

# Periodic Technical Report

## PART A

Project Acronym:	EXCELLABUST	
Grant Agreement number:	691980	
Project title:	Excelling LABUST in marine robotics	
Funding:	Horizon2020 Twining	
Call:	H2020-TWINN-2015	
Type of action:	CSA	
Start date of project:	1 <sup>st</sup> January 2016	
Duration:	36 months	
Period covered by the report:	from 01/01/2016 to 31/03/2018	
Periodic report	1 <sup>st</sup>	
Project website:	<a href="http://excellabust.fer.hr/">http://excellabust.fer.hr/</a>	
Delivery date:	06/04/2018	
Version:	1.0	
Lead participant	UNIZG-FER	
Dissemination level:		
PU	Public	X
CO	Confidential, only for members of the consortium (including the Commission Services)	



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 691980.



## SUMMARY FOR PUBLICATION

[Laboratory for Underwater Systems and Technologies \(LABUST\)](#) at the University of Zagreb Faculty of Electrical and Engineering (UNIZG-FER) in Croatia positioned itself in the last years as the regional leader in marine robotics: LABUST has the required technologies, people, infrastructure, and experience in field experiments. What LABUST is missing is research excellence that will allow it to fully exploit and bring available resources to a level compatible with internationally leading institutions in the area of marine robotics. The **main goal** of [EXCELLABUST](#) project is to address networking gaps and deficiencies between UNIZG-FER and internationally leading counterparts at EU level, by significantly strengthening marine robotics research within LABUST through twinning with expert partners.

The **first objective** is to increase UNIZG-FER marine robotics scientific excellence and innovation capacity, and raise staff's research profile within three strategic research domains (SRDs) that are aligned with the Strategic Research Agenda for Robotics in Europe 2014 - 2020: 1) mapping and perception, 2) advanced navigation, guidance, and control, and 3) autonomy and cognition. The **second objective** is to increase UNIZG-FER scientific involvement and visibility. These objectives will be reached through a set of strategic measures: staff exchanges and expert visits for providing S&T knowledge transfer; on-site trainings for providing hands-on S&T experience; innovation management trainings; organization of research-industry workshops for strengthening links to marine robotics industry; and joint organization of summer schools with strong emphasis on application of marine robotics for strengthening links to marine robotics end-users from marine biology, marine archaeology, oceanography, marine security, etc. In order to measure the quality of the twinning action, key impact indicators are defined and they will be monitored during and after the EXCELLABUST project lifetime.

### 1. Summary of the context and overall objectives of the project (For the final period, include the conclusions of the action)

[Laboratory for Underwater Systems and Technologies \(LABUST\)](#) at the University of Zagreb Faculty of Electrical and Engineering (UNIZG-FER) in Croatia positioned itself in the last years as the regional leader in marine robotics: LABUST has the required technologies, people, infrastructure, and experience in field experiments. What LABUST is missing is research excellence that will allow it to fully exploit and bring available resources to a level compatible with internationally leading institutions in the area of marine robotics. The **main goal** of [EXCELLABUST](#) project is to address networking gaps and deficiencies between UNIZG-FER and internationally leading counterparts at EU level, by significantly strengthening marine robotics research within LABUST through twinning with expert partners.

The **first objective** is to increase UNIZG-FER marine robotics scientific excellence and innovation capacity, and raise staff's research profile within three strategic research domains (SRDs) that are aligned with the Strategic Research Agenda for Robotics in Europe 2014 - 2020: 1) mapping and perception, 2) advanced navigation, guidance, and control, and 3) autonomy and cognition. The **second objective** is to increase UNIZG-FER scientific involvement and visibility. These objectives will be reached through a set of strategic measures: staff exchanges and expert visits for providing S&T knowledge transfer; on-site trainings for providing hands-on S&T experience; innovation management trainings; organization of research-industry workshops for strengthening links to marine robotics industry; and joint organization of summer schools with strong emphasis on application of marine robotics for

strengthening links to marine robotics end-users from marine biology, marine archaeology, oceanography, marine security, etc. In order to measure the quality of the twinning action, key impact indicators are defined and they will be monitored during and after the EXCELLABUST project lifetime.

## **2. Work performed from the beginning of the project to the end of the period covered by the report and main results achieved so far (For the final period please include an overview of the results and their exploitation and dissemination)**

### **Objective 1: Increase UNIZG-FER marine robotics scientific excellence and innovation capacity, and raise staff's research profile**

Overall we have organized **89** events that have contributed to the accomplishment of this objective.

- **S&T knowledge transfer:**
  - **4** staff exchanges from UNIZG-FER to partner institutions (each in the duration of two months)
  - **45** expert visit invited talks at UNIZG-FER and during BtS'16 and BtS'17 summer school
  - **10** expert visit tutorials at UNIZG-FER and during BtS'16 and BtS'17 summer school
- **hands-on S&T experience**
  - **2** on-site trainings by CNR in Genova, Italy and UdG in Girona, Spain
- **knowledge on innovation management**
  - **28** innovation management trainings on various topics

### **Objective 2: Increase UNIZG-FER scientific involvement and visibility**

Overall we have organized **13** events that have contributed to the accomplishment of this objective.

- **strengthen links to marine robotics industry:**
  - organized **2** "EU-funded projects in marine robotics and applications workshop - EMRA" (by CNR in Newcastle, UK, and by UdG in Girona, Spain)
  - **28** conferences and industrial events
- **strengthen links to marine robotics end-users**
  - **15** open-door events, **7** of which were organized at UNIZG-FER
  - **2** "Breaking the Surface" summer schools in 2016 and 2017 in Biograd na Moru, Croatia

## **3. Progress beyond the state of the art and expected potential impact (including the socio-economic impact and the wider societal implications of the project so far)**

The overall progress of the project as well as the impact of the results is best demonstrated through a list of Key Impact Indicators (KIIs) that have been defined in the project proposal. Even though not all KIIs have shown to be useful since they cannot be directly influenced through the set of proposed measures (e.g. the success rate in proposal funding), we provide a full table with the KIIs as they were

defined in the proposal. Some initial indicators have also been changed relative to the original table of indicators due to slightly different methodology.

KII 1. Publications <sup>1</sup> - This indicator specifically addresses Objective 1 and is a clear demonstrator of the national impact. Out of the list of specific measures to implement the strategy within EXCELLABUST project, the greatest influence on increasing the value of this indicator will have staff exchanges and trainings.			
	2010 – 15	M36	M48
1.1. Number of publications in top 10% peer-reviewed journals	0	1	2
Journal publications in 2016 – March 2018: 1 Total current status (2010 – March 2017): <u>1</u>			
List of journal papers:			
Vasiljević, Antonio; Nađ, Đula; Mandić, Filip; Mišković, Nikola; Vukić, Zoran. Coordinated Navigation of Surface and Underwater Marine Robotic Vehicles for Ocean Sampling and Environmental Monitoring. // <b>IEEE/ASME transactions on mechatronics</b> , 22 (2017), 3; 1174-1184. doi:10.1109/TMECH.2017.2684423	Q1 (top 10%, 2016; 6/60 in Automation & Control Systems; 1/44 in Engineering, manufacturing; 25/262 in Engineering, electrical and electronic; 3/130 in Engineering, mechanical)		
1.2. Number of public. in Q1/Q2/Q3/Q4 peer-reviewed journals <sup>2</sup>	1/2/1/2 <sup>3</sup>	3/3/5/5	4/4/5/5
Journal publications in 2016 – March 2018: 6 (1/3/2/0) Total current status (2010 – March 2018): <u>12 (2/5/3/2)</u>			
List of journal papers:			
Vasiljević, Antonio; Jambrošić, Kristian; Vukić, Zoran. Teleoperated path following and trajectory tracking of unmanned vehicles using spatial auditory guidance system // <b>Applied acoustics</b> , 129 (2018) 72-85. doi:10.1016/j.apacoust.2017.07.001	Q2 (2016)		
Vasiljević, Antonio; Nađ, Đula; Mandić, Filip; Mišković, Nikola; Vukić, Zoran. Coordinated Navigation of Surface and Underwater Marine Robotic Vehicles for Ocean Sampling and Environmental Monitoring. // <b>IEEE/ASME transactions on mechatronics</b> , 22 (2017), 3; 1174-1184. doi:10.1109/TMECH.2017.2684423	Q1 (10%, 2016)		
Mandić, Filip; Rendulić, Ivor; Mišković, Nikola; Nađ, Đula. Underwater object tracking using sonar and USBL measurements. // <b>Journal of Sensors</b> . 2016 (2016) ; 8070286-1-8070286-10	Q2 (2016)		
Mišković, Nikola; Bibuli, Marco; Birk, Andreas; Caccia, Massimo; Egi, Murat; Grammer, Karl; Marroni, Alessandro; Neasham, Jeff; Pascoal, Antonio; Vasiljević, Antonio; Vukić, Zoran. CADDY - Cognitive Autonomous Diving Buddy: Two Years of Underwater Human-Robot Interaction. // <b>Marine technology society journal</b> . 50 (2016) , 4; 54-66	Q3 (2016)		

<sup>1</sup> The analysis has been made based on publications by Prof Zoran Vukić (LABUST Director) and Prof Nikola Mišković (Coordinator) for the sake of simplicity. Publications from the database <https://bib.irb.hr/index.html?lang=EN> are taken into account.

<sup>2</sup> Journal ranking is taken from [ISI Web of Knowledge – Journal Citation Reports](https://www ISI Web of Knowledge – Journal Citation Reports)

<sup>3</sup> Original numbers were 1/0/2/2, however since the project approval new publications and journal ranking is available, hence the new status of publications ranking in the period 2010 – 2015.

Stilinović, Nikola; Marković, Milan; Mišković, Nikola; Vukić, Zoran; Vasiljević, Antonio. Mechanical Design of an Autonomous Marine Robotic System for Interaction with Divers. // <b>Brodogradnja</b> : časopis brodogradnje i brodograđevne industrije. 67 (2016) , 3; 73-86	Q3 (2016)		
Mišković, Nikola; Nađ, Đula; Vukić, Zoran. Full-scale identification by use of self- oscillations for overactuated marine surface vehicles. // <b>International journal of adaptive control and signal processing</b> . 2016 (2016) ; 2709-1-2709-19	Q2 (2016)		
between 2010 – 2015:			
Mišković, Nikola; Nađ, Đula; Rendulić, Ivor. Tracking Divers : An Autonomous Marine Surface Vehicle to Increase Diver Safety. // <b>IEEE robotics &amp; automation magazine</b> . 22 (2015) , 3; 72-84	Q2		
Nađ, Đula; Mišković, Nikola; Mandić, Filip. Navigation, guidance and control of an overactuated marine surface vehicle. // <b>Annual reviews in control</b> . 40 (2015) ; 172-181	Q2		
Vasiljević, Antonio; Borović, Bruno; Vukić, Zoran. Underwater Vehicle Localization with Complementary Filter: Performance Analysis in the Shallow Water Environment. // <b>Journal of intelligent &amp; robotic systems</b> . 68 (2012) , 3/4; 373-386	Q3		
Vasiljević, Antonio; Borović, Bruno; Vukić, Zoran. Augmented Reality in Marine Applications. // <b>Brodogradnja</b> : časopis brodogradnje i brodograđevne industrije. 62 (2011) , 2; 136-142	Q4		
Mišković, Nikola; Bibuli, Marco; Caccia, Massimo; Vukić, Zoran; Bruzzone, Gabriele. Fast In-Field Identification of Unmanned Marine Vehicles. // <b>Journal of field robotics</b> . 28 (2011), 1; 101-120	Q1		
Mišković, Nikola; Nađ, Đula; Vukić, Zoran. 3D Line Following for Unmanned Underwater Vehicles. // <b>Brodogradnja</b> : časopis brodogradnje i brodograđevne industrije. 61 (2010) , 2; 121-129	Q4		
<b>1.3. Number of peer-reviewed conference publications</b>	37 <sup>4</sup>	50	57
In 2016 – March 2018: 11 Total current status (2010 – March 2018): <b>48</b>			
<b>1.4. Number of citations<sup>5</sup></b>	367	580	700
2010 – 2015: [228 (Mišković) + 506 (Vukić)]/2 = 367 2016 – March 2018: [154 (Mišković) + 188 (Vukić)]/2 = 171 Total current status (2010 – March 2018): <b>538 (+47%)</b>			

**KII 2. Participation in national and EU level research and innovation programmes** - This indicator also addresses Objective 1, by measuring participation in research and innovation programmes. It is expected that the greatest influence on increasing the value of this indicator will have expert visits and innovation management trainings.

	2010 – 15	M36	M48
<b>2.1. Number of national and international proposal submitted</b>	~ 40	8-10 p.a.	8-10 p.a.
In 2016: <b>22</b> (19 international and 3 national)			

<sup>4</sup> Original number was 27 but more conference papers were published since the project proposal submission and project start.

<sup>5</sup> Citations are taken from Google Scholar and an average value of citations for [Prof Zoran Vukić](#) and [Prof Nikola Mišković](#) are taken as an indicator for the sake of simplicity. Due to this change in methodology, the target numbers are somewhat changed (it used to be 95 / 150 / 180) but the relative percentage in increase has still remained.

In 2017: 7 (6 international and 1 national)  
From Jan - Mar 2018: 3 (2 international and 1 national)

Total: 32 (27 international and 5 national) – see tables below for details

International projects 2018		
H2020-MSCA	MARE - Marine Robotic Systems and Technologies for Ocean Exploration and Sustainable Exploitation	submitted
H2020-MSCA	BlueGuard - New integrated approaches and technological innovations for coastal and marine water monitoring	submitted
National projects 2018		
EFRR	INFRA-LAPOST - Istraživačka infrastruktura Laboratorija za podvodne sustave i tehnologije	submitted

International projects 2017		
H2020-INFRAIA	EUMarineRobots - Marine robotics research infrastructure network	approved
BILAT	CC-MARS – China-Croatia collaboration on marine robotic systems	approved
H2020-ERA Chair	ERA Chair in Internet of Underwater Things at LABUST	not approved
ERASMUS+	IMPACT - Intelligent Marine systems - a Pathway towards sustAinable eduCation, knowledge and empowerment	not approved
H2020-MSCA	MARE - Marine Robotic Systems and Technologies for Ocean Exploration and Sustainable Exploitation	not approved
H2020-FET	RoboEve – Robotics Evolution	not approved
National projects 2017		
HRZZ	Biosensor-augmented unmanned autonomous surface vehicles for marine toxicant monitoring	submitted

International projects in 2016		
H2020-WIDESPREAD	ACROSS - Centre of Excellence for Autonomous and Cooperative Robotic Systems	approved
DG-ECHO	e-URready4OS – Expanded Underwater Robotics Ready for Oil Spill	approved
I4MS	CROBOHUB - Feasibility study for Croatian robotics digital innovation hub	approved
H2020-FETOPEN	aPad - smaller, lighter, smarter autonomous marine surface vehicle	approved
FLAG-ERA	RoboCom++ - Rethinking Robotics for the Robot Companion of the future	approved
INTERREG-MED	BLUEMED - Plan/test/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	approved
H2020 (RAWFIE)	PlaDyFleet - A fleet of unmanned surface marine vehicles PlaDyPos	approved
ONR-G	TICA - Towards Immersion into Submerged Coastal Archaeological Environment	approved

INTERREG BALK-MED	NetMaRo - Collaborative Network on Marine Robotics	not approved
H2020	DiSCOVERY - Digital reconstruction of Shallow water and COastal archaeological sites with VEHICLE Robots in full autonomy	not approved
H2020 – ICT	ASSIST - Autonomous system for inspection of offshore wind and mariculture farms	not approved
INTERREG - ADRIAN	GMOD - Geohazards global modelling to homogenize information in the peri-Adrian regions	not approved
H2020 – ICT	COGNATION - COGNition enabled and environment Aware robot for underwater structural inspection	not approved
COST	MARVELOUS - SubMARine Volcanoes European collabOration Uniting experts and Society	not approved
H2020 – FET	PINOCCHIO - Pilot study of Interdisciplinary and innovative Concept of a Cyber-whale for marine Inspections	not approved
H2020- MSCA	MARE - Marine Robotic Systems and Technologies for Ocean Exploration and Sustainable Exploitation	not approved
EDA	SWARM-UP – Swarm architecture for missions of heterogeneous unmanned sensor platforms	not approved
H2020-SEC	iUAS - Intelligent Unmanned Agent System	not approved
LIFE	Kupa – river of LIFE	not approved
National projects in 2016		
EFRR	DATA CROSS - Napredne metode i tehnologije u znanosti o podacima i kooperativnim sustavima	approved
HRZZ	CroMarX – Cooperative robotics in marine monitoring and exploration	approved
UNIZG	Kooperativno upravljanje autonomnim plovilima	approved

## 2.2. Percentage of national and international proposal granted<sup>6</sup>

~ 20%

~ 40%

~ 40%

Current status (2016 – March 2018): **13 (41%)**

International projects		
H2020-INFRAIA	EUMarineRobots - Marine robotics research infrastructure network	Mar 2018- Feb 2021
BILAT	CC-MARS – China-Croatia collaboration on marine robotic systems	Feb 2018- Feb 2020
H2020-WIDESPREAD	ACROSS - Centre of Excellence for Autonomous and Cooperative Robotic Systems	Oct 2017 - Sep 2018
DG-ECHO	e-URready4OS – Expanded Underwater Robotics Ready for Oil Spill	Jan 2017 - Dec 2018
I4MS	CROBOHUB - Feasibility study for Croatian robotics digital innovation hub	Nov 2016 - Apr 2017

<sup>6</sup> This KII is very difficult (almost impossible) to influence hence it should not be considered strictly.

H2020-FETOPEN	aPad - smaller, lighter, smarter autonomous marine surface vehicle	May 2017 - Oct 2018
FLAG-ERA	RoboCom++ - Rethinking Robotics for the Robot Companion of the future	Mar 2017 - Feb 2020
INTERREG-MED	BLUEMED - Plan/test/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	Sep 2016 - Aug2019
H2020 (RAWFIE)	PlaDyFleet - A fleet of unmanned surface marine vehicles PlaDyPos	Sep 2016- Dec 2018
ONR-G	TICA - Towards Immersion into Submerged Coastal Archaeological Environment	Mar 2016- Sep 2016
National projects		
EFRR	DATA CROSS - Napredne metode i tehnologije u znanosti o podacima i kooperativnim sustavima	Nov 2017 - Nov 2023
HRZZ	CroMarX – Cooperative robotics in marine monitoring and exploration	Apr 2017- Mar 2021
UNIZG	Kooperativno upravljanje autonomnim plovilima	Nov 2016

**KII 3. Innovation and connection with industry** - This indicator addresses Objective 2, by measuring the level of scientific involvement and visibility, through linking with industry. It is expected that the greatest influence on increasing the value of this indicator will have EMRA workshops and innovation management trainings.

	2010 – 15	M36	M48
<b>3.1. Number of collaboration agreements with businesses</b>	0	6	8
Current status: <u>5</u>			
<ol style="list-style-type: none"> <li>1. INNOVASUB, Turkey</li> <li>2. Heron Robots, Italy</li> <li>3. Kongsberg, Norway</li> <li>4. Brodarski Institute, Croatia</li> <li>5. SAAB, Norway</li> </ol>			
<b>3.2. Number of patent applications</b>	0	2	3
Current status: <u>0</u>			
<b>3.3. Number of commercialization agreements</b>	0	2	3
Current status: <u>0</u>			
<b>3.4. Number of new innovative products or services</b>	0	1	2
Current status: <u>2</u>			
<ol style="list-style-type: none"> <li>1. autonomous surface marine platform</li> <li>2. autonomous underwater vehicle BUDDY</li> </ol>			

**KII 4. Extent of synergy** - This indicator addresses Objective 2, by measuring the level of scientific involvement and visibility, through linking with industry as well as end-users. It is expected that the greatest influence on increasing the value of this indicator will have EMRA workshops and BtS trainings. In addition, synergy will be achieved through joint trainings.

	2010 – 15	M36	M48
<b>4.1. Percentage of joint publications</b>	~ 20% <sup>7</sup>	~ 50%	~ 50%
Current status (2016 – March 2018): 7 of 17 ( <b>41%</b> )			
<b>4.2. Number of collab. agreements with research institutions</b>	2	7	10
Current status (2016 – March 2017): <b>4</b>			
<ol style="list-style-type: none"> <li>1. University of Girona, Spain</li> <li>2. Divers Alert Network Europe, Malta</li> <li>3. Faculty of Science and Engineering University of Limerick, Ireland</li> <li>4. Jacobs University Bremen, Germany</li> </ol>			
<b>4.3. Number of joint events</b>	1	6	8
Current status (2016 – March 2018): <b>4</b>			
<ol style="list-style-type: none"> <li>1. EMRA'16, Newcastle, UK;</li> <li>2. BtS'16, Biograd na Moru, Croatia</li> <li>3. EMRA'17, Girona, Spain;</li> <li>4. BtS'17, Biograd na Moru, Croatia</li> </ol>			

#### 4. Images attached to the Summary for publication



<sup>7</sup> The analysis has been made based on publications by Prof Zoran Vukić (LABUST Director) and Prof Nikola Mišković (Coordinator) for the sake of simplicity. Previous number used to be around 15% however this has changed due to some new publications that were made since the proposal submission. Publications from the database <https://bib.irb.hr/index.html?lang=EN> are taken into account.

## DISSEMINATION & COMMUNICATION ACTIVITIES

1. Specify the total funding amount used for Dissemination and Communication activities linked to the project:  
cca 100.000 EUR
2. Specify the number of Dissemination and Communication activities linked to the project for each of the following categories:

Organisation of a Conference	0
Organisation of a Workshop	4
Press release	3
Non-scientific and non-peer-reviewed publication (popularised publication)	5
Exhibition	8
Flyer	6
Training	30
Social Media	1
Website	1
Communication Campaign (e.g. Radio, TV)	15
Participation to a Conference	16
Participation to a Workshop	6
Participation to an Event other than a Conference or a Workshop	8
Video/Film	1
Brokerage Event	0
Pitch Event	0
Trade Fair	8
Participation in activities organized jointly with other H2020 projects	16
Other	

3. Specify the estimated number of persons reached, in the context of all dissemination and communication activities, in each of the following categories:

Scientific Community (Higher Education, Research)	2000+
Industry	1500+
Civil Society	300
General Public	3000+
Policy Makers	10
Media	20
Investors	5
Customers	5
Other	

## GENDER

BENEFICIARY NAME	NUMBER OF FEMALE PARTICIPANTS	NUMBER OF MALE PARTICIPANTS	TOTAL NUMBER OF PARTICIPANTS
UNIZG-FER	6	10	16
CNR	4	5	9
UDG	3	6	9
UL	1	5	6

# Periodic Technical Report

## PART B

Project Acronym:	EXCELLABUST	
Grant Agreement number:	691980	
Project title:	Excelling LABUST in marine robotics	
Funding:	Horizon2020 Twining	
Call:	H2020-TWINN-2015	
Type of action:	CSA	
Start date of project:	1 <sup>st</sup> January 2016	
Duration:	36 months	
Period covered by the report:	from 01/01/2016 to 31/03/2018	
Periodic report	M1 – M27 report	
Project website:	<a href="http://excellabust.fer.hr/">http://excellabust.fer.hr/</a>	
Delivery date:	06/04/2018	
Version:	1.0	
Lead participant	UNIZG-FER	
Dissemination level:		
PU	Public	X
CO	Confidential, only for members of the consortium (including the Commission Services)	



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 691980.



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## 1. EXPLANATION OF THE WORK CARRIED OUT AND OVERVIEW OF THE PROGRESS

### 1.1. Objectives

#### 1.1.1. Objective 1: Increase UNIZG-FER marine robotics scientific excellence and innovation capacity, and raise staff's research profile

Overall we have organized **89** events that have contributed to the accomplishment of this objective.

- **S&T knowledge transfer:**
  - **4** staff exchanges from UNIZG-FER to partner institutions (each in the duration of two months)
  - **45** expert visit invited talks at UNIZG-FER and during BtS'16 and BtS'17 summer school
  - **10** expert visit tutorials at UNIZG-FER and during BtS'16 and BtS'17 summer school
- **hands-on S&T experience**
  - **2** on-site trainings by CNR in Genova, Italy and UdG in Girona, Spain
- **knowledge on innovation management**
  - **28** innovation management trainings on various topics

#### 1.1.2. Objective 2: Increase UNIZG-FER scientific involvement and visibility

Overall we have organized **13** events that have contributed to the accomplishment of this objective.

- **strengthen links to marine robotics industry:**
  - organized **2** "EU-funded projects in marine robotics and applications workshop - EMRA" (by CNR in Newcastle, UK, and by UdG in Girona, Spain)
  - **28** conferences and industrial events
- **strengthen links to marine robotics end-users**
  - **15** open-door events, **7** of which were organized at UNIZG-FER
  - **2** "Breaking the Surface" summer schools in 2016 and 2017 in Biograd na Moru, Croatia

## 1.2. Explanation of the work carried per WP

### 1.2.1. Work Package 1: Project management

The list of major project meetings for the period is given below.

#### 1. [Kick-off meeting, 21 January 2016, Zagreb \(HR\)](#)



All partners gathered in Zagreb for a successful kick-off meeting of the Horizon2020 project EXCELLABUST. Kick-off meeting was held on 21st of January 2016 at the University of Zagreb Faculty of Electrical Engineering and Computing, Zagreb (HR).

#### 2. [Project meeting, 16 June 2016, Newcastle \(UK\)](#)



A project meeting was held in Newcastle (UK) on 16th June 2016, one day after the [EMRA'16](#) workshop. The meeting took place at the University of Newcastle and all partner institutions were represented. In addition to progress reporting, the main topic of the meeting was organisation of the upcoming [Breaking the Surface 2016](#) workshop.

#### 3. [Project meeting during Breaking the Surface summer school, 5th October 2016, Croatia](#)



During H2020 EXCELLABUST summer school Breaking the Surface, representatives of all partners and Advisory Board members gathered and held a project meeting. The project meeting was held on 5th October 2016 in Biograd na Moru (Croatia).

Meeting goals were to get familiarized with each partner's activity since the last meeting, establish a detailed meeting schedule, work plan and deliverable list for the following 12 months, and to make detailed plans for EMRA'17.

#### 4. [Project meeting, 16th March, Skype](#)

During the meeting, the following topics were addressed: final preparations for EMRA'17, preparations for the 1<sup>st</sup> periodic report, arrangements for the meeting during EMRA'17, arrangements for the review meeting in Brussels, and planning for BtS workshop.

#### 5. [Project meeting during EMRA'18, 17 May 2017, Girona \(Spain\)](#)



A project meeting was held during second H2020 EXCELLABUST [workshop on EU-funded Marine Robotics and Applications - EMRA '17](#), at University of Girona (Spain) on 17th May 2017. Meeting goals were to get familiarized with each partner's activity since the last meeting, establish a detailed meeting schedule, workplan and deliverable list for the following 12 months, make detailed plans for the review meeting, and make detailed plans for BtS'17. Meeting was participated by all project partners.

#### 6. [First review meeting, 27 June 2017, Brussels \(Belgium\)](#)

The EXCELLABUST 1<sup>st</sup> review meeting was held at Research Executive Agency, Brussels, Belgium on **27th June 2017**. The meeting was attended by **Zoran Vukić, Ivana Mikolić** (both LABUST), **Edin Omerdić** (UL), **Massimo Caccia** (CNR) and **Pedro Ridao** (UDG). Meeting goals were to get familiarize the Officer and the reviewers with EXCELLABUST activities and to acknowledge the Officer's and the reviewers' comments.

#### 7. [Project meeting during Breaking the Surface summer school, 5th October 2017, Croatia](#)



The project meeting was held in Biograd na Moru, Croatia on **5th October 2017** during the Breaking the Surface workshop. The meeting was attended by Nikola Mišković, Ivana Mikolić (both LABUST), Edin Omerdić (UL), Marc Carreras, Joseta Roca (both UDG), Marco Bibuli and Angelo Odetti (both CNR). Meeting goals were to get familiarized with each partner's activity since the last meeting and establish a detailed meeting schedule and working plan for next 12 months.

#### 8. [Project meeting, 19th January 2018, Skype](#)

During the meeting, the following topics were addressed: preparations for EMRA'18 and other events in Limerick, preparations for training in Svalbard, and planning for BtS'18 workshop.

## Key impact indicators:

**KII 1. Publications<sup>1</sup>** - This indicator specifically addresses Objective 1 and is a clear demonstrator of the national impact. Out of the list of specific measures to implement the strategy within EXCELLABUST project, the greatest influence on increasing the value of this indicator will have staff exchanges and trainings.

	2010 – 15	M36	M48
<b>1.1. Number of publications in top 10% peer-reviewed journals</b>	0	1	2

Journal publications in 2016 – March 2018: 1

Total current status (2010 – March 2017): 1

List of journal papers:

Vasiljević, Antonio; Nađ, Đula; Mandić, Filip; Mišković, Nikola; Vukić, Zoran. Coordinated Navigation of Surface and Underwater Marine Robotic Vehicles for Ocean Sampling and Environmental Monitoring. // <b>IEEE/ASME transactions on mechatronics</b> , 22 (2017), 3; 1174-1184. doi:10.1109/TMECH.2017.2684423	<b>Q1</b> (top 10%, 2016; 6/60 in Automation & Control Systems; 1/44 in Engineering, manufacturing; 25/262 in Engineering, electrical and electronic; 3/130 in Engineering, mechanical)
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<b>1.2. Number of public. in Q1/Q2/Q3/Q4 peer-reviewed journals<sup>2</sup></b>	1/2/1/2 <sup>3</sup>	3/3/5/5	4/4/5/5
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Journal publications in 2016 – March 2018: 6 (1/3/2/0)

Total current status (2010 – March 2018): 12 (2/5/3/2)

List of journal papers:

Vasiljević, Antonio; Jambrošić, Kristian; Vukić, Zoran. Teleoperated path following and trajectory tracking of unmanned vehicles using spatial auditory guidance system // <b>Applied acoustics</b> , 129 (2018) 72-85. doi:10.1016/j.apacoust.2017.07.001	<b>Q2</b> (2016)
Vasiljević, Antonio; Nađ, Đula; Mandić, Filip; Mišković, Nikola; Vukić, Zoran. Coordinated Navigation of Surface and Underwater Marine Robotic Vehicles for Ocean Sampling and Environmental Monitoring. // <b>IEEE/ASME transactions on mechatronics</b> , 22 (2017), 3; 1174-1184. doi:10.1109/TMECH.2017.2684423	<b>Q1</b> (10%, 2016)
Mandić, Filip; Rendulić, Ivor; Mišković, Nikola; Nađ, Đula. Underwater object tracking using sonar and USBL measurements. // <b>Journal of Sensors</b> . 2016 (2016) ; 8070286-1-8070286-10	<b>Q2</b> (2016)
Mišković, Nikola; Bibuli, Marco; Birk, Andreas; Caccia, Massimo; Egi, Murat; Grammer, Karl; Marroni, Alessandro; Neasham, Jeff; Pascoal, Antonio; Vasiljević, Antonio; Vukić, Zoran.	<b>Q3</b> (2016)

<sup>1</sup> The analysis has been made based on publications by Prof Zoran Vukić (LABUST Director) and Prof Nikola Mišković (Coordinator) for the sake of simplicity. Publications from the database <https://bib.irb.hr/index.html?lang=EN> are taken into account.

<sup>2</sup> Journal ranking is taken from [ISI Web of Knowledge – Journal Citation Reports](https://www.jcr.org/)

<sup>3</sup> Original numbers were 1/0/2/2, however since the project approval new publications and journal ranking is available, hence the new status of publications ranking in the period 2010 – 2015.

CADDY - Cognitive Autonomous Diving Buddy: Two Years of Underwater Human-Robot Interaction. // <b>Marine technology society journal</b> . 50 (2016) , 4; 54-66			
Stilinović, Nikola; Marković, Milan; Mišković, Nikola; Vukić, Zoran; Vasiljević, Antonio. Mechanical Design of an Autonomous Marine Robotic System for Interaction with Divers. // <b>Brodogradnja</b> : časopis brodogradnje i brodograđevne industrije. 67 (2016) , 3; 73-86	Q3 (2016)		
Mišković, Nikola; Nađ, Đula; Vukić, Zoran. Full-scale identification by use of self- oscillations for overactuated marine surface vehicles. // <b>International journal of adaptive control and signal processing</b> . 2016 (2016) ; 2709-1-2709-19	Q2 (2016)		
between 2010 – 2015:			
Mišković, Nikola; Nađ, Đula; Rendulić, Ivor. Tracking Divers : An Autonomous Marine Surface Vehicle to Increase Diver Safety. // <b>IEEE robotics &amp; automation magazine</b> . 22 (2015) , 3; 72-84	Q2		
Nađ, Đula; Mišković, Nikola; Mandić, Filip. Navigation, guidance and control of an overactuated marine surface vehicle. // <b>Annual reviews in control</b> . 40 (2015) ; 172-181	Q2		
Vasiljević, Antonio; Borović, Bruno; Vukić, Zoran. Underwater Vehicle Localization with Complementary Filter: Performance Analysis in the Shallow Water Environment. // <b>Journal of intelligent &amp; robotic systems</b> . 68 (2012) , 3/4; 373-386	Q3		
Vasiljević, Antonio; Borović, Bruno; Vukić, Zoran. Augmented Reality in Marine Applications. // <b>Brodogradnja</b> : časopis brodogradnje i brodograđevne industrije. 62 (2011) , 2; 136-142	Q4		
Mišković, Nikola; Bibuli, Marco; Caccia, Massimo; Vukić, Zoran; Bruzzone, Gabriele. Fast In-Field Identification of Unmanned Marine Vehicles. // <b>Journal of field robotics</b> . 28 (2011), 1; 101-120	Q1		
Mišković, Nikola; Nađ, Đula; Vukić, Zoran. 3D Line Following for Unmanned Underwater Vehicles. // <b>Brodogradnja</b> : časopis brodogradnje i brodograđevne industrije. 61 (2010) , 2; 121-129	Q4		
<b>1.3. Number of peer-reviewed conference publications</b>	37 <sup>4</sup>	50	57
In 2016 – March 2018: 11 Total current status (2010 – March 2018): <b>48</b>			
<b>1.4. Number of citations<sup>5</sup></b>	367	580	700
2010 – 2015: [228 (Mišković) + 506 (Vukić)]/2 = 367 2016 – March 2018: [154 (Mišković) + 188 (Vukić)]/2 = 171 Total current status (2010 – March 2018): <b>538 (+47%)</b>			

<sup>4</sup> Original number was 27 but more conference papers were published since the project proposal submission and project start.

<sup>5</sup> Citations are taken from Google Scholar and an average value of citations for [Prof Zoran Vukić](#) and [Prof Nikola Mišković](#) are taken as an indicator for the sake of simplicity. Due to this change in methodology, the target numbers are somewhat changed (it used to be 95 / 150 / 180) but the relative percentage in increase has still remained.

**KII 2. Participation in national and EU level research and innovation programmes** - This indicator also addresses Objective 1, by measuring participation in research and innovation programmes. It is expected that the greatest influence on increasing the value of this indicator will have expert visits and innovation management trainings.

	2010 – 15	M36	M48
<b>2.1. Number of national and international proposal submitted</b>	~ 40	8-10 p.a.	8-10 p.a.

In 2016: 22 (19 international and 3 national)

In 2017: 7 (6 international and 1 national)

From Jan - Mar 2018: 3 (2 international and 1 national)

Total: 32 (27 international and 5 national) – see tables below for details

International projects 2018		
H2020-MSCA	MARE - Marine Robotic Systems and Technologies for Ocean Exploration and Sustainable Exploitation	submitted
H2020-MSCA	BlueGuard - New integrated approaches and technological innovations for coastal and marine water monitoring	submitted
National projects 2018		
EFRR	INFRA-LAPOST - Istraživačka infrastruktura Laboratorija za podvodne sustave i tehnologije	submitted

International projects 2017		
H2020-INFRAIA	EUMarineRobots - Marine robotics research infrastructure network	approved
BILAT	CC-MARS – China-Croatia collaboration on marine robotic systems	approved
H2020-ERA Chair	ERA Chair in Internet of Underwater Things at LABUST	not approved
ERASMUS+	IMPACT - Intelligent Marine systems - a Pathway towards sustainable education, knowledge and empowerment	not approved
H2020-MSCA	MARE - Marine Robotic Systems and Technologies for Ocean Exploration and Sustainable Exploitation	not approved
H2020-FET	RoboEve – Robotics Evolution	not approved
National projects 2017		
HRZZ	Biosensor-augmented unmanned autonomous surface vehicles for marine toxicant monitoring	submitted

International projects in 2016		
H2020-WIDESPREAD	ACROSS - Centre of Excellence for Autonomous and Cooperative Robotic Systems	approved
DG-ECHO	e-URready4OS – Expanded Underwater Robotics Ready for Oil Spill	approved
I4MS	CROBOHUB - Feasibility study for Croatian robotics digital innovation hub	approved
H2020-FETOPEN	aPad - smaller, lighter, smarter autonomous marine surface vehicle	approved

FLAG-ERA	RoboCom++ - Rethinking Robotics for the Robot Companion of the future	approved
INTERREG-MED	BLUEMED - Plan/test/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	approved
H2020 (RAWFIE)	PlaDyFleet - A fleet of unmanned surface marine vehicles PlaDyPos	approved
ONR-G	TICA - Towards Immersion into Submerged Coastal Archaeological Environment	approved
INTERREG BALK-MED	NetMaRo - Collaborative Network on Marine Robotics	not approved
H2020	DiSCOVERY - Digital reconstruction of Shallow water and COastal archaeological sites with VEHICLE Robots in full autonomy	not approved
H2020 – ICT	ASSIST - Autonomous system for inspection of offshore wind and mariculture farms	not approved
INTERREG - ADRIAN	GMOD - Geohazards global modelling to homogenize information in the peri-Adrian regions	not approved
H2020 – ICT	COGNATION - COGNition enabled and environment Aware robot for underwater structural inspection	not approved
COST	MARVELOUS - SubMARine Volcanoes European collabOration Uniting experts and Society	not approved
H2020 – FET	PINOCCHIO - Pilot study of INTERdisciplinary and innOvative Concept of a Cyber-wHale for marine Inspections	not approved
H2020-MSCA	MARE - Marine Robotic Systems and Technologies for Ocean Exploration and Sustainable Exploitation	not approved
EDA	SWARM-UP – Swarm architecture for missions of heterogeneous unmanned sensor platforms	not approved
H2020-SEC	iUAS - Intelligent Unmanned Agent System	not approved
LIFE	Kupa – river of LIFE	not approved
National projects in 2016		
EFRR	DATA CROSS - Napredne metode i tehnologije u znanosti o podacima i kooperativnim sustavima	approved
HRZZ	CroMarX – Cooperative robotics in marine monitoring and exploration	approved
UNIZG	Kooperativno upravljanje autonomnim plovilima	approved
<b>2.2. Percentage of national and international proposal granted<sup>6</sup></b>		
		~ 20%
		~ 40%
		~ 40%
Current status (2016 – March 2018): <b>13 (41%)</b>		

<sup>6</sup> This KII is very difficult (almost impossible) to influence hence it should not be considered strictly.

International projects		
H2020-INFRAIA	EUMarineRobots - Marine robotics research infrastructure network	Mar 2018-Feb 2021
BILAT	CC-MARS – China-Croatia collaboration on marine robotic systems	Feb 2018-Feb 2020
H2020-WIDESPREAD	ACROSS - Centre of Excellence for Autonomous and Cooperative Robotic Systems	Oct 2017 - Sep 2018
DG-ECHO	e-URready4OS – Expanded Underwater Robotics Ready for Oil Spill	Jan 2017 - Dec 2018
I4MS	CROBOHUB - Feasibility study for Croatian robotics digital innovation hub	Nov 2016 - Apr 2017
H2020-FETOPEN	aPad - smaller, lighter, smarter autonomous marine surface vehicle	May 2017 - Oct 2018
FLAG-ERA	RoboCom++ - Rethinking Robotics for the Robot Companion of the future	Mar 2017 - Feb 2020
INTERREG-MED	BLUEMED - Plan/test/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	Sep 2016 - Aug2019
H2020 (RAWFIE)	PlaDyFleet - A fleet of unmanned surface marine vehicles PlaDyPos	Sep 2016-Dec 2018
ONR-G	TICA - Towards Immersion into Submerged Coastal Archaeological Environment	Mar 2016-Sep 2016
National projects		
EFRR	DATA CROSS - Napredne metode i tehnologije u znanosti o podacima i kooperativnim sustavima	Nov 2017 - Nov 2023
HRZZ	CroMarX – Cooperative robotics in marine monitoring and exploration	Apr 2017-Mar 2021
UNIZG	Kooperativno upravljanje autonomnim plovilima	Nov 2016

**KII 3. Innovation and connection with industry** - This indicator addresses Objective 2, by measuring the level of scientific involvement and visibility, through linking with industry. It is expected that the greatest influence on increasing the value of this indicator will have EMRA workshops and innovation management trainings.

	2010 – 15	M36	M48
<b>3.1. Number of collaboration agreements with businesses</b>	0	6	8
Current status: <u>5</u>			
<ol style="list-style-type: none"> <li>1. INNOVASUB, Turkey</li> <li>2. Heron Robots, Italy</li> <li>3. Kongsberg, Norway</li> <li>4. Brodarski Institute, Croatia</li> <li>5. SAAB, Norway</li> </ol>			
<b>3.2. Number of patent applications</b>	0	2	3
Current status: <u>0</u>			

<b>3.3. Number of commercialization agreements</b>	0	2	3
Current status: <u>0</u>			
<b>3.4. Number of new innovative products or services</b>	0	1	2
Current status: <u>2</u>			
<ol style="list-style-type: none"> <li>1. autonomous surface marine platform</li> <li>2. autonomous underwater vehicle BUDDY</li> </ol>			

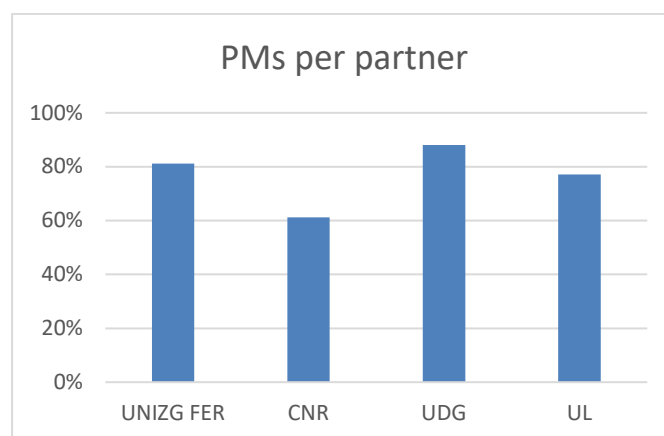
<b>KII 4. Extent of synergy</b> - This indicator addresses Objective 2, by measuring the level of scientific involvement and visibility, through linking with industry as well as end-users. It is expected that the greatest influence on increasing the value of this indicator will have EMRA workshops and BtS trainings. In addition, synergy will be achieved through joint trainings.			
	2010 – 15	M36	M48
<b>4.1. Percentage of joint publications</b>	~ 20% <sup>7</sup>	~ 50%	~ 50%
Current status (2016 – March 2018): 7 of 17 ( <b>41%</b> )			
<b>4.2. Number of collab. agreements with research institutions</b>	2	7	10
Current status (2016 – March 2017): <u>4</u>			
<ol style="list-style-type: none"> <li>1. University of Girona, Spain</li> <li>2. Divers Alert Network Europe, Malta</li> <li>3. Faculty of Science and Engineering University of Limerick, Ireland</li> <li>4. Jacobs University Bremen, Germany</li> </ol>			
<b>4.3. Number of joint events</b>	1	6	8
Current status (2016 – March 2018): <u>4</u>			
<ol style="list-style-type: none"> <li>1. EMRA'16, Newcastle, UK;</li> <li>2. BtS'16, Biograd na Moru, Croatia</li> <li>3. EMRA'17, Girona, Spain;</li> <li>4. BtS'17, Biograd na Moru, Croatia</li> </ol>			

<sup>7</sup> The analysis has been made based on publications by Prof Zoran Vukić (LABUST Director) and Prof Nikola Mišković (Coordinator) for the sake of simplicity. Previous number used to be around 15% however this has changed due to some new publications that were made since the proposal submission. Publications from the database <https://bib.irb.hr/index.html?lang=EN> are taken into account.

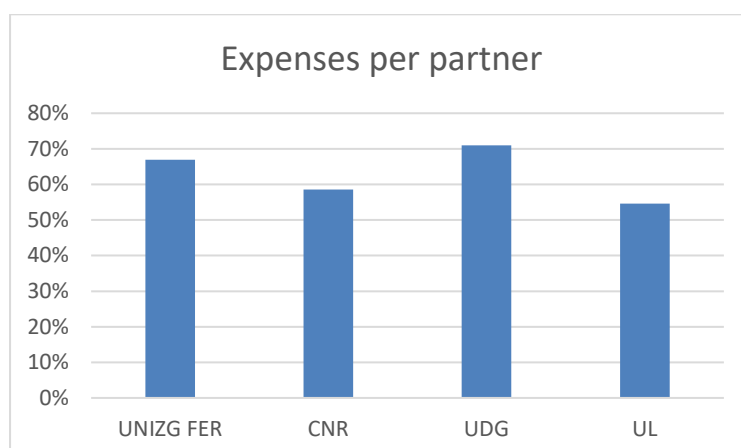
### PM consumption by partner:

Person-month consumption is shown in the figure below and is according to plan.

	UNIZG FER	CNR	UDG	UL	
<i>WP1 planned</i>	4	1	1	1	7
<b>WP1 actual</b>	<b>3.1</b>	<b>0.88</b>	<b>1.5</b>	<b>0.75</b>	<b>6.23</b>
<i>WP2 planned</i>	15	8	8	8	39
<b>WP2 actual</b>	<b>11.39</b>	<b>7.12</b>	<b>9</b>	<b>6.15</b>	<b>33.66</b>
<i>WP3 planned</i>	14	7	7	7	35
<b>WP3 actual</b>	<b>12.76</b>	<b>4.85</b>	<b>6</b>	<b>4.8</b>	<b>28.41</b>
<i>WP4 planned</i>	8	5	5	5	23
<b>WP4 actual</b>	<b>6.04</b>	<b>0</b>	<b>2</b>	<b>4.5</b>	<b>12.54</b>
<i>Total planned</i>	41	21	21	21	104
<b>Total actual</b>	<b>33.29</b>	<b>12.85</b>	<b>18.5</b>	<b>16.2</b>	<b>80.84</b>



### Summary of expenses per partner:



## 1.2.2. Work package 2: Know-how exchange

- **Short-term staff exchanges**

	TITLE	DATE
1.	<a href="#">Filip Mandić visited University of Girona</a>	Feb – Mar 2016
2.	<a href="#">Nadir Kapetanović visited Consiglio Nazionale delle Ricerche, Genova</a>	Jun – Jul 2016
3.	<a href="#">Anja Babić visited Consiglio Nazionale delle Ricerche, Genova</a>	Feb – Mar 2017
4.	<a href="#">Ivan Lončar visited Universitat de Girona, Spain</a>	May – Jun 2017

- **Short-term trainings**

	TITLE	DATE	NAME	INSTITUTION
1.	<a href="#">1<sup>st</sup> training: Unmanned vehicles - building cooperative control and perception held at CNR, Italy</a>	19-20/06/2016	CNR team	CNR, Genova, IT
2.	<a href="#">2<sup>nd</sup> training: Intervention AUV's held at UdG, Spain</a>	17-18/05/2017	UDG team	UdG, Girona, ES

- **Expert visits – tutorials**

	TITLE	DATE	NAME	INSTITUTION
1.	<a href="#">Tutorial: "High-level architectures and path planning" by UdG</a>	19-20/01/2016	Prof. Marc Carreras and Dr. Narcis Palomeras	UdG
2.	<a href="#">Tutorial: "Modelling, identification and motion estimation of unmanned marine vehicles" by CNR</a>	24-25/05/2016	Massimo Caccia	CNR
3.*	<a href="#">Tutorial: "Mission planning" &amp; "Girona500 deployment" &amp; "Data analysis" by UdG @BtS</a>	03/10/2016	Prof. Pere Ridao, Dr. Narcis Palomeras,	UdG
4.*	<a href="#">Tutorial: "Mission planning" &amp; "Data analysis" by OceanScan @BtS</a>	06/10/2016	Luis Madureira	OceanScan
5.*	<a href="#">Tutorial: "Thruster Control using LabVIEW Real-Time &amp; FPGA Graphical Programming" by UL @BtS</a>	06/10/2016	Dr. Edin Omerdić	UL
6.	<a href="#">Tutorial: "Modelling, Simulation &amp; Control of Marine Craft" by UL</a>	18-20/01/2017	Dr. Edin Omerdić	UL
7.	<a href="#">Tutorial: "Underwater Image Processing and Photomosaicing" by UdG</a>	11-13/04/2017	Prof. Rafael Garcia and Dr. Ricard Campos	UdG
8.**	<a href="#">Tutorial: "Omnidirectional vision for underwater robots" @BTS</a>	02/10/2017	Dr. Nuno Gracias, Dr. Ricard Campos	UdG

9. **	<a href="#">Tutorial: "Parallel Computing with CUDA made (almost) simple" @BTS</a>	04/10/2017	Matija Rossi	UL
10. **	<a href="#">Tutorial: "POP ART (Portable Pelagic Autonomous Robotic Technology) concept &amp; field demonstration" @BtS</a>	06/10/2017	Marco Bibuli, Gabriele Bruzzone, Massimo Caccia, Angelo Odetti	CNR

\* Tutorials given at BtS'16

\*\* Tutorials given at BtS'17

• **Expert visits – invited talks**

	TITLE	DATE	NAME	INSTITUTION
1.	<a href="#">"Girona Underwater Vision and Robotics lab: AUVs for inspection and intervention"</a>	20/01/2016	Prof. Marc Carreras	UdG
2.	<a href="#">"Towards heterogeneous cooperative field robotics: the CNR-ISSIA experience"</a>	22/01/2016	Massimo Caccia and Marco Bibuli	CNR
3.	<a href="#">"Overview of research activities in Mobile &amp; Marine Robotics Research Centre, University of Limerick"</a>	22/01/2016	Prof. Daniel Toal and Dr. Edin Omerdić	CNR
4.	<a href="#">Invited talk "Towards Reproducible Robotics Research"</a>	22/01/2016	Prof. Fabio Bonsignorio	Scuola Superiore Sant'Anna, IT
5.	<a href="#">"Heterogeneous Adaptive Maritime Mobile Expeditionary Robots"</a>	23/05/2016	Dr. Vladimir Djapic	SPAWAR, USA
6.	<a href="#">"Bio-Hybrid Systems: Challenges and Potentials"</a>	29/09/2016	Dr. Serge Kernbach	Cybertronica, GE
7.*	<a href="#">The H2020 project WiMUST: Widely scalable Mobile Underwater Sonar Technology. An overview @BtS'16</a>	03/10/2016	Giovanni Indiveri	Università del Salento (ISME node), IT
8.*	<a href="#">Deep sea sampling with soft robotics: early results and future directions @BtS'16</a>	03/10/2016	Stephen C. Licht	University of Rhode Island, USA
9.*	<a href="#">Nautical archaeology from the naval architecture point of view @BtS'16</a>	03/10/2016	Smiljko Rudan	FSB, HR
10.*	<a href="#">Methodology of recording and analysing shipwreck sites using multi-image photogrammetry @BtS'16</a>	03/10/2016	Kotaro Yamafune	Texas A&M University, USA
11.*	<a href="#">Co-existence of top marine predators and humans... and the role of technology @BtS'16</a>	04/10/2016	Mark Jessopp	University College Cork, IR
12.*	<a href="#">Modular portable marine robotics @BtS'16</a>	04/10/2016	Massimo Caccia	CNR, IT
13.*	<a href="#">The role of underwater robotics in the growth of marine renewable energy @BtS'16</a>	04/10/2016	Tim Mundon	University of Washington, USA

14.*	<a href="#">Recording "in the dark". The challenges of recording a submerged 8th century structure in the Schlei Fjord, Northern Germany @BtS'16</a>	04/10/2016	Jens Auer	University of Southern Denmark, DK
15.*	<a href="#">Marine Robotics Applications in Humanitarian, Search &amp; Rescue and Civilian Focussed Security Operations – what might the future hold? @BtS'16</a>	04/10/2016	Cormac Gebruers	National Maritime College of Ireland, IR
16.*	<a href="#">Robotics for challenging ocean intervention in marine renewable energy and other applications @BtS'16</a>	05/10/2016	Dan Toal	UL, IE
17.*	<a href="#">Observations from the Invisible Forest: the diversity of marine phytoplankton @BtS'16</a>	05/10/2016	Sunčica Bosak	PMF, HR
18.*	<a href="#">Aquatic Micro Aerial Vehicles (AquaMAV) for water sampling and marine exploration @BtS'16</a>	05/10/2016	Mirko Kovač	Imperial College London, UK
19.*	<a href="#">The Underwater Archaeology Centre of Catalonia. The works with AUV and submersibles in archaeological sites @BtS'16</a>	05/10/2016	Gustau Vivar	Centre d'Arqueologia Subaquàtica de Catalunya, Catalonia, ES
20.*	<a href="#">Marine robotics – A tool for increased awareness from land to the deep sea @BtS'16</a>	05/10/2016	Alfredo Martins	INESC TEC / ISEP, Portugal
21.*	<a href="#">Unmanned system for maritime security and environmental monitoring @BtS'16</a>	06/10/2016	Stjepan Bogdan	UNIZG FER, HR
22.*	<a href="#">Investigating the submarine canyons and seamounts in Spanish waters through noninvasive methodologies @BtS'16</a>	06/10/2016	Francisco Sanchez	Instituto Español de Oceanografía (IEO), ES
23.*	<a href="#">A decade of research in underwater cooperative navigation: what have we learned? @BtS'16</a>	06/10/2016	Mandar Chitre	National University of Singapore, SG
24.*	<a href="#">Underwater and Instrumental Archaeology. A Special Relationship @BtS'16</a>	06/10/2016	Francesco Tiboni	University of Genova, IT
25.	<a href="#">"Fjord ecosystems on the West Antarctic Peninsula - hotspots of biodiversity and response to climate warming (the FjordEco Project)"</a>	25/10/2017	Prof. Craig Smith	Uni. of Hawai'i at Manoa, Honolulu, USA
26.	<a href="#">"Bringing Smart Underwater Manipulators &amp; Vision to Work-Class ROVs: Recent Field Trials"</a>	18/01/2017	Dr. Gerard Dooly	UL
27.	<a href="#">"Flying Robot Companions for Future Smart Cities"</a>	31/03/2017	Dr. Mirko Kovac	Imperial College London, UK
28.	<a href="#">"High-resolution Sea-floor Optical Mapping using Unmanned Underwater Vehicles"</a>	12/04/2017	Prof. Rafael Garcia	UdG

29. **	<a href="#">“Human-robot interaction under water” @BtS’17</a>	02/10/2017	Nikola Mišković	UNIZG-FER, HR
30. **	<a href="#">“DexROV: 2017 trials results and perspectives” @BtS’17</a>	02/10/2017	Jeremi Gancet	Space Applications Services, BE
31. **	<a href="#">“A Methodology for Accurate and Quick Photogrammetric Recording of Underwater Cultural Heritage” @BtS’17</a>	02/10/2017	Kotaro Yamafune	A.P.P.A.R.A.T.U.S. LLC, JP
32. **	<a href="#">“Shipwreck discovered along the western coast of Turkey” @BtS’17</a>	02/10/2017	A.Harun Özdaş,	Dokuz Eylul University Institute of Marine Science and Technology, TR
33. **	<a href="#">“Localization and mapping in dynamic underwater environments” @BtS’17</a>	04/10/2017	Eduardo Silva	INESC TEC / ISEP, PT
34. **	<a href="#">“ Technology, archeology and student challenges: Finding a best practice for presenting maritime archaeology” @BtS’17</a>	04/10/2017	Andreas Kallmeyer Bloch	The Viking Ship Museum in Roskilde, DK
35. **	<a href="#">“Relevance of UMS for below the surface (BTS) tasks” @BtS’17</a>	04/10/2017	Richard J. Nagle	Naval Sea Systems Command, USA
36. **	<a href="#">“Cetaceans and sea turtles of the Adriatic- the next step” @BtS’17</a>	04/10/2017	Draško Holcer	Croatian Natural History Museum, HR
37. **	<a href="#">“FOCE- Long term in situ ocean acidification instrumentation” @BtS’17</a>	05/10/2017	William Kirkwood	Monterey Bay Aquarium Research Institute, USA
38. **	<a href="#">“Extreme seafloor ecology: use of ROV’s and AUV’s to evaluate biodiversity and ecosystem function in the world’s most remote ecosystems” @BtS’17</a>	05/10/2017	Craig R. Smith	University of Hawaii at Manoa, USA
39. **	<a href="#">“Late Quaternary and Holocene submerged landscapes of the Eastern Adriatic Sea” @BtS’17</a>	05/10/2017	Slobodan Miko	Croatian Geological Survey, HR
40. **	<a href="#">“Contemporary Underwater Archaeology in Portugal. New challenges, new ideas” @BtS’17</a>	05/10/2017	Augusto Salgado	CINAV - Centro de Investigação Naval, PT
41. **	<a href="#">“Ex machina- Integrating maritime robots into human endeavours” @BtS’17</a>	06/10/2017	John Potter	NATO STO Centre for Maritime Research and Experimentation (CMRE), IT

42. **	<a href="#">"Subterranean groundwater discharge and marine ecosystems" @BtS'17</a>	06/10/2017	Renee E. Bishop	Pennsylvania State University, USA
43. **	<a href="#">"Navigation and control of unmanned vehicles: a fuzzy logic perspective" @BtS'17</a>	06/10/2017	Kimion P. Valavanis	University of Denver, USA
44. **	<a href="#">"Breaking the surface of the seafloor: Studying the traces if earthquakes underwater" @BtS'17</a>	06/10/2017	Javier Escartin	Institut de Physique du Globe de Paris, FR
45.	<a href="#">"Distributed hybrid control of multi-agent systems under high level specifications"</a>	19/12/2017	Prof. Dimos V. Dimarogonas	KTH, Royal Insitute of Technology, Stockholm, SE

\* invited talks given at BtS'16

\*\* invited talks given at BtS'17

#### • Participation in innovation management trainings

	TITLE	DATE	NAME	INSTITUTION
1.	<a href="#">"Fundamentals of the intellectual property for the researchers"</a>	04/03/2016	State Intellectual property office	State Intellectual property office
2.	<a href="#">Excellence in Horizon 2020 proposal writing and project implementation training</a>	15-16/04/2016	European Training Academy	European Training Academy
3.	Invited talk "University of Girona Project Management System – sharing experiences with LABUST laboratory"	09/06/2016	Joseta Roca	UdG
4.	<a href="#">"Patent: A tool to promote"</a>	18/06/2016	CNR team	CNR
5.	<a href="#">"First 5 Decisions When Founding a Startup"</a>	20/09/2016	Martin Reents, CEO	Hetras GmbH
6.*	<a href="#">Value creation from research through university spin-offs @BtS'16</a>	04/10/2016	Anders Aune	NTNU, NO
7.*	<a href="#">The Art of Innovation @BtS'16</a>	04/10/2016	Kemal Delić	Hewlett-Packard Co, FR
8.*	<a href="#">BluEye Robotic – providing underwater adventures for everyone @BtS'16</a>	04/10/2016	Erik Dyrkoren and Martin Ludvigsen	Blueye Robotics, NO
9.*	<a href="#">Bootstrapping SonarSim: A Start-up Journey @BtS'16</a>	04/10/2016	Francis Flannery	SonarSim, IR
10.*	<a href="#">From Research to Revenues - The Puzzle of the Market @BtS'16</a>	04/10/2016	David Lane	Heriot-Watt University, UK
11.*	<a href="#">The Light Autonomous Underwater Vehicle – Affordable technology to address scientific and societal needs @BtS'16</a>	04/10/2016	Luis Madureira	OceanScan - Marine Systems & Technology, Lda, PT
12.*	<a href="#">IQUA Robotics: from lab to market @BtS'16</a>	04/10/2016	Pere Ridao	UdG, ES

13.*	<a href="#">Why and how becoming a researcher and entrepreneur? @BtS'16</a>	04/10/2016	Asgeir J. Sørensen	NTNU, NO
14.*	<a href="#">Titanrob: 3d printed Titanium Manipulators Innovation in the ROV sector @BtS'16</a>	04/10/2016	Darío Sosa Cabrera	ACSM, ES
15.*	<a href="#">Comments on the Management of Technology Startup Companies @BtS'16</a>	04/10/2016	Clayton Stewart	University College London (UK)
16.	<a href="#">"Design Thinking Workshop"</a>	11/11/2016	IBM Croatia	IBM Croatia
17.	<a href="#">Coordinators' Day (Amendments / Reporting and Payments)</a>	14/02/2017	EC	EC
18.	<a href="#">"University Entrepreneurship"</a>	19/05/2017	Jeff Skinner	London Business School
19.**	<a href="#">"Startup how to" @BtS'17</a>	03/10/2017	Vladimir Franceschi	Founder Institute Inc
20.**	<a href="#">"The scaling of innovation tools" @BtS'17</a>	03/10/2017	Thomas Curtin	Applied Physics Laboratory, USA
21.**	<a href="#">"Rich &amp; famous with underwater robotics? Attempt of an objective assessment" @BtS'17</a>	03/10/2017	Tom Runge	German Research Center for Artificial Intelligence DFKI, Robotics InnovationCenter, DE
22.**	<a href="#">"Paths to market- getting university innovation into the right hands" @BtS'17</a>	03/10/2017	Vlatka Petrović	University of Zagreb, HR
23.**	<a href="#">"Breaking the corporate" @BtS'17</a>	03/10/2017	Marin Bek	UNIZG-FER / H2O Robotics, HR
24.**	<a href="#">"Soft sensing and simulation" @BtS'17</a>	03/10/2017	Alexander Alspach	Toyota Research Institute, USA
25.**	<a href="#">"Bridging the gap between academic research and commercially viable technology" @BtS'17</a>	03/10/2017	Cesare Fantuzzi	University of Modena and Reggio Emilia, IT
26.**	<a href="#">"From research to business: some experiences at the University of Calabria" @BtS'17</a>	03/10/2017	Fabio Bruno	University of Calabria, IT
27.	<a href="#">"FET2RIN trainings"</a>	28-29/09/2017 26-27/10/2017 30/11-1/12/2017	Monica Pesce	European BIC Network (EBN)
28.	<a href="#">"H2020 FET - Innovation management training"</a>	26/01/2018	Mirjam Ros Vincent Ryckaert Markus Riester Richard Leaver	EC

\* given at BtS'16

\*\* given at BtS'17

### 1.2.3. Work package 3: Broad networking events

- EMRA workshops
  - **1st EXCELLABUST workshop: EMRA'16**

[EMRA'16 - Workshop on EU-funded Marine Robotics and Applications](#) was organized by Consiglio Nazionale delle Ricerche and Newcastle University's School of Electrical & Electronic Engineering on **14th and 15th June 2016 in Newcastle, UK**. This event brought together a diverse range of speakers, from ongoing FP7/H2020 projects, industry, end-users and stakeholders. The interdisciplinary event provided an excellent opportunity for networking and cross-fertilisation of ideas in marine robotics, enabling technologies and applications.

EMRA'16 in numbers:

- 10 EU projects presented
- 18 speakers from industry and academia
- more than 100 participants

More info is available [here](#) and photos [here](#).

- **2nd EXCELLABUST workshop: EMRA'17**

[EMRA '17 Workshop on EU-funded Marine Robotics and Applications](#) was organized at the University of Girona from May 15 to May 16, 2017, as a part of H2020 project "[EXCELLABUST](#) - Excelling [LABUST](#) in marine robotics". The goal of this workshop was to bring together academia and industry representatives from all around EU, who work in the field of marine robotics, so that they can present their work, exchange ideas, and discuss about the development of marine robotics in the future.

EMRA'17 in numbers:

- 95 Attendees
- 45 European Institutions and Companies
- 15 Different Countries
- 19 EU-funded projects presented
- 6 Private Sector and Tech Transfer Presentations

The [workshop programme](#), [workshop proceedings](#), and [photo gallery](#) are available on [EMRA '17 site](#).



- **BtS summer schools**

- **1st EXCELLABUST summer school: BtS'16**

8th International Interdisciplinary Field Workshop of Marine Robotics and Applications “Breaking the Surfac 2016” was held **from 2nd until 9th October 2016 in Biograd na Moru, Croatia.**

It was jointly organized by all EXCELLABUST partners as a 1st EXCELLABUST summer school. This edition broke all records: more than 220 participants from various fields (marine robotics, marine biology, marine archaeology, maritime security, oceanology etc.) joined BTS!

In short, BTS presented:

- 29 invited lectures
- 11 equipment, project and research groups demonstrations
- 3 tutorials

More information about the programme are available at [BTS web site](#) and photos in the [Gallery](#).



- **2nd EXCELLABUST summer school: BtS'17**

9th International Interdisciplinary Field Workshop of Marine Robotics and Applications “Breaking the Surfac 2017” was held **from 1st until 8th October 2017 in Biograd na Moru, Croatia.**

It was jointly organized by all EXCELLABUST partners as a 2nd EXCELLABUST summer school.

In 2017 edition, we:

- hosted more than 180 attendees
- held 38 lectures from various fields (marine robotics, marine biology, marine archaeology, maritime security, oceanology etc.) in 6 programme tracks
- organized 5 tutorials
- presented 4 maritime companies
- demonstrated 10 maritime vehicles developed through EU projects

More information about the programme and photos are available at BTS web site.



- **Conference and industrial events attendance**

	EVENT	DATE	LOCATION	PARTICIPANTS
1.	<a href="#">'Robotics in Space, Underwater, Industry and the Law'</a>	02/02/2016	Dublin, Ireland	UL
2.	<a href="#">European Robotics Forum - ERF 2016</a>	21-23/03/2016	Ljubljana, Slovenia	UNIZG-FER
3.	<a href="#">Oceanology International 2016</a>	15-17/03/2016	London, UK	UNIZG-FER, CNR, UdG, UL
4.	<a href="#">Marine Renewable Energy Ireland Symposium</a>	5-6/05/2016	Galway, Ireland	UL
5.	<a href="#">International Conference on Computer Applications and Information Technology in the Maritime Industries (COMPIT'16)</a>	09-11/05/2016	Lecce, Italy	CNR
6.	<a href="#">Student Autonomous Underwater Vehicles Challenge Europe (SAUCE'16)</a>	3-8/07/2016	La Spezia, Italy	UNIZG-FER, CNR
7.	Visit to central offices of <a href="#">SENER</a>	21/07/2016	Spain	UdG
8.	<a href="#">Underwater Communications and Networking (UCOMMS'16)</a>	30/08 – 01/09/2016	Lerici, Italy	UNIZG-FER
9.	<a href="#">10th IFAC Conference on Control Applications in Marine Systems (CAMS'16)</a>	13-16/09/2016	Trondheim, Norway	UNIZG-FER, UL, UdG
10.	<a href="#">Rijeka Nautic Show 2016</a>	23-25/09/2016	Rijeka, Croatia	UNIZG-FER
11.	<a href="#">IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2016)</a>	9-14/10/2016	Daejeon, Korea	UdG
12.	<a href="#">Autonomous Underwater Vehicles (AUV 2016)</a>	6-9/11/2016	Tokio, Japan	UdG
13.	<a href="#">Project Management Forum</a>	10/11/2016	Zagreb, Croatia	UNIZG-FER
14.	<a href="#">14th International Conference on Control, Automation, Robotics and Vision - ICARCV 2016</a>	13-15/11/2016	Phuket, Thailand	UL
15.	<a href="#">Zagreb Energy Conference</a>	09/12/2016	Zagreb, Croatia	UNIZG-FER
16.	<a href="#">Drone and Tech Expo Ireland</a>	10-12/03/2017	Dublin, Ireland	UL

17.	<a href="#">Ocean Business 2017</a>	04-05/04/2017	Southampton, UK	UdG
18.	<a href="#">International Convention on Information and Communication Technology, Electronics and Microelectronics - MIPRO</a>	22-26/05/2017	Opatija, Croatia	UNIZG-FER
19.	<a href="#">AdriaS International Workshop on Underwater and Nautical Archaeology</a>	03-10/06/2017	Dubrovnik, Croatia	UNIZG-FER
20.	<a href="#">OCEANS '17 MTS/IEEE conference</a>	20-22/06/2017	Aberdeen, UK	UNIZG-FER, UdG
21.	<a href="#">SeaFest 2017: Marine trade Show, Digital Ocean Conference &amp; Our Ocean Wealth Summit</a>	29-30/06/2017	Dublin, Ireland	UL
22.	<a href="#">IFAC 2017 World congress</a>	9-14/07/2017	Toulouse, France	UNIZG-FER, CNR
23.	<a href="#">(ERL) Robots Major Tournament</a>	15-23/09/2017	Piombino, Italy	UNIZG-FER
24.	<a href="#">Festival of Science and Innovation "Trieste NEXT"</a>	21-23/09/2017	Trieste, Italy	UNIZG-FER
25.	<a href="#">Economic Conference Montenegro 2017</a>	2-3/11/2017	Budva, Montenegro	UNIZG-FER
26.	<a href="#">7th Conference on Marine Technology</a>	17/11/2017	Rijeka, Croatia	UNIZG-FER
27.	<a href="#">Robotics 2018 Fair</a>	13-15/02/2018	Ljubljana, Slovenia	UNIZG-FER
28.	<a href="#">Oceanology International 2018</a>	13-15/03/2018	London, UK	UNIZG-FER, UL, UdG, CNR

#### 1.2.4. Work package 4: Dissemination and outreach

- **General dissemination**

##### **Project visual identity**

EXCELLABUST visual identity was created at the beginning of the project and in accordance to the projects main objectives. Developed materials will lead to project's recognisability among scientific and general community.

Developed materials:

- Logotype





### **Web-site**

EXCELLABUST (<http://excellabust.fer.hr/>) web-site was created at the beginning of the project and it is continuously updated with project news, information, deliverables, training materials, photos etc. by the members of the Consortium.



### **Social media accounts**

EXCELLABUST news are primarily shared through [LABUST Facebook page](#) with the community. All partners also share news through their social media accounts.



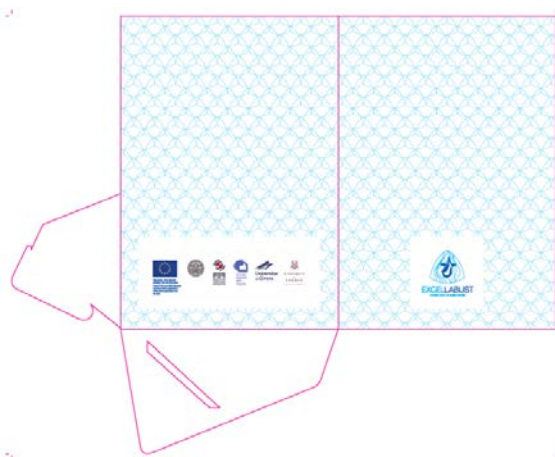


## Promotional materials – for EXCELLABUST trainings, lectures, events and visiting conferences, fairs and events

- Posters



- Folders



- EXCELLABUST soft-shell jackets for Consortium



- EXCELLABUST bags for training participants



- pens for dissemination



- “Open door” events – outreach to schools, pupils and teachers**

	EVENT	DATE	LOCATION
1.	<a href="#">Open-door event for elementary school students</a>	03/02/2016	UNIZG-FER
2.	<a href="#">Open-door event for high school students</a>	16/02/2016	CNR
3.	<a href="#">Open-door event during Job Fair</a>	09-10/05/2016	UNIZG-FER
4.	<a href="#">Open-door event in Limerick: Pint of Science</a>	25/05/2016	UL
5.	<a href="#">UdG organizes R2B2 workshops for pupils</a>	03, 04, 05, 07/2016	UdG
6.	<a href="#">MaREI Open Days in June - Cork Harbour Festival</a>	05/06/2016	UL

7.	<a href="#">Open Days 2016 at University of Limerick</a>	20-21/10/2016	UL
8.	<a href="#">University of Zagreb open-door event</a>	17-19/11/2016	UNIZG-FER
9.	<a href="#">FIRST Lego league Girona 2017</a>	28/01/2017	UdG
10.	<a href="#">University of Zagreb open-door event (2017)</a>	23-25/09/2017	UNIZG-FER
11.	<a href="#">Open Days 2017 at University of Limerick</a>	19-20/10/2017	UL
12.	<a href="#">Round table on gender equality</a>	25/11/2017	UNIZG-FER
13.	<a href="#">Panel discussion on robotics</a>	22/01/2018	UNIZG-FER
14.	<a href="#">Exhibition of young Croatian creators</a>	26/01/2018	UNIZG-FER
15.	<a href="#">FIRST Lego League Girona 2018</a>	31/01/2018	UdG

- **Visits to other institutions**

	INSTITUTION	DATE	PARTNER
1.	<a href="#">University of Rostock, DE: Invited talk on LABUST research activities by Prof. Nikola Mišković</a>	03/02/2016	UNIZG-FER
2.	<a href="#">University of Limerick, Ireland</a>	09-10/05/2016	UNIZG-FER, UL
3.	<a href="#">King's College London</a>	15/03/2017	UNIZG-FER
4.	<a href="#">Imperial College London</a>	15/03/2017	UNIZG-FER

- **Database with key industrial and research stakeholders**

University of Limerick has been responsible to develop the Marine Robotics Database. The database is envisioned to be a complete registry of all European key academic, industrial, research, end user, and government stakeholders for the benefit of the whole marine robotics community. The initial version of the Marine Robotics database was available online for selected members of Consortium in period M12-M18 for testing purposes, open to feedback and suggestions (D 4.3). Following the testing phase and after implementation of proposed changes and improvements, the final version of Marine Robotics database has been made available online since M19 (July 2017) for all stakeholders in marine robotics sector. For registered institutions, the database contains short description, end user sectors, products, services and contact details including the name of contact person, address of institution, web page, logo, e-mail and phone number. In period, M19-M27 the extensive database promotion campaign has been carried on in order to ensure as many new entries as possible.

Database is up and running and can be found on <http://excellabust.mmrrc.ul.ie/>.

### 1.3. Summary of deliverables

WP #	Del Rel. No	Del No	Title	Lead benef.	Submitted (date)
WP4	D1	D4.1	Website online	UNIZG-FER	02 Feb 2016
WP2	D2	D1.1	Statement on entering publication list to the Participant Portal	UNIZG-FER	25 Feb 2016
WP4	D3	D4.2	Dissemination plan - first version	UL	01 Apr 2016
WP3	D4	D3.1	Proceedings of EMRA workshop 1	CNR	14 Jul 2016
WP1	D5	D1.2	Nine-month project report 1	UNIZG-FER	30 Sep 2016
WP2	D9	D2.1	Nine-month report on the progress of know-how exchange 1	UdG	03 Oct 2016
WP3	D6	D3.2	Proceedings of BtS summer school 1	UNIZG-FER	31 Oct 2016
WP4	D7	D4.3	Database v1 with key industrial and research stakeholders online	UL	05 Jan 2017
WP1	D8	D1.3	Minutes of meetings 1	UNIZG-FER	04 Jul 2017
WP3	D10	D3.3	Proceedings of EMRA workshop 2	UdG	25 May 2017
WP3	D11	D3.4	Report on conference and industrial events attendance 1	CNR	29 Jun 2017
WP4	D12	D4.4	Dissemination plan - final version	UL	29 Jun 2017
WP4	D13	D4.5	Report on "Open-door" events 1	UL	29 Jun 2017
WP2	D17	D2.2	Nine-month report on the progress of know-how exchange 2	UdG	30 Jun 2017
WP3	D14	D3.5	Proceedings of BtS summer school 2	UNIZG-FER	31 Oct 2017
WP4	D15	D4.6	Database with key industrial and research stakeholders finalized	UL	29 Oct 2017

### 1.4. Summary of milestones

No	Name	Lead benef.	Delivery date	Achieved
1	1st year complete	UNIZG-FER	01 Jan 2017	Yes
2	2nd year complete	UNIZG-FER	01 Jan 2018	Yes

### 1.5. Impact

The information in the DoA related to the project impact are still relevant and do not need updating.

### 1.6. Exploitation

The information in the DoA related to the project exploitation are still relevant and do not need updating.

## 2. UPDATE OF THE PLAN FOR EXPLOITATION AND DISSEMINATION OF RESULT

The first version of the dissemination plan has been produced by UL in the form of D4.2, while the final version was delivered as D4.4. The plan outlines the main objectives of the project and describes the internal and external communication methods defining tools and strategies to achieve them, including the basic mechanisms, which will be adopted by project consortium, and possible steps that should be taken for their realisation.

The plan represents the indispensable support to project partners in carrying on dissemination activities during the project lifetime and after. It is intended to ensure that relevant target groups and end users are informed about the project's outputs and that exploitation of the results is carried out in satisfactory and efficient way. The main activities include standard dissemination activities to raise awareness of the initiative among the key actors and specific target groups on different levels in the sector and a broader European level.

The main modification to the dissemination and exploitation plan includes addressing the relations with policy makers.

- A project proposal was submitted to European Structural and Innovation Funds specifically designed for the development of infrastructure for Croatian Twinning actions
- Project Officer has been contacted in order to find suitable ways of attracting EU policy makers to EMRA'18 and BtS'18 events
- "Citizens' Dialogue" with European Commissioner for digital economy and society Mariya Gabriel has been organized at UNIZG-FER on 23<sup>rd</sup> March 2018.

## 3. UPDATE OF THE DATA MANAGEMENT PLAN

Data management plan is not applicable for this project.

## 4. FOLLOW-UP OF RECOMMENDATIONS AND COMMENTS FROM PREVIOUS REVIEW(S)

During the first review meeting, the following major recommendations and comments were made.

- *It is recommended to take into consideration the gender balance data for the next period as "Gender equality" is one specific concern of Horizon 2020. A paragraph on this topic should be added in the second periodic technical report, in chapter 4: FOLLOW-UP OF RECOMMENDATIONS AND COMMENTS FROM PREVIOUS REVIEW*

In order to address this recommendation, we participated in a Skype meeting with a company involved in gender issues, at the recommendation of the Project Officer. The major result of the meeting was the involvement of Prof Martina Schraudner (<https://www.cerri.iao.fraunhofer.de/en/ueber-uns/leitung.html>), the Head of Fraunhofer Center for Responsible Research and Innovation, who also heads the "Gender and Diversity Aspects in Organizations" department at the Technische Universität

Berlin. She was invited to give a talk on gender aspects in innovation management during “Breaking the Surface 2017”, however she had to cancel her participation at the last moment due to private reasons. She will be invited again to participate at “Breaking the Surface 2018”.

Further on, EXCELLABUST Project Manager Ivana Mikolić participated at the round table on gender equality in Faculty of Electrical Engineering and Computing University of Zagreb, with the main aim of demonstrating how study of technical science at UNIZG-FER can be made accessible to all, regardless of gender. Invited speakers at round table were women who have studied or currently studying at UNIZG-FER.

We will continue to participate in similar events in order to promote and contribute to gender balance in research areas where traditionally gender disbalance is present.

- *The beneficiaries propose to stimulate the participation of policy makers in some of the events for a better understanding of the project and looking for their cooperation in future strategies. This is a relevant initiative that should be well documented in the second periodic report in chapter 2: UPDATE OF THE PLAN FOR EXPLOITATION AND DISSEMINATION OF RESULT*

Strong efforts have been made to invite policy makers to events organized within EXCELLABUST project, however without much success. However, it should be stated that local Croatian policy makers have identified the importance of Twinning actions and have opened a call for successful Twinning projects within the European Structural and Investment Funds for supporting the development of infrastructure which is not funded by H2020 Twinning programmes. We have submitted the “INFRA-LAPOST - Istraživačka infrastruktura Laboratorija za podvodne sustave i tehnologije” proposal which envisions the development of experimental pool for LABUST. The proposal is in the evaluation phase.

In addition, “Citizens’ Dialogue” with European Commissioner for digital economy and society Mariya Gabriel has been organized at UNIZG-FER on 23<sup>rd</sup> March 2018.

Additional modifications have been made to the dissemination and exploitation plan in Chapter 2 of the report.

## 5. DEVIATIONS FROM ANNEX 1

### 5.1. Tasks

All tasks are running according to the plan in the DoA.

### 5.2. Use of resources

#### 5.2.1. Unforeseen subcontracting

There was no unforeseen subcontracting.

#### 5.2.2. Unforeseen use of in kind contribution from third party against payment or free of charges

There was no unforeseen use of in kind contribution from third party against payment or free of charges.

## 6. QUESTIONNAIRE ANNEXED TO PART B OF THE PERIODIC REPORT

### 1. How has the Twinning exercise so far, helped to raise the research profile of the coordinating institution within the country and abroad?

During the first 27 months, EXCELLABUST action has significantly helped in raising research profile of the University of Zagreb Faculty of Electrical Engineering and Computing (UNIZG-FER), within the marine robotics research field that is conducted in the Laboratory for Underwater Systems and Technologies (LABUST).

Firstly, we experienced a **high increase in scientific excellence, innovation capacity, and staff's research profile**. Measures that contributed to this increase include: staff exchanges, invited talks, tutorials, technical trainings, and innovation management trainings.

Secondly, there was a **significant increase in UNIZG-FER scientific involvement and visibility within the international marine robotics community**. This increase was accomplished through the networking done on a series of events aimed towards strengthening links to marine robotics industry as well as end-users.

Raise in UNIZG-FER research profile is measured through a set of key impact indicators: publications, participation in national and EU level research and innovation programmes, innovation and connection with industry, and extent of synergy. Specific numbers quantifying these indicators are mentioned in the following part of the questionnaire.

### 2. How has the Twinning exercise so far, helped to raise the research excellence of the coordinating institution in the chosen field of research?

During the first 27 months, EXCELLABUST action has significantly helped in raising research excellence of UNIZG-FER in the research area of marine robotics. This is mostly visible through the number of research publications published at peer reviewed conferences and in high quality journals (during first 27 months of EXCELLABUST action):

- **11** peer reviewed conference publications
- **6** journal publications: one in top 10% journals, three in Q2 journal and two in Q3 journals

### 3. Have you seen so far a leap forward in terms of reputation, attractiveness and opening of new networks of the coordinating institution as a result of the Twinning exercise?

During the first 27 months, EXCELLABUST action has resulted in a significant leap forward in terms of UNIZG-FER reputation, attractiveness and opening of new networks. This is mostly visible through increase in citations, joint activities with international partners, and new collaboration agreements with industries and research institutions, as listed below:

- **47%** increase in citations

- Joint activities:
  - o **27** proposal submissions (10 international projects approved) with international partners
  - o **41%** of peer reviewed publications are joint publications with international partner
  - o organization of **4** joint events
- New collaboration agreements:
  - o **5** new collaboration agreements with industry
  - o **4** new collaboration agreements with research institutions

**4. Has there been an improvement in terms of being able to attract more competitive research funding (national/EU/international) by the coordinating institution as a result of the Twinning exercise?**

During the first 27 months of EXCELLABUST action, UNIZG-FER has experienced a **significant improvement in terms of attracting competitive research funding** in the research area of marine robotics. Out of 32 submitted research proposals (27 international and 5 national), 13 research proposals (10 international and 3 national) were selected for funding. Table below gives concise overview of funded projects. It is expected that this trend will continue in the future, thus significantly contributing to LABUST excellence and sustainability.

International projects		
H2020-INFRAIA	EUMarineRobots - Marine robotics research infrastructure network	Mar 2018- Feb 2021
BILAT	CC-MARS – China-Croatia collaboration on marine robotic systems	Feb 2018- Feb 2020
H2020-WIDESPREAD	ACROSS - Centre of Excellence for Autonomous and Cooperative Robotic Systems	Oct 2017 - Sep 2018
DG-ECHO	e-URready4OS – Expanded Underwater Robotics Ready for Oil Spill	Jan 2017 - Dec 2018
I4MS	CROBOHUB - Feasibility study for Croatian robotics digital innovation hub	Nov 2016 - Apr 2017
H2020-FETOPEN	aPad - smaller, lighter, smarter autonomous marine surface vehicle	May 2017 - Oct 2018
FLAG-ERA	RoboCom++ - Rethinking Robotics for the Robot Companion of the future	Mar 2017 - Feb 2020
INTERREG-MED	BLUEMED - Plan/test/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	Sep 2016 - Aug2019
H2020 (RAWFIE)	PlaDyFleet - A fleet of unmanned surface marine vehicles PlaDyPos	Sep 2016- Dec 2018
ONR-G	TICA - Towards Immersion into Submerged Coastal Archaeological Environment	Mar 2016- Sep 2016
National projects		

EFRR	DATA CROSS - Napredne metode i tehnologije u znanosti o podacima i kooperativnim sustavima	Nov 2017 - Nov 2023
HRZZ	CroMarX – Cooperative robotics in marine monitoring and exploration	Apr 2017- Mar 2021
UNIZG	Kooperativno upravljanje autonomnim plovilima	Nov 2016

## 5. How have the non-Widening consortium beneficiaries contributed so far, and how have they been effecting and optimising the low performing partner institutions, in the Widening country?

Non-widening partners, Consiglio Nazionale delle Ricerche (Italy), University of Girona (Spain) and University of Limerick (Ireland) have **significantly contributed** to the EXCELLABUST project and their influence on University of Zagreb Faculty of Electrical Engineering as a low performing partner institution has been extremely positive. All the events within the EXCELLABUST action have been organized jointly which demonstrates their strong willingness to contribute towards raising UNIZG-FER potential, with specific emphasis on the area of marine robotics.

During the first 27 months of the EXCELLABUST action, high performing partner institutions have specifically contributed in the following areas:

- **S&T knowledge transfer:** staff exchanges were all executed towards high performing partners, and 9 out of 10 tutorials were held by them, and they gave 6 out of 45 invited talks,
- **hands-on S&T experience:** on-site training event were held by CNR and UdG, while more are planned during the action,
- **knowledge on innovation management:** various seminars have significantly contributed to the organisational capacity of UNIZG-FER. The high-performing partners have transferred their management skills and thus made UNIZG-FER a better institution from the operational point of view. Thanks to this, UNIZG-FER Centre for Research Support has been reorganized in order to achieve higher efficiency.
- **strengthening links to marine robotics industry:** in the first 27 months by joint participation in conferences and industrial events. In addition, CNR and UdG organized “EU-funded projects in marine robotics and applications workshop - EMRA” in Newcastle, UK and Girona, Spain with high participation of industrial stakeholders.
- **strengthening links to marine robotics end-users:** accomplished through a series of open-door events, and joint organisation of “Breaking the Surface” summer schools in 2016 and 2017.

All of the mentioned activities will be continued during EXCELLABUST project.

## 6. What were the main measures applied during the implementation of the Action so far, which have significantly enhanced the expected impacts of the project (i.e. staff exchanges, experts' visits, short-term onsite or visual trainings, workshops, conferences' attendance, organization of joint summer schools type activities, dissemination, exploitation, outreach activities, etc.)?

A complete set of measures have been planned within the EXCELLABUST project to enhance the expected impacts of the project. A list of these measures, and specific numbers of events organized within the first 27 months of the project is given below.

- **4 staff exchanges** from UNIZG-FER to partner institutions (each in the duration of two months)
- **45 expert visit invited talks** at UNIZG-FER and during BtS'16 and BtS'17 summer school
- **10 expert visit tutorials** at UNIZG-FER and during BtS'16 and BtS'17 summer school
- **2 on-site trainings** by CNR in Genova, Italy and UdG in Girona, Spain
- **28 innovation management trainings** on various topics
- **2 workshops** for strengthening links with industry "EU-funded projects in marine robotics and applications workshop - EMRA" – EMRA'16 in Newcastle, UK, organized by CNR and EMRA'17 in Girona, Spain, organized by UdG
- **28 conferences and industrial events**
- **15 open-door** events, 7 of which were organized at UNIZG-FER
- **2 summer schools** for strengthening links with end-users and increasing UNIZG-FER visibility and involvement, "Breaking the Surface" in 2016 and 2017 in Biograd na Moru, Croatia

**7. Any other aspects/points that you would like to communicate to the European Commission?  
Any particular difficulties or benefits at a consortium level?**

During the first 27 months of EXCELLABUST action, we did not experience any difficulties at a consortium level and we do not anticipate any upcoming difficulties. None of the risks in the risk register were materialized.

As for benefits, we would like to emphasize strong partner collaboration and devotion to achieving project results.

Significant effort has been made in terms of dissemination through various media. All partners have committed to further develop events and communication means for reaching out to the society.

Finally, UNIZG-FER LABUST has also experienced a significant improvement in the area of product commercialization and technology transfer to the industry.