with high practical applicability, has led the LSTS to currently participate in various development challenges not only on the command and control aspect of this systems but also in the development and expansion of its current system fleet. These projects work in tandem with each other to ultimately create a network of autonomous systems which can have a persistence presence in the ocean ranging from the surface to its depths.

PRESENTATIONS – Wednesday, 15th May, 11:50-12:10h

Title: EUMarineRobots - One year review of community engagement

Speaker: João Borges de Sousa, *LSTS-FEUP, Portugal*

João Tasso de Figueiredo Borges de Sousa is with the Electrical and Computer Engineering Department from Porto University in Portugal and he is also the head of LSTS (Underwater Systems and Technologies Laboratory). He is the coordinator of the H2020 EU Marine Robots project. His research interests include autonomous underwater, surface and air vehicles, planning and execution control for networked vehicle systems, optimization and control, cyber-physical systems, and applications of networked vehicle systems to the ocean sciences, security and defense. He has been involved in fostering and growing a world-wide research community in this field with yearly conferences and workshops in the areas of Hybrid Systems, Networked Vehicle Systems and Unmanned Vehicle Systems. He was the chair of the 2013 IFAC Navigation, Guidance and Control Workshop and of 2018 IEEE OES AUV Symposium. He has authored over 400 publications, including 40 journal papers.

EUMR

EUMarineRobots

Marine robotics research infrastructure network

Website: www.eumarinerobots.eu

Description: The marine-robotics industry is growing rapidly and is a crucial high-value/high-cost sector with considerable entry barriers to R&D. Currently, Europe leads in many aspects of maritime, but lacks well integrated and coordinated oceanic robotic infrastructure or presence. It's in this challenging environment that EUMarineRobots (EUMR) emerges. The main objective of the EUMR project is to open up key national and regional marine robotics research infrastructures (RIs) to all European researchers, from both academia and industry, ensuring their optimal use and joint development to establish a world-class marine robotics integrated infrastructure. After its one year mark an analysis of the work, outreach efforts and results is done to better frame the road for the years to come.

PRESENTATIONS – Wednesday, 15th May, 12:10-12:50h

Title: Pôle Mer Méditerranée - a regional Cluster for Blue Economy

Speaker: Alain FIDANI, *Pôle Mer Méditerranée, France*

Alain FIDANI got a Master Degree in Physics from The University of Paris-Sud Saclay (PARIS XI) in 1987 and graduated from ENSTA-ParisTech in 1989 in System Engineering. During his career, he worked for STANFORD University's Robotics Laboratory, AIRBUS, CYBERNETIX and TECHNIP before joining ECA GROUP. His technical expertise lies in control, robotics, and autonomous systems for hazardous environments. He has an extensive experience working on projects with customers from the oil&gas, nuclear, and defence industries. He is today the Director of Research & Innovation for ECA ROBOTICS. He also works for the Pole Mer Mediterranée where he is in charge of the Deep Offshore and Robotics activities.

Website: https://www.polemermediterranee.com/

Description: In 2017, the Pôle Mer Méditerranée has launched a new working group called the GT ROBOTIQUE. This initiative caught the attention of about 40 members of the Pôle. The group is composed of small and medium size companies, midcaps, and large corporations, as well as national institutions and public research laboratories.
The presentation will underline the main objectives and activities carried out by the Pôle and its members during the past two years with a special focus on the technological challenges addressed in robotics illustrated by a few emblematic R&D projects presented by the actors themselves.

PRESENTATIONS – Wednesday, 15th May, 14:00-14:20h

Title: RoboVaaS - Robotics Vessels as-a-Service

Speaker: Gerard Dooly, *Centre for Robotics & Intelligent Systems, Ireland*

Dr. Gerard Dooly has worked extensively in sensor development and marine robotics at UL for over 10 years. His research interests include real-time 3D reconstruction, real-time dense SLAM, subsea structural health monitoring, teleoperation and automated manipulation. He is focused on the design and development of underwater robotics and has engaged in numerous offshore maritime operations and survey missions both here in Ireland and on the continent. Some of his recent offshore operations involved environmental sensing, anti-mine countermeasure ops, remote vehicles for incident response, archaeological survey and ROV operations on high-energy sites. He has a keen interest in underwater shipwreck discovery, survey and identification and has participated in many deep water diving expeditions worldwide, successfully diving and identified newly discovered shipwrecks to depths of up to 135 metres. He has published over 26 journals, 85 conference proceedings, 1 granted patent, 1 patent in review.

Website: https://www.martera.eu/projects/robovaas

Description: The RoboVaaS project concerns the development of on-demand unmanned underwater and surface vehicle services for shipping and nearshore industries. The system will be facilitated by interconnected vehicles equipped with specialized sensor technology, a reliable data transfer cloud network for over- and underwater communication, a monitoring station and a real-time web-based user interface. Autonomous vessel technology will be used where possible; however, some operations will offer human control from shore e.g. teleoperated remotely operated vehicles. Targeted use cases include anti-grounding, inspection services and emission and bathymetry measurements. The disruptive concept has the potential to improve maritime and human safety, to increase flexibility and accessibility of European waterways and to reduce costs for a multitude of maritime stakeholders.

PRESENTATIONS – Wednesday, 15th May, 14:20-14:40h

Title: H2O Robotics

Speaker: Nikola Mišković, *University of Zagreb Faculty of Electrical Engineering and Computing; H2O Robotics, Croatia*

Nikola Mišković is an Associate Professor at University of Zagreb, Faculty of Electrical Engineering and Computing (UNIZG-FER), Laboratory for Underwater Systems and Technologies (https://labust.fer.hr/). He is a co-founder of H2O Robotics, a UNIZG-FER spin-off company. His research interests include cooperative control in marine robotics, human-machine interaction in the underwater, and navigation, guidance and control.
He is a Senior Member of IEEE (president of Chapter for Robotics and Automation of the Croatian Section from 2016 to 2019), IFAC (member of the Technical Committee on Marine Systems) and Centre for Underwater Systems and Technologies (vice-president since 2010). In 2013 he received the young scientist award "Vera Johanides" of the Croatian Academy of Engineering (HATZ) for scientific achievements, and he received the annual State science award for 2015, awarded by the Croatian Parliament.

H2O ROBOTICS

Website: https://h2o-robotics.com/

Description: H2O Robotics is a spin-off company of University of Zagreb, Faculty of Electrical Engineering and Computing, Laboratory for Underwater Systems and Technologies (LABUST). Mission of H2O Robotics is to help maritime industry increase safety of underwater workers, offer innovative solutions to maritime challenges and help preserve our seas and oceans.

As the biggest and main maritime research facility in the region, LABUST is able to provide H2O Robotics with latest advancements in technology and science, which can then be used to offer competitive products and services to clients worldwide in a commercial and business environment.

PRESENTATIONS – Wednesday, 15th May, 14:40-15:00h

Title: ROBINS - Robotics Technology for Inspection of Ships

Speaker: Enrico Carrara, *RINA Services S.p.A., Italy*

Enrico Carrara is a technical officer of the Marine Excellence Center at RINA and member of the Cyber System Panel and of the Joint Working Group on Cyber Systems in IACS, the International Association of Classification Societies. He is an expert in software engineering, artificial intelligence, embedded systems and robotics. He has also participated to several R&D projects on Robotics applied to Marine Industry and he is currently the Technical Coordinator of the ROBINS project (H2020 ICT-25-2017 #779776).
He has strong personal interest in software engineering, robotics, new technologies, open source and crowdsourcing development models, innovation and powerful ideas.

ROBINS
ROBotics technology for INspection of Ships

Website: https://www.robins-project.eu/

Description: ROBINS (ROBotics technology for INspection of Ships) aims at filling the technology and regulatory gaps that today still represent a barrier to the adoption of Robotics and Autonomous Systems (RAS) in activities related to inspection of ships. The technology gap is mainly related to the capability of RAS to provide at least outcomes equivalent to those obtained by traditional procedures. On the other side, the regulatory gap is mainly related to the possibility to verify such equivalence. The development of robust technical solutions for RAS-assisted ship inspection, based on the understanding of the challenges being faced by asset owners, is expected to streamline wide scale adoption of RAS technology in marine industry.

PRESENTATIONS – Wednesday, 15th May, 15:00-15:20h

Title: iBubble

Speaker: Solène Guéré, *Notilo Plus, France*

notilo plus

Website: http://www.notiloplus.com/

Description: Coming soon

PRESENTATIONS – Wednesday, 15th May, 15:20-15:25h

Title: PLOCAN Glider School

Speaker: Daniel Alcaraz, *PLOCAN, Spain*

Daniel Alcaraz is working as H2020 Project Manager at PLOCAN. He has been working on the private sector as a consultant for Ericsson and also on R&D project management for Innovalia Association. On the public sector, he has been working nearly three years for the Institute of Applied Microelectronics of the University of Las Palmas de Gran Canaria (IUMA) involved in research projects for the DSI and DMEMS divisions. His qualification includes a PhD in Telecommunication Technologies, M.S. degree in Telecommunication Engineering from IUMA and a M.S. degree in Renewable Energies from the University of San Pablo CEU Madrid.

Website: http://www.gliderschool.eu/

Description: PLOCAN is an initiative committed with both its adjoining socioeconomic environment and the international excellence in science and technology. Hence, it promotes this Glider School call which is oriented towards university students in the marine-maritime and technological scopes, as well as technicians/ professionals of the sector. The objective is to train them in theoretical and practical abilities and skills concerning underwater vehicles, as gliders. This edition is supported by the H2020 EUMarineRobots initiative.

PRESENTATIONS – Thursday, 16th May, 15:25-15:30h

Title: Shiptest - A multimode Non-Destructive Testing robotic platform for ship inspections with underwater operation capability

Speaker: Kyriakos Berketis, *SpectrumNDT, Greece*

Kyriakos Berketis is a Programs Manager with SpectrumNDT, a privately held Quality Control services provider in Greece. He holds a PhD in Composites Materials Engineering and is a practicing Materials Engineer with extensive experience in NDT R&D, materials failure analysis and characterization.
His research interests include NDT of Fiber Reinforced Polymer Composites and robotic systems development for inspection.

SPECTRE-X

Website: http://www.shiptest.eu/

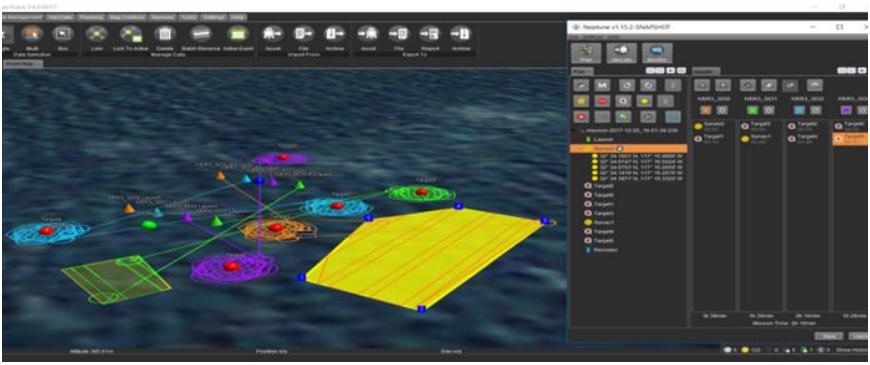
Description: The shipbuilding industry has extensive requirements for quality control of the welding works during new shipbuilding. Additionally, corrosion mapping is expected to replace traditional thickness gauging. Spectre-x is a fully submersible, down to 30 m, multi-mode robotic NDT inspection system that uses the well-established ACFM and PAUT techniques with universal acceptance in the NDT world regarding their flaw detection capabilities. It also integrates a laser profilometer for vision-based weld-center tracking and simultaneous real time surface visual inspection with selectable acceptance standards. A tethered tracked crawler uses permanent magnets for attachment on ferrous metallic surfaces. The Spectre-X inspection platform allows for a safe, reliable and digitally secured documented inspection. The system certainly introduces considerable cost reductions as it can provide all the inspection information required in a simultaneous dual/triple technique scanning pass, thus reducing the overall inspection time and associated cost substantially while a private cloud platform allows for great flexibility in inspection data handling, storage and assessment.

PRESENTATIONS – Thursday, 16th May, 15:30-15:35h

Title: Next Generation Autonomy Tools focused on improving HMI

Speaker: Alexis Urvoy, *SeeByte, UK*

Alexis Urvoy completed an Engineering Masters in Computer Science from the University of Technology in Belfort-Montbeliard, France before starting work at SeeByte in 2013. Alexis has provided key autonomous capabilities on a wide variety of SeeByte's commercial C2 and Autonomy products including Neptune and SeeTrack, which are sold to Navies worldside. In 2018 Alexis took over the management of SeeTrack and is responsible for delivering this product to SeeByte's international customers. In 2019 he was made an Engineer Manager, taking a lead role in all aspects of SeeByte's engineering group.



Website: http://www.seebyte.com/

Description: Unmanned Maritime Systems (UMS) are now being deployed for long periods of time to remote regions of the Oceans. Commercial autonomy solutions allow these vehicles to co-operatively fulfil the mission objectives but interactions with the operator are limited, in part due to sporadic and poor quality communication links. This talk will present some of SeeByte's latest developments in the area of HMI, including new multi-modal HMI interfaces and the use of Augmented Reality. Recent developments in expanding SeeByte's current autonomy suite to include large area planning and scheduling of multiple autonomous assets will also be presented.

PRESENTATIONS – Wednesday, 15th May, 16:00-16:20h

Title: Subsea remote docking technologies and resident ROV

Speaker: Manuel Lopes Mendes, *FORSSEA-ROBOTICS, France*

Manuel Lopes Mendes is a mechanical engineer at FORSSEA-ROBOTICS, who has graduated with the French engineering degree (Master) from the University of Technologies of Compiegne. Since 2017 he has been part of the FORSSEA where his work focused on designing ATOLL, a fully plug & play autonomous docking ROV (remote operated vehicle), as well as defining all the ATOLL system components by taking in account the Client's, environment and software constraints/needs. Currently, he coordinates the team developing FORSSEA's semi-autonomous ROV/AID Argos (Autonomous Inspection Drone) with Deep Ocean.

FORSSEA
ROBOTICS

Website: https://www.forssea-robotics.fr/

Description: Offshore subsea operations need for the most part the use of ROV systems, for inspection or intervention. In the current offshore niche market, the use of ROV systems resonates with the use of big constructions vessels to accommodate for their control team and other needs, even for smaller inspection type ROVs. The need to use such vessels drives the operations costs up by a factor of 5 at least. FORSSEA was created in 2016 with the aim to reduce subsea campaigns costs directly related to ROV operations by bringing autonomous capability to our systems combined with enhanced electronics and mechanical design. These characteristics make it possible for our system to be deployed from lighter vessels with minimal cost, and even autonomous surface vessels in the next years. After reaching this first full autonomous mark, our systems will keep evolving to reach the residency and further reduce the cost of operation.

PRESENTATIONS – Wednesday, 15th May, 16:20-16:40h

Title: Miniature flash imaging LiDAR for bathymetry - an experimental proof-of-concept

Speaker: Christophe Pache, *CSEM, Switzerland*

Christophe Pache received his M.S. degree in microengineering from the Swiss Federal Institute of Technology in Lausanne (EPFL) in 2008 and his PhD in 2012 from the same university on the development of techniques for 3D microscopy. After two years' experience in the development of optical systems, he joined CSEM in 2015. Since then, he has mainly been contributing to the development of LiDAR systems for space, as well as their diversification towards bathymetric applications. Now, acting as system engineer and project manager, he is also active in business development for setting-up new projects in collaborations with external partners.

Website: https://www.csem.ch/

Description: Nowadays, the advent of low-cost unmanned vehicles opens doors to new opportunities for bathymetric imaging. In comparison to state-of-the-art sonars, LiDARs offer a tremendous advantage in terms of spatial and axial resolutions for shallow water 3D mapping. However, existing systems either suffer from a lack of miniaturization to be mounted on small platforms or from a limited achievable water depth below 3 m in typical sea water.
At CSEM, we developed a prototype of a miniature flash imaging LiDAR in the frame of projects funded by the European Space Agency, compatible with vehicles capable to carry 7 kg payload, such as medium-sized USVs, ROVs or UAVs. This system, based on single-photon counting detector with advanced ranging functionalities, offers a spatial resolution of about 15 cm and a range precision below 5 cm at distances up to 200 m in air. Taking advantage of the high transmission of green wavelength underwater, we successfully performed a proof of concept for underwater 3D imaging of a sunk replica of a Roman boat.
This presentation aims at introducing CSEM's LiDAR concept and assess its potential for sub-surface bathymetric applications for which the acquisition of fast and accurate 3D information is key, such as mapping, infrastructure monitoring and objects detection. After reviewing the system's figures and proof-of-concept results, we provide details about processing needs and implementation to generate valuable data for the end-user. Finally, we provide an outlook towards solutions to tackle practical challenges.

Authors: C. Pache, A. Pollini, C. Meier, J. Haesler (CSEM), M. Perenzoni (FBK)

PRESENTATIONS – Wednesday, 15th May, 16:40-17:00h

Title: ROBUST - ready for sea trials

Speaker: Alessio Turetta, *GraalTech, Italy*

Alessio Turetta received the Graduation degree in Software Engineering and the Ph.D. in Robotics from the University of Genova, Italy, in 2000 and 2005, respectively.
After a brief experience as Business Analyst in McKinsey & Co, in 2001, he started the cooperation with Graal Tech, as a Control System Consultant. In parallel, since 2005, he had a scientific and teaching career with the University of Genova, where he got the permanent position of Lecturer and Assistant Professor. During years, his relationship with Graal Tech consolidated, and he became first Director and then Partner. In 2015 he left the University and became Business Development Manager in Graal Tech, taking care of the EU projects and other R&D projects for international customers.
His research interests include swarms of unmanned vehicles, underwater acoustics, systems engineering, and software architectures for multi-vehicle systems.

Website: www.eu-robust.eu

Description: There is a need to develop an autonomous, reliable, cost effective technology to map vast terrains, in terms of mineral and raw material contents which will aid in reducing the cost of mineral exploration, currently performed by ROVs and dedicated SSVs and crew. Furthermore there is a need to identify, in an efficient and non-intrusive manner, the richest mineral sites.
The ROBUST proposal aims to tackle the aforementioned issues by developing sea bed in situ material identification through the fusion of two technologies, namely laser-based in-situ element-analyzing capability merged with underwater AUV (Autonomous Underwater Vehicle) technologies for sea bed 3D mapping. This will enable resource identification done by robotic control enabled by the synergy between AUV hovering and manipulator capabilities. The underwater robotic laser process is the Laser Induced Breakdown Spectroscopy (LIBS), used for identification of materials on the sea bed. The AUV Robotic vehicle will dive, identify the resources that are targeted for LIBS scanning through 3D real time mapping of the terrain (hydro-acoustically, laser scanners, photogrammetry) and position the LIBS in the required locations of mineral deposits on the ocean floor to autonomously perform qualitative and quantitative analyses.

PRESENTATIONS – Wednesday, 15th May, 17:00-17:20h

Title: Making AUVs more autonomous using Sparse-LBL

Speaker: Yann Casamajou, *iXblue, France*

Yann Casamajou was graduated in 2000 from ENSEEIHT high school in Toulouse (France), with a master degree in Electronics and Signal Processing. After few years working in RF signal processing market, he entered iXBlue Acoustic Product Division in 2008 to conduct studies and developments of various positioning solutions, starting with the new generation of deep-water positioning system for IFREMER.

His global system knowledge of mixed inertial and acoustic systems recently conducted him to take the lead of RAMSES and COMMET product lines within iXBlue. He is now charge of both business and technical developments on these systems.

Website: https://www.ixblue.com/

Description: The use of Autonomous Underwater Vehicles (AUV) is now commonplace throughout scientific community, most of them being usually equipped with high grade Inertial Navigation Systems (INS) to minimize the position uncertainty during long navigation patterns.

However, despite their excellent level of performances, AUVs usually remain dependent on USBL tracking by surface vessels, which is often required for security reasons to monitor their drift real-time, and to also allow offline enhancement of acquired data through post-processing.

Based on field data acquired on IFREMER IdefX AUV, this paper shows how sparse-LBL systems can further increase vehicles' capability to really work autonomously, and how –with a single transponder deployed on seabed- the vehicle can conduct long survey operations, fixing potential drift in the water column during the dive, keeping full accuracy on tens of km^2 for hours or days, and ultimately removing the need for vessel supervision during ops.

PRESENTATIONS – Thursday, 16th May, 17:20-17:40h

Title: The future of subsea survey

Speaker: Felipe Lima, uSEA, *Norway*
Felipe Lima holds a Eng. degree in Production Engineering from Rio de Janeiro State Federal University, a MSc in Subsea Engineering from University of Aberdeen and a MSc in Innovation and Entrepreneurship from University of Oslo. He started with uSEA in 2017, after working in some of the most innovative offshore projects in Norway, Japan, Brazil and other countries. Since 2007 he has held several positions in Subsea 7, Aker Solutions and Xodus Group. Before joining the oil and gas industry, Felipe served for four years in the Brazilian Navy.
His main interests are on the application of marine and underwater robotics in industrial scale.

Website: http://useatechnologies.com/

Description: The industry has identified that marine operations must be more efficient, safer and cleaner. In seabed survey and subsea inspection in particular, there is a very interesting dichotomy: whereas the underwater robots create most of the value gathering underwater data, the surface vessels are the main cost, emission and hazard drivers.
The above contrast has motivated the industry to promote a change with the adoption of unmanned and autonomous underwater systems based on subsea docking stations. That is an attractive solution for areas with subsea infrastructure that require frequent inspection or intervention. In areas with smaller and/or simpler subsea infrastructure, however, the benefits of resident underwater drones may not pay off the required investment. For these cases, mobile "subsea garages" may be an alternative, as they will free up the surface vessel while the subsea missions are undertaken. However, the latter still requires a vessel with crane and other facilities to deploy and recover the mobile subsea garage.
uSEA is developing and qualifying a system that fills that gap. The system is a relatively compact unmanned surface vessel (USV) that is capable of transporting, launching, recovering, recharging batteries and transferring data with one or more AUVs. It comprises only what is essential to serve as a mobile, floating AUV docking station, with the following key benefits:
Far more cost-efficient than a conventional survey vessel

- Minimised emissions
- No risk to human lives onboard
- Healthier working environment for operators - located onshore

While uSEA system can perform offshore campaigns as a standalone system, it can also operate in combination with conventional vessel-based and subsea docking station-based systems, optimising the overall system value.

PRESENTATIONS – Thursday, 16th May, 9:00-9:40h

Title: The Science Junction Box in the KM3NeT, an EMSO ERIC underwater observatory (part 1) & BathyBot – the deep-sea crawler to see the unseen of the NW Mediterranean Sea (part 2).

Speakers: Jennifer Greer, *IFREMER, France* & Christian Tamburini, *MIO-CNRS, France*

Jennifer Greer joined IFREMER's Underwater Systems Unit as an Electronic Engineer after graduating from INSA Rennes engineering school in 2015 with a Master's degree in Communication Systems and Networks and a Master's degree by research in Electronics. She is pleased to have contributed to several EU-funded projects: FixO3 TNA, FP7 Eurofleets2, EUMR, KM3NeT, MEUST-NuMerEnv and EMSO. Her research interests include underwater vehicles and observatories, multi-sensor hubs and control systems, electronics and industrial computing.

Christian Tamburini, CNRS Senior Scientist (MIO, Marseille, France), does research in microbial oceanography, biological carbon pump and bioluminescence with a specific focus on the deep sea. For such an aim, he has been involved in several research expeditions at sea (more than 340 days) and he has contributed to the development of several deep-sea tools including high-pressure systems.

emso
ERIC
EUROPEAN RESEARCH INFRASTRUCTURE CONSORTIUM

Website: http://emso.eu/

Description:

Part 1: The KM3NeT and EMSO ERIC underwater observatory is deployed in the Mediterranean Sea 50km off the coast of Toulon, France, at a depth of 2400m with an electro-optical cable connecting it to the shore. This observatory is composed of a next-generation neutrino telescope based on the experience acquired with the ANTARES prototype and an infrastructure dedicated to the observation of the underwater environment that is a part of the EMSO ERIC (European Multidisciplinary Seafloor and water column Observatory). The Science Junction Box in this monitoring infrastructure is the key element that provides the powering and the real-time internet link for up to six deployed scientific pieces of equipment. This part of the presentation describes the functional characteristics of the Scientific Junction Box in the KM3NeT infrastructure and the intervention operations performed on it with small ROVs.

Part 2: The deep sea remains one of the less known environments on earth and is characterized by its high pressure, low organic matter availability and its darkness. While there are still numerous discoveries awaiting the capabilities of deep-sea organisms, this ecosystem is under an increasing pressure due to anthropogenic stressors such as carbon sequestration related to climate change, deep-sea fishing, mineral mining, oil and gas extraction. These changes are impacting deep-sea biodiversity and biogeochemistry as well as optical properties by sediments re-suspension. How these changes will affect communication between species is one question of major importance for the future.

In the framework of the EMSO ERIC network, we will implement 'BathyBot' a deep-sea crawler on the observatory. It will be linked to the Scientific Junction Box at this KM3NeT and EMSO ERIC site. BathyBot, provided by iSeaMC, will be deployed in November 2019 using the engineering conception of the CNRS-DT-INSU engineers. Over an area of about 15 000 m^2, BathyBot will be devoted to 1) explore relationships between deep-sea organisms, biogeochemical (carbon, oxygen) and environmental variables (temperature, salinity, current) in the context of global changes and their effects on the deep ocean, 2) better define the role of bioluminescence *in situ* (increasing the dataset of bioluminescence records) and 3) observe and monitor deep-sea pelagic and benthic organisms.

PRESENTATIONS – Thursday, 16th May, 9:40-10:00h

Title: Underwater umbilical management between two robots

Speaker: *Vincent Hugel, COSMER Lab, University of Toulon, France*

Vincent Hugel is Full Professor at the University of Toulon. He holds a Ph.D. degree and a Research degree in robotics from the Paris VI and Versailles Universities. He was involved in the national project, ROMEO, that aimed to design assistant humanoid robots, and he was collaborating with biologists from the National Museum of Natural History. From 1998 to 2012, he participated in the RoboCup standard platform League. Since 2014 he leads the COSMER Lab, developing research activities on mobility and autonomy of marine robots, currently involved in several projects with marine technology institutes and companies, e.g. the CORAL project lead by IFREMER.

Description: This presentation will focus on research activities dedicated to the management of underwater umbilicals between two robots. Two cases are under study. In the first case, an underwater leader robot and an underwater follower robot are linked by a passive tether. The follower robot is controlled to follow the leader which is a ROV while maintaining a desired shape of the tether, assuming the tether is slightly weighing. In the second case, an underwater robot is linked with a USV through an active cable whose length can be varied thanks to a smart winch located on board the surface boat. The objective here is to reduce the impact of the cable on the underwater robot while allowing it to execute its mission. These developments aim to enable autonomous or semi-autonomous exploration of the sea. The first scenario can be useful to explore underwater caves, pipes or even wrecks, whereas the second scenario can serve to monitor or map shallow water seabeds. These activities are developed within the framework of two ongoing PhD in cooperation with the French SUBSEATECH company.

PRESENTATIONS – Thursday, 16th May, 10:00-10:20h

Title: OceanRINGS+ - Making Complex Subsea Tasks Simple

Speaker: Edin Omerdic, *University of Limerick, Ireland*

Edin Omerdic received Dipl. Eng. and M.S. degree in electrical engineering from the University of Zagreb, Zagreb, Croatia, in 1997 and 2001 respectively, and Ph.D. in electrical engineering from the University of Wales, Newport, United Kingdom in 2004. He is currently a Senior Research Fellow at the Department of Electronic and Computer Engineering, Centre for Robotics & Intelligent Systems, University of Limerick, Ireland.
Edin is the main developer & designer of OceanRINGS concept & software suite, including the design of state-of-the-art control architecture for ROV LATIS, MRE ROV Étaín and I-ROV. Edin's research interests include: Modelling & Simulation of Dynamic Systems, Real-Time Simulators & Real-Time Embedded Control Systems, Virtual Reality, Augmented Reality, Simulated Reality, Multi-Modal Human Machine Interface for Cyber-Physic Systems based on AI techniques (VR headsets, speech recognition, hand gesture recognition), Machine Learning, Application of AI Techniques (Neural Networks and Fuzzy Logic) in Intelligent Systems, Guidance, Navigation and Control System for Marine Platforms, Nonlinear Control Systems, Underwater Robotics, Fault-Tolerant Systems, Internet of Things and Network Security.

Website: www.mmrrc.ul.ie/dotnetnuke/mmrrc/ResearchProjects/OceanRINGS.aspx

Description: The OceanRINGS+ is an extended version of OceanRINGS software suite, providing modules for smart control of a range of heterogeneous vehicles, including ROVs, USVs, UAVs, etc. The new user interface enables interaction with system agents using state-of-the-art emerging technologies, such as VR headsets, speech recognition, 6 DoF input devices, and touch screens. The smart control interface of OceanRINGS+ has been validated during research cruise CE19001 in January 2019, where the work-class ROV Étaín, deployed from support vessel Celtic Explorer via Tether Management System (TMS), performed several complex subsea tasks with extreme accuracy and quality. This presentation will show results from these trials and discuss further steps in development.

PRESENTATIONS – Thursday, 16th May, 10:20-10:40h

Title: ECOBOTICS.SEA – Bio-inspired Technologies for a Sustainable Marine Ecosystem

Speaker: Jorge Lobo, *ISR - University of Coimbra, Portugal*

Jorge Lobo is a tenured Assistant Professor at Coimbra University, working at the Electrical and Computer Engineering Department, and researcher at the Institute of Systems and Robotics, ISR-UC, working in computer vision, sensor fusion, and mobile robotics. His research interests focus on visuo-inertial computer vision systems, Bayesian models for multimodal perception of 3D structure and motion, and low power edge computing solutions for probabilistic approaches using reconfigurable hardware. He has been involved in several EU projects, including BACS - Bayesian Approach to Cognitive Systems, and HANDLE - Developmental pathway towards autonomy and dexterity in robot in-hand manipulation, and recently in BAMBI - Bottom-up Approaches to Machines dedicated to Bayesian Inference. He is an IEEE senior member and vice-president of the RAS Portuguese Chapter

Website: https://ecobotics.isr.uc.pt/

Description: ECOBOTICS.SEA (H2020-MSCA-RISE-2018 n. 824043) is an international research and training project that will meaningfully extend the current state-of-the-art on robotics for the analysis and monitoring of marine species communities, focusing mainly on aquatic biodiversity. The long-term aim is to provide better range and quality of ecological services that can have a high societal and economic impact on quality of life, including quality of water, cultural heritage and recreation activities, sustainable food production, raw materials and medicine. Interdisciplinary research will be carried out on how autonomous, interactive, and also biomimetic, underwater robots can support Ecologists and other stakeholders in this domain, providing powerful novel tools that may help them tackle fundamental issues in the Environment, and open new business opportunities for companies investing in the fast-growing eco-market.

PRESENTATIONS – Thursday, 16th May, 10:40-11:00h

Title: subCULTron – Swarm Robotics in the Lagoon of Venice

Speaker: Ronald Thenius, *Karl-Franzens-University, Austria*

Ronald Thenius currently researcher in the subCULTron project. Since 2004 he works in the Artificial Life Lab of the University of Graz. After his Ph.D. (Biology) he has been participating in the EU-funded projects I-SWARM, Symbrion, Replicator and CoCoRo. His main fields of research are swarm robotics, bioinspried robotics and bio mimicry in robot control, with a special focus on slimemould, honeybees and vertebrate neuronal systems as archetypes. The "long distance goal" of his research is the development of a general model of organization in swarms of biological lifeforms, to allow to generate control strategies for swarms of autonomous artificial entities.

Website: http://www.subcultron.eu/

Description: subCULTron aims for achieving long-term autonomy in a learning, self-regulating, self-sustaining underwater society/culture of robots in a high-impact application area: Venice, Italy. Our heterogeneous system consists of 3 different agent types: On the sea-ground, artificial mussels are the collective long-term memory of the system, allowing information to stay beyond the runtime of other agents, thus allowing to continue learning from previously learned states. These mussels monitor the natural habitat, including biological agents like algae, bacterial incrustation and fish. On the water surface, artificial lily pads interface with the human society, delivering energy and information influx from ship traffic or satellite data. Between those two layers, artificial fish move/monitor/explore the environment and exchange info with the mussels and lily pads. Artificial mussels are novel class of underwater agents. We aim to push forward the edge of knowledge with novel sensors (electric sense / electro-communication), novel bio-inspired algorithms and novel energy harvesting in underwater scenarios.

PRESENTATIONS – Thursday, 16th May, 11:20-11:40h

Title: ROS - A backbone for collaborative robotics software development: an example of system implementation of IFREMER's HROV

Speaker: Lorenzo Brignone, *IFREMER, France*

Dr Lorenzo Brignone is a mechanical engineer with 15 years' experience in the design and development of underwater vehicles and autonomous systems. After receiving his PhD in AI and autonomous manipulator control, his main focus has turned to the development of autonomous underwater vehicle prototypes targeting several applicative domains. These range from scientific exploration, oil and gas survey and exploitation, mine detection and disposal.
Since joining IFREMER he led the development of the embedded controller of IFREMER's latest HROV Ariane and he is now in charge of the new deep diving AUV program for the Institute. As head of the Robotics and Applications Laboratory within the Underwater Systems Unit at IFREMER he is also actively involved in a number of R&D activities within the institute and in international consortia.

Description: The HROV Ariane is the most recent underwater vehicle being entirely engineered, developed and successfully deployed into operation by Ifremer. This novel robotic platform is intended for use in scientific and oceanographic exploration; being a hybrid ROV/AUV, Ariane is able to combine both high resolution mapping and sampling/intervention tasks. Several innovative features have been integrated into the design at multiple levels: architectural, functional and operational.

The vehicle's embedded control system is based on a distributed architecture using the open source ROS middleware for inter-process communication. This makes of HROV Ariane the first deep diving operational underwater platform entirely based on ROS.

The presentation will focus on Ifremer's experience in developing the embedded control system and the perspectives of scaling the system up to suit the remaining operational platforms (tethered, manned and autonomous) operated by the Institute. Stemming from this experience, the joint effort among several partners and institutes aiming to build and develop a wider ROS community for underwater applications will also be presented and discussed.

PRESENTATIONS – Thursday, 16th May, 11:40-12:00h

Title: MATRAC

Speaker: Massimo Caccia, *CNR, Italy*

Massimo Caccia, (MSc 1991) joined the Italian National Research Council as a researcher in May 1993 and has been senior research scientist since 2002. From October 16, 2013 to October 15, 2017 he was Director of the Institute of Intelligent Systems for Automation (ISSIA), and Acting Director until May 2018. He has authored over 150 papers in international journals and conferences in the area of marine robotics, focusing on modeling and identification, (cooperative) navigation, guidance and control, and prototype deveopment of Unmanned Marine Vehicles. He coordinated, among others, the projects: "SEa Surface Autonomous MOdular unit" funded by National Antarctica Research Programme in (2002-2004), "Harbour and coastal underwater anti-intrusion system" funded by the IARP-FESR Regione Liguria programme (2005-07), "Unmanned Multipurpose Vessel" funded by the Scientific and Technological Park of Liguria (2007-08), "MATRAC-ACP (Adaptive Real-time monitoring with sampling automation - Harbor and coastal waters)" (2018-2021). He was CNR scientific leader in the projects EC projects MINOAS (2009-2012), CART (2011-2013),and MORPH (2012-2016), and member of the Steering Committee of the EC projects CADDY (2014-2016), and EXCELLABUST (2014-2016). From 2017 he is member of CapTech Guidance, Navigation and Control (GNC) of the European Defence Agency.

Website: http://interreg-maritime.eu/fr/web/matracacp/projet

Description: The MATRAC-ACP (Adaptive Real-time monitoring with sampling automation - Harbor and coastal waters) project aims at defining innovative water monitoring protocols based on the use of Unmanned Marine Vehicles and adaptive sampling strategies. The project, coordinated by the Institute of Marine Engineering of the Italian National Research Council, and has a partnership constituted by CNR Institute for Applied Math- ematics and Information Technologies "Enrico Magenes"; Earth, Environment and Life Department of University of Genova; and IFREMER. MATRAC-ACP, started in April 2018 with a foreseen duration of three years, is funded by the Interreg Maritime Italy-France Programme. The presentation deals with project issues and proposed approaches, focusing on innovative robotics and geochemical adaptive sampling methodologies. The activities carried out during the first year of the project will be presented, providing a view of the foreseen adaptation of existing AUV platforms to operate in harbour waters.

PRESENTATIONS – Thursday 16th May, 12:00-12:20h

Title: BLUEMED

Speaker: Đula Nađ, University of Zagreb, Faculty of Electrical Engineering and Computing, *LABUST, CROATIA*

Đula Nađ is a member of the Laboratory for Underwater Systems and Technologies (LABUST) since 2009. During his time, he worked on numerous European and national projects in the field of marine robotics. On two occasions, he participated in the visiting researcher programme at NATO Centre for Maritime Research and Experimentation (CMRE) conducting research in autonomous mine-countermeasures. He acquired his PhD in 2017, and his research interests include guidance, control and navigation of underwater vehicles, embedded control systems and lately diver-robot interaction.

Website: https://bluemed.interreg-med.eu/

Description: The Mediterranean coastal region and its islands benefit from its important natural and cultural assets thanks to their geomorphic characteristics and from the resulting tourism-based economies. However, Mediterranean coastal areas and islands are vulnerable to the climate change's effect and consequently face various common challenges such as the necessity to coordinate policies and strategies adjusted to their specific needs in order to support a sustainable economic development; the need to protect their natural and cultural heritage and to use them as assets for a sustainable and responsible tourism development; and the necessity to develop measures to tackle the effects of the climate change.

The BLUEMED project goal is to plan, test and coordinate Underwater Museums, Diving Parks and Knowledge Awareness Centres in order to support sustainable and responsible tourism development and promote Blue growth in coastal areas and islands of the Mediterranean. The talk introduce the main elements of the BLUEMED project, with more focus on technical concepts, and will present what was done to date.

PRESENTATIONS – Thursday 16th May, 12:20-12:40h

Title: IQUA Robotics - reconfigurable AUVs for research

Speaker: Joseta Roca and Guillem Vallicrosa, *IQUA Robotics*

Joseta Roca holds a MSc in Business Innovation and Technology Management and is a graduate in Business Administration. Since 2008 she's been involved in Business Development and Technology Management at the Computer Vision and Robotics research lab (ViCOROB) at the University of Girona. For her role in the lab, specialized in technology transfer and technology valorization processes, she was directly involved in the creation of IQUA Robotics and is part of the company's team. She currently works as a management assistant at IQUA and as a Project manager at ViCOROB.

Guillem Vallicrosa holds a PhD on Technology by the University of Girona. He's an Industrial Engineer and a MSc in Computer Vision and Robotics. Since 2012, Guillem has been part of Girona Underwater Vision and Robotics Research Lab (CIRS) and has focused his work on online localization algorithms for AUVs. He currently works at the University of Girona as a Post-Doctoral fellow and as a software engineer at IQUA Robotics. His research interests include unmanned vehicle systems, simultaneous localization and mapping (SLAM), communications and coordination of multiple dynamic systems, systems engineering and management architectures for multi-vehicle systems.

Website: http://iquarobotics.com/

Description: IQUA Robotics designs, manufactures and commercializes Autonomous Underwater Vehicles (AUVs) which can be adapted for a wide range of research and professional applications. The main products of the company are Girona 500 and Sparus II, two lightweight and versatile vehicles, which can be easily configured for any task thanks to their open conception from both the software and hardware points of view. These characteristics make IQUA's AUVs highly suitable for research laboratories. Examples of the customer's applications will be presented, as well as the current research projects in which IQUA is working for incorporating state of the art technologies, in the near future.

Thank you all for your participation.

We hope to see you at the next
EMRA'20 Workshop
in Italy, hosted by ISME.

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