

## Deliverable D3.7

### Proceedings of Breaking the Surface summer school 3

Project Acronym:	EXCELLABUST	
Grant Agreement number:	691980	
Project title:	Excelling LABUST in marine robotics	
Funding:	Horizon2020 Twinning	
Call:	H2020-TWINN-2015	
Type of action:	CSA	
Start date of project:	1 <sup>st</sup> January 2016	
Duration:	36 months	
Project website:	<a href="http://excellabust.fer.hr/">http://excellabust.fer.hr/</a>	
Delivery date:	31 <sup>st</sup> October 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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Work package:		WP3 – Broad networking events			
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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
<p>The 3<sup>rd</sup> EXCELLABUST summer school “Breaking the Surface” 2018 (<a href="http://bts.fer.hr/">http://bts.fer.hr/</a>) was held from 30<sup>th</sup> September until 7<sup>th</sup> October in Biograd na Moru, Croatia and more than 200 people participated. The programme was divided in six programme tracks: marine robotics (MAROB); marine biology and marine nature protection (MARBIO); maritime security, naval and coast guard operations (MARSEC); maritime, nautical and ship archaeology (MARCH); marine geology (MARGEO); and Innovation Tuesday programme (INNOVA). In 7 days 29 lectures, 8 demonstrations and 4 tutorial were presented.</p> <p>This deliverable offers report on organization of BtS and its programme. The deliverable is accompanied with appendixes with abstracts, biographies and presentations of the programme presenters:</p> <p><i>APPENDIX I. – Abstracts and biographies</i></p> <p><i>APPENDIX II. – Presentations (slides)</i></p>

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## 1. INTRODUCTION



The 3<sup>rd</sup> EXCELLABUST summer school “Breaking the Surface” 2018 (<http://bts.fer.hr/>) was held from 30<sup>th</sup> September until 7<sup>th</sup> October in Biograd na Moru, Croatia and more than 200 people participated. The programme was divided in six programme tracks: marine robotics (MAROB); marine biology and marine nature protection (MARBIO); maritime security, naval and coast guard operations (MARSEC); maritime, nautical and ship archaeology (MARCH); marine geology (MARGEO); and Innovation Tuesday programme (INNOVA). In 7 days 29 lectures, 8 demonstrations and 4 tutorial were presented.

**Dates:** 30<sup>th</sup> September until 7<sup>th</sup> October 2018

**Location:** Biograd na Moru, Croatia

**Website:** <http://bts.fer.hr/>

## 2. REPORT ORGANIZATION

The first part of the report describes the BtS 2018 organization, including the work program. The deliverable is accompanied with appendixes with abstracts, biographies and presentations of the programme presenters:

*APPENDIX I. – Abstracts and biographies*

*APPENDIX II. – Presentations (slides)*

### 3. ABOUT BREAKING THE SURFACE

Breaking the Surface - BtS summer school has been organized by UNIZG FER LABUST for the last 10 years – first three years as a part of FP7-REGPOT CURE project, in following years until 2015 by Office of Naval Research Global support. From 2015 until 2018, BtS was funded by the European Commission under EXCELLABUST project. During the years, BtS served as a meeting place of experts and students of marine robotics and the marine robotics application areas such as marine biology, marine archaeology, marine security, oceanography, marine geology and oceanology. This is the world's first successful, multi-year field training program that combines academic topics in marine robotics and robotics application areas and hands-on working experience in the sea, doing remote sensing and sampling for various ocean sciences.

Breaking the Surface summer school is organized in attempt to strengthen links between marine robotics research and end-users and provide EXCELLABUST partners with one-week intense summer school consisting of plenary talks, hands-on trainings and demonstrations of marine technologies, by EXCELLABUST partners and worldwide experts.

The program is organized in the form of plenary talks, hands-on tutorials and demonstrations of marine technologies, e.g. marine robotics (MAROB); marine biology and marine nature protection (MARBIO); maritime security, naval and coast guard operations (MARSEC); maritime, nautical and ship archaeology (MARCH), marine geology (MARGEO), and Innovation Tuesday programme (INNOVA).

### 4. ORGANIZERS

Breaking the Surface summer school is organized under the European Union's Horizon 2020 project EXCELLABUST - Excelling LABUST in marine robotics (GA 691980). The main organizers are University of Zagreb Faculty of Electrical Engineering and Computing, Laboratory for Underwater Systems and Technologies and Centre for Underwater Systems and Technologies with organization support from Institute of Studies on Intelligent Systems for Automation - ISSIA, National Research Council of Italy (CNR), University of Girona (UdG), and University of Limerick (UL).





## ORGANIZERS



University of Zagreb



Faculty of Electrical  
Engineering and Computing



Laboratory for Underwater  
Systems and Technologies



Centre for Underwater  
Systems and Technologies

## IN PARTNERSHIP WITH



Institute of Studies on Intelligent  
Systems for Automation - ISSIA,  
National Research Council of Italy  
(CNR)



University of Girona (UdG)



University of Limerick (UL)

## BREAKING THE SURFACE ORGANIZATION STRUCTURE:

### 4.1. COMMITTEES CHAIRS



**Prof. Dr. Sc. Zoran Vukić**  
General Chair

*University of Zagreb,  
Faculty of Electrical  
Engineering and Computing,  
Laboratory for Underwater  
Systems and Technologies*



**Assoc. Prof. Dr. Sc. Nikola Mišković**  
Programme  
Committee Chair  
**EXCELLABUST project  
Coordinator**

*University of Zagreb,  
Faculty of Electrical  
Engineering and Computing,  
Laboratory for Underwater  
Systems and Technologies*



**Ivana Mikolić, mag. ing.**  
Organizing  
Committee Chair

*University of Zagreb,  
Faculty of Electrical  
Engineering and Computing,  
Laboratory for Underwater  
Systems and Technologies*



**Dr. Sc. Antonio Vasiljević,**  
Technical Committee Chair

*University of Zagreb,  
Faculty of Electrical  
Engineering and Computing,  
Laboratory for Underwater  
Systems and Technologies*

## 4.2. PROGRAMME COMMITTEE



**Marco Bibuli, PhD**

*Centre Nazionale delle  
Ricerche - CNR  
Institute of intelligent systems  
for automation - ISSIA*



**Prof. Bridget Buxton,  
PhD**

*University of Rhode Island,  
Department of History*



**Massimo Caccia, MSc**

*Centre Nazionale delle  
Ricerche - CNR  
Institute of intelligent systems  
for automation - ISSIA*



**Assoc. Prof. Marc  
Carreras, PhD**

*University of Girona  
Computer Vision and Robotics  
Research Institute - VICOROB*



**Edin Omerdić, PhD**

*University of Limerick*



**Asst. Prof. Dr. Sc. Irena  
Radić-Rossi**

*University of Zadar,  
Department of Archaeology*



**Prof. Pere Ridao, PhD**

*University of Girona  
Computer Vision and Robotics  
Research Institute - VICOROB*



**Prof. Asgeir Sørensen,  
PhD**

*Norwegian University of  
Science and Technology*



**Prof. Daniel Toal, PhD**

*University of Limerick*

### 4.3. ORGANIZING COMMITTEE



Petra Kovačević



Tonko Bogovac



Anamarija Miličević



Ivan Trubić



Ivan Dominić



Mladen Petr



Valentino Žinić



#### 4.4. TECHNICAL COMMITTEE



**Anja Babić, mag. ing.**

UNIZG FER LABUST



**Nadir Kapetanović, mag. ing.**

UNIZG FER LABUST



**Ivan Lončar, mag. ing.**

UNIZG FER LABUST



**Filip Mandić, mag. ing.**

UNIZG FER LABUST



**Milan Marković**

UNIZG FER LABUST



**Dr. Sc. Đula Nađ**

UNIZG FER LABUST



**M. Eng. Marin Stipanov**

UNIZG FER LABUST



**Kruno Zubčić**

*Croatian Conservation  
Institute*

## 5. PROGRAMME

### 5.1. PROGRAMME STRUCTURE

BtS program is comprised of academic lectures, hands-on tutorials, presentation of projects and equipment and company demonstrations.



#### 29 LECTURES

- 9 MAROB
- 2 MARBIO
- 2 MARCH
- 2 MARSEC
- 3 MARGEO
- 11 INNOVA



#### 4 TUTORIALS

- groups of 20 students
- 2-3 students per computer



#### 4 COMPANY PRESENTATIONS

- BluEye Robotics
- Blueprint Subsea
  - EvoLogics
- Sonardyne International Ltd



#### 4 DEMOS



#### 4 EU PROJECTS

#### 5.1.1. LECTURES

Lectures by experts in the domains of:



maritime robotics  
MAROB



marine biology  
MARBIO



marine archaeology  
MARCH



maritime security  
MARSEC



innovation day  
INNOVA

List of speakers:

### Marine robotics (MAROB):

- Aviad Avni, University of Haifa, Israel: [Advanced maneuvering and vision algorithms for surveys with the SPARUS II AUV](#)
- Milica Stojanović, Northeastern University, USA: [Underwater acoustic communications: Fundamentals and new results](#)
- Torsten Jeinsch, University of Rostock, Germany: [Key technologies towards the vision of complex autonomous underwater operations: From project SMIS to MUM](#)
- William Kirkwood, Monterey Bay Aquarium Research Institute, USA: [Shearwater: The future of hybrid autonomous marine vehicles](#)
- Alexander Philips, National Oceanography Centre, UK: [Oceanids: Development of next generation marine autonomous systems for ocean science](#)
- Tim Mundon, University of Washington, USA: [Micro-scale wave energy generation for autonomous sensors and robotics](#)
- Walter Caharija, SINTEF Ocean AS, Norway: [Autonomy and remote control technology in sea aquaculture activities](#)
- Xianbo Xiang, Huazhong University of Science and Technology, China: [Cloud-based Management and Control of Autonomous Marine Vehicles: Concept and Demonstration](#)
- Iain A. Anderson, University of Auckland: [A fast fish-like human-powered racing submarine](#)

### Marine biology (MARBIO):

- Ivona Cetinić, NASA Goddard Space Flight Center/USRA, USA: [Chasing ocean carbon – from sky to sea and below](#)
- Andrea Gori, Institut de Ciències del Mar - Consejo Superiores de Investigaciones Científicas, Spain: [Submarine technology for the study and conservation of deep coral gardens and cold-water coral reef](#)

### Marine archaeology (MARCH):

- Bridget Buxton, University of Rhode Island, USA: [“We’re \(not\) going to need a bigger boat”: the tech that will replace traditional research vessels in deep sea and coastal environments](#)
- Kotaro Yamafune, Texas A&M University, USA: A brief history of ancient ships
- Irena Radić Rossi, University of Zadar, Croatia: [How to protect an outstanding shipwreck site?](#)
- **Kotaro Yamafune**, A.P.P.A.R.A.T.U.S. LLC & **Matko Čvrljak**, Roskilde Viking Ship Museum: *A Methodology for Accurate and Quick Photogrammetric Recording of Underwater Cultural Heritage*

### Maritime security (MARSEC):

- Philip Macilivray, US Coast Guard Pacific Area, USA: [Cyber-security solutions for unmanned systems, and their use in conjunction with new technologies to advance port security and maritime domain awareness](#)
- Niv David, Tel Aviv University, Israel: [Cyber security for marine technologies](#)



### Maritime geology (MARGEO):

- Hironobu Kan, Kyushu University, Japan: [New survey visualization: Merging photogrammetric 3D model with a multibeam bathymetry](#)
- Marko Bakašun, GEOMAR d.o.o., Croatia: [ROV inspection](#)
- Manuel Bensi, Istituto Nazionale di Oceanografia e di Geofisica Sperimentale – OGS: [Exploring the ocean and the seabed: oceanographic case studies where marine robotics can be applied](#)

### Innovation Tuesday (INNOVA):

- Yvan Petillot, Heriot-Watt University, UK: [The ORCA Hub: Offshore robotics for certification of assets](#)
- Scott Reed, SeeByte, UK: [The evolution of smart software within maritime robotics](#)
- Daniel M. Lofaro, George Mason University, USA: [Robots in politics and business](#)
- Paul Oh, University of Nevada Las Vegas, USA: [Consumer Robotics in the Age of Acceleration](#)
- Miriam Rueda, Asociación Emerge, Spain: Protoatlantic – [Protoatlantic – a European accelerator program of the marine sector](#)
- Marc Carreras, IQUA Robotics, Spain: [IQUA Robotics: past, present and future](#)
- Iain Vincent, Planet Ocean Limited / ecoSUB Robotics Limited, UK: [Democratising the AUV: ecoSUB Robotics – from concept to commercial reality](#)
- Enrique Gonzalez Sancho, Nido Robotics, Spain: [Entrepreneurship in marine robotics](#)
- Marin Bek, H2O Robotics, Croatia: [Experiences in building an international business](#)
- James Ives, XOCEAN, Ireland: [Unmanned ocean data collection](#)
- António Sérgio Ferreira, Laboratório de Sistemas e Tecnologia Subaquática (UPorto), Portugal: [EUMarineRobots: The “Oprah” of Marine Robotics](#)

## 5.1.2. TUTORIALS

- Mandar Chitre, Chinmay Pendharkar, Prasad Anjani, Manu Ignatius, Subnero, Singapore: [Hands-on with software-defined modems & underwater networks](#)
- Barbara Arbanas; Anja Babić; Ivan Lončar; Milan Marković; Filip Mandić; Goran Vasiljević, University of Zagreb Faculty of Electrical Engineering and Computing, Croatia: [subCULTron – underwater measurements using aMussel](#)
- Nuno Gracias; László Neumann, Computer Vision and Robotics Institute of the Universitat de Girona/ ViCOROB, Portugal: [Underwater Optical Image Enhancement Techniques](#)
- Narcís Palomeras, University of Girona, (Spain) and Natàlia Hurtós, IQUA Robotics, (Spain): [Sparus II](#)

## 5.1.3. DEMONSTRATIONS

- Thomas Glotzbach; Sabir Ouchen; Joaquim Pinol Bel, Torpex Scooter, Germany: [Underwater scooter Torpex with newly developed hollow shaft motor](#)
- Iain Vincent; Jeremy Sitbon, Ecosub Robotics, UK: [Smart network localisation](#)
- Marko Bakašun; Matej Ćurić; Ivor Meštrović, Geomar, Croatia: [ROV inspection](#)
- Enrique Gonzalez Sancho, Nido Robotics, Spain: [Enrique Gonzalez Sancho](#)

#### 5.1.4.COMPANY PROGRAMME

- Martin Ludvigsen, Norway: [BLUEYE ROBOTICS](#)
- Tom Bennetts, Colin Sutherland, UK: [SONARDYNE INTERNATIONAL LTD](#)
- Konstantin Kebkal, Oleksiy Kebkal, Germany: [EVOLOGICS](#)
- Robin Sharphouse, Kevin Webster, UK: [BLUEPRINT SUBSEA](#)

#### 5.1.5.WORKSHOPS

- Narcís Palomeras, University of Girona, Spain and Natàlia Hurtós, IQUA Robotics, Spain: [Workshop: defining a ROS package to standardize underwater messages](#)

## 5.2. SCHEDULE

	SUNDAY 30.09.	MONDAY 01.10.	TUESDAY 02.10.	WEDNESDAY 03.10.	THURSDAY 04.10.	FRIDAY 05.10.	SATURDAY 06.10.
09:00		Opening session Zoran Vukobratovic, Ivan Stokich	The CECA Hub: Offshore robotics for certification of assets Yves Fassin	Maritime assessment of an autonomous planning craft in survey Muel Cooper	Underwater acoustic communications: Fundamentals and new results Milica Stojanovic	Key technologies towards the vision of complete autonomous underwater operations: From project SMIS to MILIM Tomasz Jelech and Marcin Kucinski	
09:45		Cyber security for marine technologies Nir David	The evolution of smart software within maritime robotics Sara Reid	New survey classification, merging photogrammetric 3D model with a multibeam bathymetry Hironobu Kari	How to protect an outstanding shipwreck site? Irene Radic-Ross	Chasing ocean carbon – from sky to sea and below Irene Catala	
10:30		COFFEE BREAK	COFFEE BREAK	COFFEE BREAK	COFFEE BREAK	COFFEE BREAK	
10:45		"We're (not) going to need a bigger boat": the fact that will replace traditional coastal research vessels Indigo Rusan	Robots in politics and business David M. Lajolo	Cyber security solutions for command systems, and their use in conjunction with new technologies to enhance port security and maritime domain awareness Philip McGilver	Micro-scale wave energy generation for autonomous sensors and robotics Tim Menden	Autonomy and remote control technology in sea applications activities Walter Czarnecki	
11:30		Shoewater: The future of hybrid autonomous marine vehicles William Kibben	Consumer robotics in the age of acceleration Paul Oh	Submarine technology for the study and conservation of deep coral gardens and cold-water coral reefs Andrea Gori	Exploring the ocean and the seabed, oceanographic case studies where marine robotics can be applied Manuel Bernal	A fast fish-like human-powered racing submersible John A. Anderson	
12:15		The role of technical devices in the frame of underwater archaeological researches Sébastien Tuna	Proteoblastic – A European accelerator program of the marine sector Miriam Rueda	Oceanic Development of next generation marine autonomous systems for ocean science Alexander Phillips	Cloud-based management and control of autonomous marine vehicles. Concept and demonstration Xianbo Xiang	ROV Inspections Marko Babalik, Miroslav Covic and Ivan Malenovic	FIELD TRIP
13:00		LUNCH	LUNCH	LUNCH	LUNCH	LUNCH	
14:30		COMPANY PRESENTATION Blueye Robotics Marc Carreras	IQUA Robotics Marc Carreras 14:30 - 15:00	COMPANY PRESENTATION Blueprint Subsea	COMPANY PRESENTATION Sonderdyne	COMPANY PRESENTATION Evelogics	
15:00		T1 Intro: Underwater optical image enhancement techniques University of Genova	acqSUB John Vincent 15:00 - 15:30	T2 Intro: Sparus II IQUA Robotics, University of Genova	T3 Intro: Hands-on with software defined modems & underwater networks Sunder National University of Singapore	T4 Intro: subCULTron UNIC PER	
15:30		DEMO 1 Nido Robotics Group 1	Nido Robotics Elihupe Gutierrez-Torres 15:30 - 16:00	DEMO 3 BluePrint Group 1	T3 hands-on Group 1	DEMO 5 Torque Group 1	DEMO 7 Evelogics Group 1
16:30		DEMO 2 Blueye Group 2	DEMO 4 acqSUB Group 2	T2 hands-on Group 2	DEMO 6 Sonderdyne Group 2	DEMO 8 GeoMar Group 2	
17:30		DEMO 3 Nido Robotics Group 3	DEMO 5 Torque Group 3	T3 hands-on Group 3	DEMO 7 Evelogics Group 3	DEMO 9 GeoMar Group 3	
18:00		DEMO 4 acqSUB Group 4	DEMO 6 Sonderdyne Group 4	T4 hands-on Group 4	DEMO 8 GeoMar Group 4	DEMO 10 GeoMar Group 4	
18:30		DEMO 5 Torque Group 5	DEMO 7 Evelogics Group 5	T5 hands-on Group 5	DEMO 9 GeoMar Group 5	DEMO 11 GeoMar Group 5	
19:30		DEMO 6 Sonderdyne Group 6	DEMO 8 GeoMar Group 6	T6 hands-on Group 6	DEMO 10 GeoMar Group 6	DEMO 12 GeoMar Group 6	
20:30		DEMO 7 Evelogics Group 7	DEMO 9 GeoMar Group 7	T7 hands-on Group 7	DEMO 11 GeoMar Group 7	DEMO 13 GeoMar Group 7	
21:00		DEMO 8 GeoMar Group 8	DEMO 10 GeoMar Group 8	T8 hands-on Group 8	DEMO 12 GeoMar Group 8	DEMO 14 GeoMar Group 8	
		DEMO 9 GeoMar Group 9	DEMO 11 GeoMar Group 9	T9 hands-on Group 9	DEMO 13 GeoMar Group 9	DEMO 15 GeoMar Group 9	
		DEMO 10 GeoMar Group 10	DEMO 12 GeoMar Group 10	T10 hands-on Group 10	DEMO 14 GeoMar Group 10	DEMO 16 GeoMar Group 10	
		DEMO 11 GeoMar Group 11	DEMO 13 GeoMar Group 11	T11 hands-on Group 11	DEMO 15 GeoMar Group 11	DEMO 17 GeoMar Group 11	
		DEMO 12 GeoMar Group 12	DEMO 14 GeoMar Group 12	T12 hands-on Group 12	DEMO 16 GeoMar Group 12	DEMO 18 GeoMar Group 12	
		DEMO 13 GeoMar Group 13	DEMO 15 GeoMar Group 13	T13 hands-on Group 13	DEMO 17 GeoMar Group 13	DEMO 19 GeoMar Group 13	
		DEMO 14 GeoMar Group 14	DEMO 16 GeoMar Group 14	T14 hands-on Group 14	DEMO 18 GeoMar Group 14	DEMO 20 GeoMar Group 14	
		DEMO 15 GeoMar Group 15	DEMO 17 GeoMar Group 15	T15 hands-on Group 15	DEMO 19 GeoMar Group 15	DEMO 21 GeoMar Group 15	
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		DEMO 18 GeoMar Group 18	DEMO 20 GeoMar Group 18	T18 hands-on Group 18	DEMO 22 GeoMar Group 18	DEMO 24 GeoMar Group 18	
		DEMO 19 GeoMar Group 19	DEMO 21 GeoMar Group 19	T19 hands-on Group 19	DEMO 23 GeoMar Group 19	DEMO 25 GeoMar Group 19	
		DEMO 20 GeoMar Group 20	DEMO 22 GeoMar Group 20	T20 hands-on Group 20	DEMO 24 GeoMar Group 20	DEMO 26 GeoMar Group 20	
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		DEMO 24 GeoMar Group 24	DEMO 26 GeoMar Group 24	T24 hands-on Group 24	DEMO 28 GeoMar Group 24	DEMO 30 GeoMar Group 24	
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		DEMO 26 GeoMar Group 26	DEMO 28 GeoMar Group 26	T26 hands-on Group 26	DEMO 30 GeoMar Group 26	DEMO 32 GeoMar Group 26	
		DEMO 27 GeoMar Group 27	DEMO 29 GeoMar Group 27	T27 hands-on Group 27	DEMO 31 GeoMar Group 27	DEMO 33 GeoMar Group 27	
		DEMO 28 GeoMar Group 28	DEMO 30 GeoMar Group 28	T28 hands-on Group 28	DEMO 32 GeoMar Group 28	DEMO 34 GeoMar Group 28	
		DEMO 29 GeoMar Group 29	DEMO 31 GeoMar Group 29	T29 hands-on Group 29	DEMO 33 GeoMar Group 29	DEMO 35 GeoMar Group 29	
		DEMO 30 GeoMar Group 30	DEMO 32 GeoMar Group 30	T30 hands-on Group 30	DEMO 34 GeoMar Group 30	DEMO 36 GeoMar Group 30	
		DEMO 31 GeoMar Group 31	DEMO 33 GeoMar Group 31	T31 hands-on Group 31	DEMO 35 GeoMar Group 31	DEMO 37 GeoMar Group 31	
		DEMO 32 GeoMar Group 32	DEMO 34 GeoMar Group 32	T32 hands-on Group 32	DEMO 36 GeoMar Group 32	DEMO 38 GeoMar Group 32	
		DEMO 33 GeoMar Group 33	DEMO 35 GeoMar Group 33	T33 hands-on Group 33	DEMO 37 GeoMar Group 33	DEMO 39 GeoMar Group 33	
		DEMO 34 GeoMar Group 34	DEMO 36 GeoMar Group 34	T34 hands-on Group 34	DEMO 38 GeoMar Group 34	DEMO 40 GeoMar Group 34	
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		DEMO 36 GeoMar Group 36	DEMO 38 GeoMar Group 36	T36 hands-on Group 36	DEMO 40 GeoMar Group 36	DEMO 42 GeoMar Group 36	
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		DEMO 38 GeoMar Group 38	DEMO 40 GeoMar Group 38	T38 hands-on Group 38	DEMO 42 GeoMar Group 38	DEMO 44 GeoMar Group 38	
		DEMO 39 GeoMar Group 39	DEMO 41 GeoMar Group 39	T39 hands-on Group 39	DEMO 43 GeoMar Group 39	DEMO 45 GeoMar Group 39	
		DEMO 40 GeoMar Group 40	DEMO 42 GeoMar Group 40	T40 hands-on Group 40	DEMO 44 GeoMar Group 40	DEMO 46 GeoMar Group 40	
		DEMO 41 GeoMar Group 41	DEMO 43 GeoMar Group 41	T41 hands-on Group 41	DEMO 45 GeoMar Group 41	DEMO 47 GeoMar Group 41	
		DEMO 42 GeoMar Group 42	DEMO 44 GeoMar Group 42	T42 hands-on Group 42	DEMO 46 GeoMar Group 42	DEMO 48 GeoMar Group 42	
		DEMO 43 GeoMar Group 43	DEMO 45 GeoMar Group 43	T43 hands-on Group 43	DEMO 47 GeoMar Group 43	DEMO 49 GeoMar Group 43	
		DEMO 44 GeoMar Group 44	DEMO 46 GeoMar Group 44	T44 hands-on Group 44	DEMO 48 GeoMar Group 44	DEMO 50 GeoMar Group 44	
		DEMO 45 GeoMar Group 45	DEMO 47 GeoMar Group 45	T45 hands-on Group 45	DEMO 49 GeoMar Group 45	DEMO 51 GeoMar Group 45	
		DEMO 46 GeoMar Group 46	DEMO 48 GeoMar Group 46	T46 hands-on Group 46	DEMO 50 GeoMar Group 46	DEMO 52 GeoMar Group 46	
		DEMO 47 GeoMar Group 47	DEMO 49 GeoMar Group 47	T47 hands-on Group 47	DEMO 51 GeoMar Group 47	DEMO 53 GeoMar Group 47	
		DEMO 48 GeoMar Group 48	DEMO 50 GeoMar Group 48	T48 hands-on Group 48	DEMO 52 GeoMar Group 48	DEMO 54 GeoMar Group 48	
		DEMO 49 GeoMar Group 49	DEMO 51 GeoMar Group 49	T49 hands-on Group 49	DEMO 53 GeoMar Group 49	DEMO 55 GeoMar Group 49	
		DEMO 50 GeoMar Group 50	DEMO 52 GeoMar Group 50	T50 hands-on Group 50	DEMO 54 GeoMar Group 50	DEMO 56 GeoMar Group 50	
		DEMO 51 GeoMar Group 51	DEMO 53 GeoMar Group 51	T51 hands-on Group 51	DEMO 55 GeoMar Group 51	DEMO 57 GeoMar Group 51	
		DEMO 52 GeoMar Group 52	DEMO 54 GeoMar Group 52	T52 hands-on Group 52	DEMO 56 GeoMar Group 52	DEMO 58 GeoMar Group 52	
		DEMO 53 GeoMar Group 53	DEMO 55 GeoMar Group 53	T53 hands-on Group 53	DEMO 57 GeoMar Group 53	DEMO 59 GeoMar Group 53	
		DEMO 54 GeoMar Group 54	DEMO 56 GeoMar Group 54	T54 hands-on Group 54	DEMO 58 GeoMar Group 54	DEMO 60 GeoMar Group 54	
		DEMO 55 GeoMar Group 55	DEMO 57 GeoMar Group 55	T55 hands-on Group 55	DEMO 59 GeoMar Group 55	DEMO 61 GeoMar Group 55	
		DEMO 56 GeoMar Group 56	DEMO 58 GeoMar Group 56	T56 hands-on Group 56	DEMO 60 GeoMar Group 56	DEMO 62 GeoMar Group 56	
		DEMO 57 GeoMar Group 57	DEMO 59 GeoMar Group 57	T57 hands-on Group 57	DEMO 61 GeoMar Group 57	DEMO 63 GeoMar Group 57	
		DEMO 58 GeoMar Group 58	DEMO 60 GeoMar Group 58	T58 hands-on Group 58	DEMO 62 GeoMar Group 58	DEMO 64 GeoMar Group 58	
		DEMO 59 GeoMar Group 59	DEMO 61 GeoMar Group 59	T59 hands-on Group 59	DEMO 63 GeoMar Group 59	DEMO 65 GeoMar Group 59	
		DEMO 60 GeoMar Group 60	DEMO 62 GeoMar Group 60	T60 hands-on Group 60	DEMO 64 GeoMar Group 60	DEMO 66 GeoMar Group 60	
		DEMO 61 GeoMar Group 61	DEMO 63 GeoMar Group 61	T61 hands-on Group 61	DEMO 65 GeoMar Group 61	DEMO 67 GeoMar Group 61	
		DEMO 62 GeoMar Group 62	DEMO 64 GeoMar Group 62	T62 hands-on Group 62	DEMO 66 GeoMar Group 62	DEMO 68 GeoMar Group 62	
		DEMO 63 GeoMar Group 63	DEMO 65 GeoMar Group 63	T63 hands-on Group 63	DEMO 67 GeoMar Group 63	DEMO 69 GeoMar Group 63	
		DEMO 64 GeoMar Group 64	DEMO 66 GeoMar Group 64	T64 hands-on Group 64	DEMO 68 GeoMar Group 64	DEMO 70 GeoMar Group 64	
		DEMO 65 GeoMar Group 65	DEMO 67 GeoMar Group 65	T65 hands-on Group 65	DEMO 69 GeoMar Group 65	DEMO 71 GeoMar Group 65	
		DEMO 66 GeoMar Group 66	DEMO 68 GeoMar Group 66	T66 hands-on Group 66	DEMO 70 GeoMar Group 66	DEMO 72 GeoMar Group 66	
		DEMO 67 GeoMar Group 67	DEMO 69 GeoMar Group 67	T67 hands-on Group 67	DEMO 71 GeoMar Group 67	DEMO 73 GeoMar Group 67	
		DEMO 68 GeoMar Group 68	DEMO 70 GeoMar Group 68	T68 hands-on Group 68	DEMO 72 GeoMar Group 68	DEMO 74 GeoMar Group 68	
		DEMO 69 GeoMar Group 69	DEMO 71 GeoMar Group 69	T69 hands-on Group 69	DEMO 73 GeoMar Group 69	DEMO 75 GeoMar Group 69	
		DEMO 70 GeoMar Group 70	DEMO 72 GeoMar Group 70	T70 hands-on Group 70	DEMO 74 GeoMar Group 70	DEMO 76 GeoMar Group 70	
		DEMO 71 GeoMar Group 71	DEMO 73 GeoMar Group 71	T71 hands-on Group 71	DEMO 75 GeoMar Group 71	DEMO 77 GeoMar Group 71	
		DEMO 72 GeoMar Group 72	DEMO 74 GeoMar Group 72	T72 hands-on Group 72	DEMO 76 GeoMar Group 72	DEMO 78 GeoMar Group 72	
		DEMO 73 GeoMar Group 73	DEMO 75 GeoMar Group 73	T73 hands-on Group 73	DEMO 77 GeoMar Group 73	DEMO 79 GeoMar Group 73	
		DEMO 74 GeoMar Group 74	DEMO 76 GeoMar Group 74	T74 hands-on Group 74	DEMO 78 GeoMar Group 74	DEMO 80 GeoMar Group 74	
		DEMO 75 GeoMar Group 75	DEMO 77 GeoMar Group 75	T75 hands-on Group 75	DEMO 79 GeoMar Group 75	DEMO 81 GeoMar Group 75	
		DEMO 76 GeoMar Group 76	DEMO 78 GeoMar Group 76	T76 hands-on Group 76	DEMO 80 GeoMar Group 76	DEMO 82 GeoMar Group 76	
		DEMO 77 GeoMar Group 77	DEMO 79 GeoMar Group 77	T77 hands-on Group 77	DEMO 81 GeoMar Group 77	DEMO 83 GeoMar Group 77	
		DEMO 78 GeoMar Group 78	DEMO 80 GeoMar Group 78	T78 hands-on Group 78	DEMO 82 GeoMar Group 78	DEMO 84 GeoMar Group 78	
		DEMO 79 GeoMar Group 79	DEMO 81 GeoMar Group 79	T79 hands-on Group 79	DEMO 83 GeoMar Group 79	DEMO 85 GeoMar Group 79	
		DEMO 80 GeoMar Group 80	DEMO 82 GeoMar Group 80	T80 hands-on Group 80	DEMO 84 GeoMar Group 80	DEMO 86 GeoMar Group 80	
		DEMO 81 GeoMar Group 81	DEMO 83 GeoMar Group 81	T81 hands-on Group 81	DEMO 85 GeoMar Group 81	DEMO 87 GeoMar Group 81	
		DEMO 82 GeoMar Group 82	DEMO 84 GeoMar Group 82	T82 hands-on Group 82	DEMO 86 GeoMar Group 82	DEMO 88 GeoMar Group 82	
		DEMO 83 GeoMar Group 83	DEMO 85 GeoMar Group 83	T83 hands-on Group 83	DEMO 87 GeoMar Group 83	DEMO 89 GeoMar Group 83	
		DEMO 84 GeoMar Group 84	DEMO 86 GeoMar Group 84	T84 hands-on Group 84	DEMO 88 GeoMar Group 84	DEMO 90 GeoMar Group 84	
		DEMO 85 GeoMar Group 85	DEMO 87 GeoMar Group 85	T85 hands-on Group 85	DEMO 89 GeoMar Group 85	DEMO 91 GeoMar Group 85	
		DEMO 86 GeoMar Group 86	DEMO 88 GeoMar Group 86	T86 hands-on Group 86	DEMO 90 GeoMar Group 86	DEMO 92 GeoMar Group 86	
		DEMO 87 GeoMar Group 87	DEMO 89 GeoMar Group 87	T87 hands-on Group 87	DEMO 91 GeoMar Group 87	DEMO 93 GeoMar Group 87	
		DEMO 88 GeoMar Group 88	DEMO 90 GeoMar Group 88	T88 hands-on Group 88	DEMO 92 GeoMar Group 88	DEMO 94 GeoMar Group 88	
		DEMO 89 GeoMar Group 89	DEMO 91 GeoMar Group 89	T89 hands-on Group 89	DEMO 93 GeoMar Group 89	DEMO 95 GeoMar Group 89	
		DEMO 90 GeoMar Group 90	DEMO 92 GeoMar Group 90	T90 hands-on Group 90	DEMO 94 GeoMar Group 90	DEMO 96 GeoMar Group 90	
		DEMO 91 GeoMar Group 91	DEMO 93 GeoMar Group 91	T91 hands-on Group 91	DEMO 95 GeoMar Group 91	DEMO 97 GeoMar Group 91	
		DEMO 92 GeoMar Group 92	DEMO 94 GeoMar Group 92	T92 hands-on Group 92	DEMO 96 GeoMar Group 92	DEMO 98 GeoMar Group 92	
		DEMO 93 GeoMar Group 93	DEMO 95 GeoMar Group 93	T93 hands-on Group 93	DEMO 97 GeoMar Group 93	DEMO 99 GeoMar Group 93	
		DEMO 94 GeoMar Group 94	DEMO 96 GeoMar Group 94	T94 hands-on Group 94	DEMO 98 GeoMar Group 94	DEMO 100 GeoMar Group 94	
		DEMO 95 GeoMar Group 95	DEMO 97 GeoMar Group 95	T95 hands-on Group 95	DEMO 99 GeoMar Group 95	DEMO 101 GeoMar Group 95	
		DEMO 96 GeoMar Group 96	DEMO 98 GeoMar Group 96	T96 hands-on Group 96	DEMO 100 GeoMar Group 96	DEMO 102 GeoMar Group 96	
		DEMO 97 GeoMar Group 97	DEMO 99 GeoMar Group 97	T97 hands-on Group 97	DEMO 101 GeoMar Group 97	DEMO 103 GeoMar Group 97	
		DEMO 98 GeoMar Group 98	DEMO 100 GeoMar Group 98	T98 hands-on Group 98	DEMO 102 GeoMar Group 98	DEMO 104 GeoMar Group 98	
		DEMO 99 GeoMar Group 99	DEMO 101 GeoMar Group 99	T99 hands-on Group 99	DEMO 103 GeoMar Group 99	DEMO 105 GeoMar Group 99	
		DEMO 100 GeoMar Group 100	DEMO 102 GeoMar Group 100	T100 hands-on Group 100	DEMO 104 GeoMar Group 100	DEMO 106 GeoMar Group 100	
		DEMO 101 GeoMar Group 101	DEMO 103 GeoMar Group 101	T101 hands-on Group 101	DEMO 105 GeoMar Group 101	DEMO 107 GeoMar Group 101	
		DEMO 102 GeoMar Group 102	DEMO 104 GeoMar Group 102	T102 hands-on Group 102	DEMO 106 GeoMar Group 102	DEMO 108 GeoMar Group 102	
		DEMO 103 GeoMar Group 103	DEMO 105 GeoMar Group 103	T103 hands-on Group 103	DEMO 107 GeoMar Group 103	DEMO 109 GeoMar Group 103	
		DEMO 104 GeoMar Group 104	DEMO 106 GeoMar Group 104	T104 hands-on Group 104	DEMO 108 GeoMar Group 104	DEMO 110 GeoMar Group 104	
		DEMO 105 GeoMar Group 105	DEMO 107 GeoMar Group 105	T105 hands-on Group 105	DEMO 109 GeoMar Group 105	DEMO 111 GeoMar Group 105	
		DEMO 106 GeoMar Group 106	DEMO 108 GeoMar Group 106	T106 hands-on Group 106	DEMO 110 GeoMar Group 106	DEMO 112 GeoMar Group 106	
		DE					



## 6. BTS PARTICIPANTS

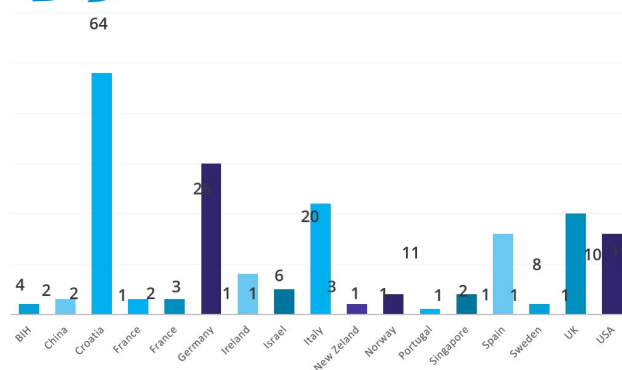
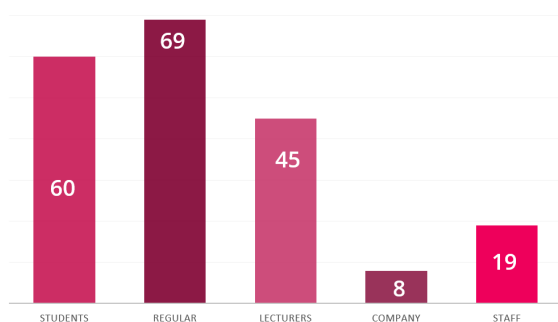
In 2018, more than 200 participants from academia and industry from various fields joined Breaking the Surface.



### PARTICIPANTS PROFILE

**201** PARTICIPANTS

**17** COUNTRIES



## 7. PROGRAMME ABSTRACTS, BIOGRAPHIES AND PRESENTATIONS

Lectures' abstracts and lecturers' biographies are available in **APPENDIX I. – Abstracts and biographies**.  
Slides from presentations are available in **APPENDIX II. – Presentations (slides)**.

## 8. SUPPORTERS

### FINANCED BY



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### SUPPORTED BY



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Foundation of the Croatian Academy  
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Ministry of Science and Education  
Republic of Croatia



## 9. APPENDIX I – ABSTRACTS AND BIOGRAPHIES

Abstracts and biographies are available [here](#).

## 10. APPENDIX II – PRESENTATIONS

Presentations are available [here](#).