EXCELLABUST

EXCELLING LABUST IN MARINE ROBOTICS

Deliverable D1.6

Report on key impact indicators 1 year after project completion

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:	1st January 2016
Duration:	36 months
Project website:	http://excellabust.fer.hr/
Delivery date:	31.12.2018.
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.

DELIVERABLE DATA SHEET

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Deliverable title:		**Report on key impact indicators 1 year after project completion**				
Work package:		**WP1 – Project management**				
Type:	**Report**	**Delivery date**	**31/12/2018**	**Version:**	**1.0**	
Lead participant		**University of Zagreb Faculty of Electrical Engineering and Computing (UNIZG - FER)**				
Dissemination level:						
PU	**Public**					**X**
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Version log			
Revision no.	Date	Author (Partner)	Change

Deliverable summary

This deliverable provides a report on key impact indicators. The planned delivery date was a year after the project will end. Since it is not possible to upload to the Participant Portal anything after the project ends, we are submitting a report with numbers for the first three years. Numbers a year after the project end will be published on EXCELLABUST website.

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INTRODUCTION

This deliverable provides a full table with the KIIs as they were defined in the proposal. The planned delivery date was a year after the project will end. Since it is not possible to upload to the Participant Portal anything after the project ends, we are submitting a report with numbers for the first three years. Numbers a year after the project end will be published on EXCELLABUST website.

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1. Key impact indicators (KII) report

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[1] - 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 – 2018: 1
Total current status (2010 – 2018): **1**

List of journal papers:

Vasilijević, Antonio; Nađ, Đula; Mandić, Filip; Mišković, Nikola; Vukić, Zoran. Coordinated Navigation of Surface and Underwater Marine Robotic Vehicles for Ocean Sampling and Environmental Monitoring. // **IEEE/ASME transactions on mechatronics**, 22 (2017), 3; 1174-1184. doi:10.1109/TMECH.2017.2684423	**Q1** (top 10%, 2017; 4/46 in Engineering, manufacturing; 9/128 in Engineering, mechanical)

1.2. Number of public. in Q1/Q2/Q3/Q4 peer-reviewed journals[2]	1/2/1/2[3]	3/3/5/5	4/4/5/5

Journal publications in 2016 – 2018: 9 (1/6/2/0)
Total current status (2010 – 2018): **15 (2/8/3/2)**

List of journal papers:

Mandić, Filip; Mišković, Nikola; Lončar, Ivan. Underwater Acoustic Source Seeking Using Time Difference of Arrival Measurements. // **IEEE Journal of Oceanic Engineering**, accepted for publication.	**Q2** (2017)
Zereik, Enrica; Bibuli, Marco; Mišković, Nikola; Ridao, Pere; Pascoal, António. Challenges and future trends in marine robotics // **Annual Reviews in Control**, 46 (2018), 350-368 doi:10.1016/j.arcontrol.2018.10.002	**Q2** (2017)
Kapetanović, Nadir; Mišković, Nikola; Tahirović, Adnan; Bibuli, Marco; Caccia, Massimo. A side-scan sonar data-driven coverage planning and tracking framework // **Annual Reviews in Control**, 46 (2018), 268-280 doi:10.1016/j.arcontrol.2018.10.012	**Q2** (2017)

[1] 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.
[2] Journal ranking is taken from ISI Web of Knowledge – Journal Citation Reports
[3] 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.

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Vasilijević, Antonio; Jambrošić, Kristian; Vukić, Zoran. Teleoperated path following and trajectory tracking of unmanned vehicles using spatial auditory guidance system // **Applied acoustics**, 129 (2018) 72-85. doi:10.1016/j.apacoust.2017.07.001	**Q2** (2017)
Vasilijević, Antonio; Nađ, Đula; Mandić, Filip; Mišković, Nikola; Vukić, Zoran. Coordinated Navigation of Surface and Underwater Marine Robotic Vehicles for Ocean Sampling and Environmental Monitoring. // **IEEE/ASME transactions on mechatronics**, 22 (2017), 3; 1174-1184. doi:10.1109/TMECH.2017.2684423	**Q1** (10%, 2017)
Mandić, Filip; Rendulić, Ivor; Mišković, Nikola; Nađ, Đula. Underwater object tracking using sonar and USBL measurements. // **Journal of Sensors**. 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; Vasilijević, Antonio; Vukić, Zoran. CADDY - Cognitive Autonomous Diving Buddy: Two Years of Underwater Human-Robot Interaction. // **Marine technology society journal**. 50 (2016) , 4; 54-66	**Q3** (2016)
Stilinović, Nikola; Marković, Milan; Mišković, Nikola; Vukić, Zoran; Vasilijević; Antonio. Mechanical Design of an Autonomous Marine Robotic System for Interaction with Divers. // **Brodogradnja** : 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. **// International journal of adaptive control and signal processing**. 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. // **IEEE robotics & automation magazine**. 22 (2015) , 3; 72-84	Q2
Nađ, Đula; Mišković, Nikola; Mandić, Filip. Navigation, guidance and control of an overactuated marine surface vehicle. // **Annual reviews in control**. 40 (2015) ; 172-181	Q2
Vasilijević, Antonio; Borović, Bruno; Vukić, Zoran. Underwater Vehicle Localization with Complementary Filter: Performance Analysis in the Shallow Water Environment. **// Journal of intelligent & robotic systems**. 68 (2012) , 3/4; 373-386	Q3
Vasilijević, Antonio; Borović, Bruno; Vukić, Zoran. Augmented Reality in Marine Applications. // **Brodogradnja** : 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. // **Journal of field robotics**. 28 (2011), 1; 101-120	Q1
Mišković, Nikola; Nađ, Đula; Vukić, Zoran. 3D Line Following for Unmanned Underwater Vehicles. // **Brodogradnja** : časopis brodogradnje i brodograđevne industrije. 61 (2010) , 2; 121-129	Q4

1.3. Number of peer-reviewed conference publications	37[4]	50	57
In 2016 – 2018: 14 Total current status (2010 – 2018): **51**			
1.4. Number of citations[5]	367	580	700
2010 – 2015: [228 (Mišković) + 506 (Vukić)]/2 = 367			

[4] Original number was 27 but more conference papers were published since the project proposal submission and project start.

[5] 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.

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2016 – 2018: [237 (Mišković) + 279 (Vukić)]/2 = 258
Total current status (2010 – 2018): **625 (+70%)**

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
2.1. Number of national and international proposal submitted	~ 40	8-10 p.a.	8-10 p.a.

In 2016: **22** (19 international and 3 national)
In 2017: **10** (8 international and 2 national)
In 2018: **11** (9 international and 2 national)

Total: **43** (36 international and 7 national) – see tables below for details

International projects 2018		
COST	Trustworthy Autonomous Cyber-Physical Systems	submitted
H2020-ERA Chair	ERA Chair in Internet of Underwater Things at LABUST	submitted
INTERREG	MARMAID - MARine Microplastics monitoring AID	submitted
INTERREG	BAGROAD - Biological, Arheological and Geological sities: a Roadmap for prOtection, vAlorization, fruition and cultural Dissemination	submitted
ONR-G	ADRIATIC - Advancing Diver-Robot Interaction Capabilities	approved
ERASMUS+	IMPACT - Intelligent Marine systems - a Pathway towards sustAinable eduCation, knowledge and empowerment	approved
H2020-MG	SeaSerpent - Autonomous subsea resident vehicles for long-range ocean survey missions	not approved
H2020-MSCA	MARE - Marine Robotic Systems and Technologies for Ocean Exploration and Sustainable Exploitation	not approved
H2020-MSCA	BlueGuard - New integrated approaches and technological innovations for coastal and marine water monitoring	not approved
National projects 2018		
EFRR	Multifunkcionalne pametne bove	submitted
EFRR	INFRA-LAPOST - Istraživačka infrastruktura Laboratorija za podvodne sustave i tehnologije	approved

International projects 2017		
H2020-INFRAIA	EUMarineRobots - Marine robotics research infrastructure network	approved
BILAT	CC-MARS – China-Croatia collaboration on marine robotic systems	approved
COST	MARVELOUS - SubMARine Volcanoes European colLabOration Uniting experts and Society	not approved
H2020-ERA Chair	ERA Chair in Internet of Underwater Things at LABUST	not approved

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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
H2020-ICT	Mobile subsea test platform for novel market applications	not approved
National projects 2017		
EFRR - UZI	NEUDRON - Podvodni NEUtronski DRON	submitted
HRZZ	Biosensor-augmented unmanned autonomous surface vehicles for marine toxicant monitoring	not approved

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 - ADRION	GMOD - Geohazards global modelling to homogenize information in the peri-Adrion 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

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H2020-SEC	iUAS - Intelligent Unmanned Agent System	not approved
LIFE	Kupa – river of LIFE	not approved
National projects in 2016		
EFRR	DATACROSS - Napredne metode i tehnologije u znanosti o podatcima 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[6]	~ 20%	~ 40%	~ 40%

Current status (2016 – 2018): **16 (43%)**

International projects		
ONR-G	ADRIATIC - Advancing Diver-Robot Interaction Capabilities	Jun 2018 – May 2021
ERASMUS+	IMPACT - Intelligent Marine systems - a Pathway towards sustAinable eduCation, knowledge and empowerment	Nov 2018 – Feb 2021
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	INFRA-LAPOST - Istraživačka infrastruktura Laboratorija za podvodne sustave i tehnologije	Oct 2018 – Sep 2020

[6] This KII is very difficult (almost impossible) to influence hence it should not be considered strictly.

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EFRR	DATACROSS - Napredne metode i tehnologije u znanosti o podatcima 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
3.1. Number of collaboration agreements with businesses	0	6	8
Current status: **7** 1. INNOVASUB, Turkey 2. Heron Robots, Italy 3. Kongsberg, Norway 4. Brodarski Institute, Croatia 5. SAAB, Norway 6. MARS, Croatia (UNIZG-FER spinoff) 7. H2O robotics, Croatia (UNIZG-FER spinoff)			
3.2. Number of patent applications	0	2	3
Current status: **0**			
3.3. Number of commercialization agreements	0	2	3
Current status: **2** 1. MARS, Croatia (UNIZG-FER spinoff) 2. H2O robotics, Croatia (UNIZG-FER spinoff)			
3.4. Number of new innovative products or services	0	1	2
Current status: **2** 1. autonomous surface marine platform 2. autonomous underwater vehicle BUDDY			

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
4.1. Percentage of joint publications	~ 20%[7]	~ 50%	~ 50%
Current status (2016 – March 2018): 10 of 22 (**46%**)			
4.2. Number of collab. agreements with research institutions	2	7	10

[7] 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.

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Current status (2016 – 2018): **5** 1. University of Girona, Spain 2. Divers Alert Network Europe, Malta 3. Faculty of Science and Engineering University of Limerick, Ireland 4. Jacobs University Bremen, Germany 5. Consiglio Nazionalle delle Ricerche, Italy			
4.3. Number of joint events	1	6	8
Current status (2016 – 2018): **7** 1. EMRA'16, Newcastle, UK; 2. BtS'16, Biograd na Moru, Croatia 3. EMRA'17, Girona, Spain; 4. BtS'17, Biograd na Moru, Croatia 5. EMRA'18, Limerick, Ireland; 6. IFAC CAMS'18, Opatija, Croatia 7. BtS'18, Biograd na Moru, Croatia			

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