21 - 23 March 2016

# Robotics for Europeans

www.erf2016.eu

# european Robotics Forum 2016 WORKSHOP DIGEST





ORGANISED BY:

Robotics

SUPPORTED BY:

European

Commission

POWERED BY:

SPARC

LOCAL ORGANISERS:

University of Ljubljana Faculty of Electrical Engineering C cankarjev dom

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### **Dear Robotics Community,**

A warm welcome to the European Robotics Forum 2016 from Ljubljana, European Green Capital 2016. I am very pleased to see that the continuing spread of robotics into many application areas is this year reflected by the broad range of developers and users of robotics technology. This success is represented by the continuing growth of our membership – we already represent the interests of more than 250 member organisations, as opposed to 200 a year ago! This shows that the community feels an increasing sense of trust in the way we work and that we are well on track to achieving results and exceeding expectations.

The annual European Robotics Forum (ERF), organised by euRobotics, is the most influential meeting of the European robotics community. Researchers, engineers, decision makers, representatives of various organisations and the European Commission, and a growing number of entrepreneurs and business people from all over Europe come together to discuss topics and contents which has an immediate impact on the development of a true robotics market in Europe.

Complementing the European Commission's funding in context of the private-public partnership SPARC, where euRobotics represents the private side, the "Digitising European Industry" (DEI) strategy proposed by Commissioner Oettinger, aims to establish links between national and regional initiatives. Moreover, the "smart specialisation" of regions is also promoted by the European Structural and Investment Funds (ESIFs) and the Committee of Regions (CoR). At the European Robotics Forum 2016 in Ljubljana, euRobotics has invited top speakers to present the impact of all these initiatives at European, national and regional level. This year's ERF also aims to reach out to Southeast Europe, in order to catalyse innovation and cooperation in robotics, and its application, hence contributing to a growing integration of Europe in this part of the continent.

I am looking forward to an illuminating experience in Ljubljana, full of fruitful discussions and networking opportunities, across the whole range of what robotics has to offer today and in the future. I would already like to thank all participants for turning this forum into a stimulating exchange of ideas by organising and participating in more than 60 workshops. Special thanks go to the local organisers around Marko Munih, my colleagues from the Board of Directors and the euRobotics' secretariat for the hard work that went into putting together this event.

Please help us to ensure it remains this way by providing feedback on our work – do not hesitate to contact me directly at the Forum.



Dr. Bernd Liepert euRobotics President

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# FORUM INFORMATION

#### Where and when?

The European Robotics Forum takes place in Ljubljana, Slovenia from Monday, 21 March to Wednesday, 23 March 2016

DATE: 21-23 March, 2016

#### VENUE:

Cankarjev Dom - Cultural and Congress Centre Prešernova cesta 10 1000 Ljubljana, Slovenia

Website: www.cd-cc.si



#### **Opening hours**

Days	Welcome Area	ERF
Monday 21 March	8:00 am to 7:00 pm	8:30 am to 5:45 pm
Tuesday, 22 March	8:00 am to 7:00 pm	8:30 am to 5:45 pm
Wednesday, 23 March	8:00 am to 7:00 pm	8:30 am to 5:45 pm



#### ORGANISER :

euRobotics AISBL Diamant Building Boulevard A. Reyers 80, 1030 Brussels, Belgium

www.eu-robotics.net

#### University of Ljubljana Faculty of Electrical Engineering

HOST ORGANISATION : University of Ljubljana, Faculty of Electrical Engineering Tržaška 25, 1000 Ljubljana, Slovenia





#### CO-HOST ORGANISATION :

Jožef Stefan Institute Department of Automatics, Biocybernetics, and Robotics Jamova 39, 1000 Ljubljana, Slovenia

www.ijs.si



#### UNDER PATRONAGE OF :

Slovenian Academy of Sciences and Arts Novi trg 3, 1000 Ljubljana, Slovenia

www.sazu.si

# FORUM INFORMATION

### How to get there



### How to get to Ljubljana / by plane

Ljubljana is best served by its International Airport at Brnik, 23 km northwest of the city, with daily connections to most major European cities. From the airport, Ljubljana can be easily reached either by <u>bus</u>, <u>shuttle</u> service (approx. 10 EUR) or by taxi (approx. 40 EUR).

#### Neighbouring airports:

- Trieste Ronchi (Italy), 128 km southwest of Ljubljana
- Klagenfurt (Austria), 90 km north of Ljubljana
- Zagreb Pleso (Croatia), 141 km southeast of Ljubljana

# FORUM INFORMATION

#### How to get to Ljubljana / by car

Arriving to Ljubljana by car is easy. Some distances to nearby cities:

- Trieste (Italy) 95 km
- Venice (Italy) 242 km
- Klagenfurt (Austria) 83 km
- Vienna (Austria) 380 km
- Munich (Germany) 408 km



### How to get to Ljubljana / by train

Ljubljana is an important railroad junction and can be reached by trains from all major European cities. The railway station is within walking distance of the city centre.



## FLOOR PLAN - Conference rooms



-2 | Foyer II

Photo credits: Viennamotion KG



## **FLOOR PLAN** - Exhibition layout

Click on each exhibitor to go to the corresponding page. To return to this page click on the arrow.



#### LIST OF EXHIBITORS

01	SCHUNK GmbH & Co. KG	8 mp	10	OptoForce	9 mp	24	euRobotics aisbl	4 mp
02	Fanuc Adria d.o.o.	4 mp	11	JOANNEUM RESEARCH GmbH	8 mp	25	Yaskawa Europe GmbH	20 mp
03	DAIHEN VARSTROJ d.d.	8 mp	12	Robotnik	4 mp	26	ABB	16 mp
04	Ortelio Ltd	4 mp	13	RLS Merilna tehnika d.o.o.	4 mp	30	NTB	4 mp
05	IDMIND	4 mp	14	incubed IT	4 mp	27a	NCCR Robotics	
06	Shadow Robot Company	4 mp	15	Nova Labs	4 mp	27b	iniLabs	12 mp
07	The Biorobotics Institute	4 mp	21	University of Zagreb	15 mp	27c	GCtronic	
08	Kolektor Group d.o.o.	12 mp	22	L-TEK d.o.o.	16 mp	28	Taurob GmbH	15 mp
09	КИКА	12 mp	23	University of Ljubljana, Robolab	16 mp	29	PAL Robotics S.L.	9 mp

## **PROGRAMME OVERVIEW**

Click on each workshop to go to the corresponding page. To return to this page click on the arrow.

Please note that the text included in the ERF2016 Workshop Digest has been provided by our partners. euRobotics assumes no liability or responsibility for any errors, omissions or image copyright in this Digest.



## PROGRAMME OVERVIEW

Click on each workshop to go to the corresponding page. To return to this page click on the arrow.

22 March	SPARC (Linhart Hall)	YASKAWA (Kosovel)	ABB (E1-2)	SCHUNK (E3-4)	TECHNALIA (M1)	PROJECT 1 (M4)
8.30 – 10.00	Digitising the European Industry (DEI) – Robotics Innovation Hubs (RIH): From Regional to European Initiatives Cécile Huet, Mariusz Baldyga, Magdalena Szwochertowska	Robotics in Education Petra Koudelková Delimoges	Transfer of Cognitive Robotics Research to Industrial Applications Tamim Asfour, Anne Bajart, Ales Ude, NorbertKrüger	Inspection and Maintenance Robotics – Review and Discussion of Systems Deployed by End-Users and Future R&D Ekkehard Zwicker, Hakon Ferkingstad, Tjibbe Bouma	starting 8:00 – 10.00 Entrepreneurship WS Speed Dating Session (closed, only for applicants) Jon Agirre Ibarbia, Renaud Champion, Geoff Pegman	Safety Standardization for Medical Robotics, Part 1 Tamás Haidegger, Gurvinder Virk, Paolo Barattini
10.00 - 10.45			Coffee	break		
10.45 – 12.15	Digitising the European Industry (DEI) - Robotics Innovation Hubs (RIH): Access to Finance and SMEs perspectives Cécile Huet, Mariusz Baldyga, Magdalena Szwochertowska	Opportunities and Challeges of the European Network of Competence Centers on Robotics Christophe Leroux, Francesco Maurelli, Ali Muhammad, Brane Semolic	Al and Cognition in EU Robotic Projects: Current Landscape and Future Priorities Alessandro Saffiotti, Markus Vincze, Vincent Müller	Autonomous Robotic Systems for Inspection and Structural Assessment of Civil Underground Infrastructures Angelos Amditis, Konstantinos Loupos, Juan G. Victores	Entrepreneurship WS Coaching Session (closed, only for selected applicants) Jon Agirre Ibarbia, Renaud Champion, Geoff Pegman	Safety Standardization for Medical Robotics, Part 2 Tamás Haidegger, Gurvinder Virk, Paolo Barattini
12.15 – 14.00	euRobotics General Assembly		Lunch break			
14.00 – 15.30	Digitising the European Industry (DEI): Digital Skills and Workforce Anne Bajart, Bjoern Juretzki, Magdalena Szwochertowska	Digitising the European Industry (DEI): Platforms Antonio Puente, Mariusz Baldyga	SPARC Workshop on Cognitive Robotics: Actions for Promoting the Deployment of Cognitive Systems in Industry David Vernon, Markus Vincze	Enlarging the Scope of Miniaturised Robotics Michaël Gauthier, Patrick Courtney	Entrepreneurship WS & Judging Session (open to all ERF participants) Jon Agirre Ibarbia, Renaud Champion, Geoff Pegman	Make Your Consortium Grow: Financial to Third Parties in H2020 – Tips & Hints Marie-Luise Neitz, Francesco Maurelli
15.30 – 16.15	Coffee break					
16.15 – 17.45	Digitising the European Industry (DEI): Smart Regulation for Smart Industry Anne Bajart, Bjoern Juretzki	Building Ethical and Legal Rules into Robots (ELS Issues in Robotics: Results of RockEU CA) Christophe Leroux, Vincent C. Müller	SPARC Workshop on Cognitive Robotics: Actions for Promoting the Deployment of Cognitive Systems in Industry David Vernon, Markus Vincze	Wearable Robots Moving out of the Lab José Pons, Jan Veneman	After the Entrepreneurship Workshop: Success Stories and Lessons Learnt Jon Agirre Ibarbia, Renaud Champion, Geoff Pegman	Construction group Andreas Mueller, Sigrid Brell-Cokcan
20.00 - 24.00	0 Banquet at the Festival Hall & euRobotics Awards Ceremony					

## PROGRAMME OVERVIEW

Click on each workshop to go to the corresponding page. To return to this page click on the arrow.

23 March	SPARC (Linhart Hall)	YASKAWA (Kosovel)	ABB (E1-2)	SCHUNK (E3-4)	TECHNALIA (M1)	PROJECT 1 (M4)
8.30 – 10.00	EU Programmes: New Funding Opportunities for Robotics Projects Franco Mastroddi, Cécile Huet	Robots for Harsh Environment – Special Features and Lessons Learned Ladislav Vargovcik	How Interactive Robots may Support Small-Batch Machining in Industry Ernesto Gambao, Dragoljub Surdilovic, Tapio Heikilla	Healthcare Topic Group Activity Christophe Leroux, Thierry Keller	Guidelines, Methods and Evaluation Infrastructures for the Market Deployment of Companion Robots Fabio Bonsignorio, Filippo Cavallo, Paolo Dario	Project Meeting
10.00 - 10.45			Coffee	break		
10.45 – 12.15	Robotics & Internet of Things Cécile Huet	Marine Robotics Massimo Caccia, Ahmed Chemori, Vincent Creuze, Eleni Patouni	Laboratory Robotics – Robots in the Service of Science, Healthcare, New Product Development and Industry Patrick Courtney	Interdisciplinary Methods for Therapeutical and Diagnostic Human Robot Interaction Marta Capiluppi, Agnieszka Wykowska	Robot Ontologies Jacek Malec, Saadia Dhouib, Tamas Haidegger, Alexander Perzylo, Moritz Tenorth	Project Meeting
12.15 – 14.00	0 Lunch break					
14.00 – 15.30	Recent Progress in Research Reproducibility in Robotics: A Critical Enabler of Research Exploitation Fabio Bonsignorio	H2020 SRC Space Robotics Technologies Daniel Noelke	3rd Workshop on Hybrid Production Systems Makris Sotiris, George Michalos, Iñaki Maurtua, Ramez Awad	Image Guided Robotic Surgery and Interventions Marta Capiluppi, Stefano Stramigioli, Riccardo Muradore	Believing in Robot's Eyes – Robust Observation of Task Relevant Cues Michael Suppa, Darius Burschka, Achim J. Lilienthal	Project Meeting
15.30 – 16.15	5 Coffee break					
16.15 – 17.45	Efficient Robot Programming, Force Control and Passive Reconfiguration Technologies for Fast Set-Up of Robotic Workcells Ales Ude, Igor Kovac, Christian Schlette, Rune Larsen, T. Rajeeth Savarimuthu	Robotics for Nuclear Applications Rustam Stolkin, Ales Leonardis, Jeff Kuo, Mathieu Grossard	Collaboration in Industry 4.0: Human, Robot and Flexible Processes Ferdinando Cannella, Sotiris Makris, Matteo Zoppi	Robotic Capsule Endoscopy: EU Innovation Initiatives in a Rapidly Emerging Global Market Paolo Dario, Gastone Ciuti	Perception and Cognitive Abilities for Disaster Management Robots Achim J. Lilienthal, Lukas Silberbauer, Oskar von Stryk, Bernardo Wagner, Gerald Steinbauer	Project Meeting

# **OFFICIAL OPENING**

Session title	Welcome and Opening Session
Room	SPARC (Linhart Hall) - entrance from Foyer I or Foyer II
Hours	10.45 - 12.15
Motivation and objectives	As in all previous annual ERFs, the Opening Session is an opportunity to shed light on "the state of robotics" by forecasting disruptive innovations made possible by scientific developments, identifying needs from demands in economy, industry, and society, while keeping the focus on Europe and European collaboration.
	The Welcoming Notes pay tribute to Slovenia, her innovative and highly developed industrial and scientific standards, supported by a modern and efficient economy, and its important role within the European Union.
	This year the Panel will discuss the opportunities for building "digital" environments where industrial and service robots are integral parts, such as in manufacturing and processing industries, transport, health and environment, smart cities and regions. The panel will collect opinions and suggestions for guiding the European Roadmap on Robotics as developed within SPARC, the partnership between euRobotics and the European Commission.
Agenda	Welcoming Notes:
	<ul> <li>Dr Maja Makovec Brenčič (Slovenian Minister for Education)</li> </ul>
	<ul> <li>Zoran Stančič (Head of the European Commission Representation in Slovenia)</li> </ul>
	<ul> <li>Jasper Wesseling (Directorate-General for Enterprise and Innovation, Ministry of Economic Affairs, The Netherlands) on behalf of the Dutch Government in function of the current Presidency of the Council of the European Union</li> </ul>
	Panel Discussion:
	Markku Markkula (President, Committee of Regions)
	Khalil Rouhana, (European Commission, DG CONNECT, Directorate A)
	Dr Bernd Liepert (President of euRobotics aisbl and CINO of KUKA)
	Mady Delvaux (European Parliament)
	Matteo Fusari (European Investment Bank)
	<ul> <li>Jasper Wesseling (Directorate-General for Enterprise and Innovation, Ministry of Economic Affairs, The Netherlands)</li> </ul>
	Moderator: Stuart Freeman
	Followed by the official opening of ERF2016, announced by Dr Bernd Liepert, President of euRobotics aisbl

Session title	I4MS – Funding Opportunities for SMEs
Room	YASKAWA (Kosovel Hall) - Foyer II
Hours	8.30 - 10.00
Organiser(s)	• Ali, MUHAMMAD, VTT Technical Research Centre of Finland, Finland
Motivation and objectives	The session will focus on match making between the business needs of manufacturing SMEs and robotics technology suppliers. The session will also advertise the EU funding opportunities for SMEs to kick-start the adoption of new manufacturing technologies and accelerate the business.
Agenda of the workshop	<ul> <li>08.30 - 08.35 : Opening of workshop and introduction of I4MS - ICT for Manufacturing SMEs, Ali Muhammad, VTT Technical Research Centre of Finland</li> <li>08.35 - 08.40 : EU Programmes: New Funding Opportunities for Robotics Projects, Cecile Huet, European Commission</li> <li>08.40 - 08.50 : ReconCell: A Reconfigurable robot work Cell for fast setup of automated assembly process in SMEs, Norbert Krüger, University of Southern Denmark</li> <li>08.50 - 09.00 : HORSE - Smart integrated Robotics system for SMEs controlled by Internet of Things based on dynamic manufacturing processes Innovation Action, Anastasia Garbi, European Dynamics</li> <li>09.00 - 09.10 : Needs of robotics and ICT in an expending SME, Mikko Puttonen, Hanlog</li> <li>09.10 - 09.20 : AGV and mobile robots: new applications and perspectives, Guy Caverot, BA Systémes</li> <li>09.20 - 09.30 : Pick-it - Small batch machine tending or order picking thanks to flexible 3D vision, Peter Soetens, Intermodalics</li> <li>09.30 - 09.40 : MTC activities for promoting ICT among manufacturing SMEs, Junuz Jakupovic, Manufacturing Technology Centre</li> <li>09.40 - 10.00 : Q&amp;A with the presenters, round table discussion</li> </ul>
What should participants prepare?	Participants will present the latest needs, advancements and available funding possibilities for European manufacturing industry. The focus will be on the accelerated adaption of advanced robotic technologies in manufacturing sector.
Workshop website link	http://i4ms.eu/events/list_events_detail.php?post_id=150



Session title	Challenges and Competitions, Witnesses from 3 European Projects: euRathlon, EuRoC, RoCKIn
Room	ABB (E1-2) - Foyer II
Hours	8.30 - 10.00
Organiser(s)	<ul> <li>Gianluca ANTONELLI, University of Cassino, Italy</li> <li>Francesco BASILE, University of Salerno, Italy</li> <li>Pedro LIMA, Instituto Superior Tecnico, Portugal</li> <li>Alan WINFIELD, University of Bristol, United Kingdom</li> </ul>
Motivation and objectives	The workshop is aimed at opening a discussion on the outcomes of 3 of the main challenges/competitions funded within the EC: euRathlon, EuRoC, RoCKIn. Participants will be asked to participate in providing inputs and criticisms for all the projects and their visions for this kind of activity as a mean to drive and validate the scientific research. Are those activities useful also to reduce the gap between academia and industry?
Agenda of the workshop	<ul> <li>8.30 : Introduction</li> <li>8.35 : euRathlon, talk by Alan Winfield</li> <li>8.55 : EuRoC, talk by Nicolas Mansard</li> <li>9.15 : RoCKIn, talk by Pedro Lima</li> <li>9.35 : Overall discussion and conclusion</li> <li>10.00 : End of the workshop</li> </ul>
What should participants prepare?	The participants should bring their experiences and curiosities to contribute to a lively discussion.
Workshop website link	https://sites.google.com/site/erf2016robocompworkshop









Session title	Socially Intelligent Robots and Smart Cities, Where the Smarter World's Future Lies
Room	TECHNALIA (M1) - Foyer I
Hours	8.30 - 10.00
Organiser(s)	<ul> <li>Amit Kumar PANDEY, Aldebaran Robotics, SoftBank Group, Paris, France</li> <li>Alberto SANNA, eServices for Life and Health, Scientific Institute San Raffaele Smart City, Milano, Italy</li> <li>Liming CHEN, Computer Science and Informatics, De Montfort University, The Gateway, Leicester, UK</li> </ul>
Motivation and objectives	A smart city uses technologies to enhance quality and performance of urban services, and to engage more effectively and actively with its citizens. Robots, being smart and connected machines, have a range of capabilities. There is a great need to investigate about how such robots could be inevitable part of smart city ecosystem, whether it is smart home, public place, hospital, shopping mall, museum or park. This will also facilitate some real use cases of societal applications of the robot and reinforce the message of robotics that it is around the centrality of the citizen. In this regard, the workshop aims to bring different stakeholders on a single platform to (i) network and create awareness by sharing their experiences at the intersection of Intelligent Robots and Smart Cities, (ii) brainstorm for Commercial, Innovation, Technical and R&D aspects and (iii) contribute to the euRobotics Multi-Annual Roadmap.
Agenda of the workshop	<ul> <li>Industrial Perspective on Socially Intelligent Robots for Smart City Ecosystem - Dr. Amit Kumar Pandey, Aldebaran Robotics, Paris, France</li> <li>End User Perspective about Smart City Ecosystem and the roles of Intelligent Robots - Mr. Alberto Sanna, San Raffaele Smart City, Milano, Italy</li> <li>Public Perception and Acceptability Perspective of Smart Robots - Dr. Marketta Niemelä, VTT Technical Research Centre, Finland</li> <li>Lesson Learned from EU Projects on Smart City and Smart Living         <ul> <li>RUBICON Project, Dr. Mauro Dragone, Distributed Systems Group, Future Cities Research Center, Trinity College, Dublin, Ireland</li> <li>ROBOT-ERA Project, Dr. Filippo Cavallo, Scuola Superiore Sant'Anna, Service Robotics and Ambient Assisted Living Lab, Pisa, Italy</li> <li>ACROSSING Project, Prof. Liming Chen, Computer Science and Informatics, De Montfort University, The Gateway, Leicester, UK</li> </ul> </li> <li>Open Panel Discussion, with audience active participation         <ul> <li>"Robotics and Smart Cities, the challenges and the potentials"</li> </ul> </li> </ul>
What should participants prepare?	Participants are expected to proactively contribute to the panel discussion, help in identifying the key challenges, use cases, R&D and funding priorities for Robotics and Smart City projects. This will also serve for enhancing the euRobotics Multi-Annual Roadmap (MAR), in which Smart City & Socially Intelligent Robots has recently been identified as one of the key operating environments.
Workshop website link	http://siromartcity16.sciencesconf.org

Session title	Pre-Commercial Procurement Enabling Robotics Based Care-Innovations for the Elderly
Room	SPARC (Linhart Hall) - entrance from Foyer I or Foyer II
Hours	9.00 - 10.30
Organiser(s) SILVER	<ul> <li>SILVER (Supporting Independent Living for the Elderly through Robotics) consortium</li> <li>Contact person: Anne-Mari SANDELL, Forum Virium Helsinki, Finland</li> </ul>
Motivation and objectives	The EU funded SILVER project seeks new technologies to assist elderly people in their everyday lives. By the use of robotics-based technologies, seniors can continue independent living at home even if they have physical or cognitive disabilities. The SILVER project has sought to develop new technologies and solutions by using the Pre-Commercial Procurement (PCP) process that so far in Europe, has been an under-utilized tool for promoting innovation. One of the aims of the SILVER project is to demonstrate the effectiveness of this approach to address societal and governmental needs. This ambitious objective has been accomplished by running a cross-border Call for Tender, which has enabled development of robotics-based innovations for the elderly care. The successful company Robot Care System has developed a mobile personal assistant LEA (Lean Elderly Assistant), which will be presented at ERF.
Agenda of the workshop	<ul> <li>09.00 - 09.05 : Welcome and introduction by the moderators; Project Manager Denisa Naidin, Innovate UK</li> <li>09.05 - 09.40 : Presentation of the SILVER project results including LEA – robotics based personal assistant; Project Manager Denisa Naidin, Innovate UK; Funding Manager Andy Bleaden, City of Stockport; CEO Maja Rudinac, Robot Care Systems</li> <li>9.40 - 10.20 : Workshop session/or round table discussions on the following areas: How can PCP be used successfully to procure further robotics-based or other innovations? How can SME's get involved and how do they benefit by participating in PCP? What are the benefits for potential procurers? How to work together in a PCP? What are the benefits of transnational working in PCP? Also, useful tips for running a successful PCP will be shared.</li> <li>10.20 - 10.30 : Conclusions</li> </ul>
What should participants prepare?	Prepare questions regarding the use of PCP from their point of view.
Workshop website link	www.silverpcp.eu/Robotics_forum_2016

Session title	Robotics – The Way to the Mining Future
Room	SCHUNK (E3-4) - Foyer II
Hours	9.00 - 10.30
Organiser(s)	• <b>Piotr KASZA</b> , AGH University of Science and Technology Cracow, Poland
Motivation and objectives	<ul> <li>Presentation of the mining TG</li> <li>Determine the specific characteristics and requirements of mining robotics by end user</li> <li>Presentation of robotic (mechatronics, automation, informatics) technologies used in mining and heavy industry</li> <li>Cross-sector networking</li> <li>The workshop will consist of five targeted presentations on different aspects of mining technologies which need robotics in the future. The session will be completed by a discussion on the program of activities of the group and the input to the MAR.</li> </ul>
Agenda of the workshop	<ul> <li>09.00 - 09.05 : Introduction to Mining TG, AGH UST, Poland</li> <li>09.05 - 09.15 : The specificity of mining robotics</li> <li>09.15 - 09.30 : The outlook for the copper mining robotics - KGHM Polska Miedź, Poland- end-user</li> <li>09.30 - 09.45 : Sensing in harsh conditions for dependable robotics RWTH Aachen, Germany</li> <li>09.45 - 10.00 : Integrating mechanical mechatronic and telecommunication techniques for application in mining - Wrocław UoT, Poland</li> <li>10.00 - 10.15 : Ultra Wide Band Localization as key enabling technology for Robotics in Mining - LTU, Sweden</li> <li>10.15 - 10.30 : Round table discussion</li> </ul>
What should participants prepare?	Participants should prepare presentation for approximately 15 minutes
Workshop website link	N/A

Session title	Robotics in Slovenia
Room	SPARC (Linhart Hall) - entrance from Foyer I or Foyer II
Hours	14.00 - 15.30
Organiser(s)	<ul> <li>Marko Munih, Faculty of Electrical Enginering, University of Ljubljana, Trzaska 25, 1000 Ljubljana, Slovenia</li> </ul>
Motivation and objectives	Slovenian robotics started in late seventies by developing industrial robot manipulators. Today, a number of enterprises in Slovenia are producing components used in robots, the robot workcells, as well as automated production lines, for domestic industry and for export. Robotisation in the automotive industry with the rate 636 per 10.000 employed is relatively high compared to the rest of the EU, while the robot density in all other sectors in Slovenia was 48. Robotisation in Slovenia's Smart Specialisation Strategy is identified as one of key enabling technologies within the (S)INDUSTRY
	4.0. Various departments from Jozef Stefan Institute and Universities of Ljubljana and Maribor are the main players in this research area. The first Slovenian robotics book was published in 1985. Today, the students can read texts in their mother language and the Slovene authors in English issued by Springer.
	Examples of global players: the RLS is providing custom and mass production absolute magnetic encoder sensors. Kolektor Vision has a track of numerous quality control and adaptive industry vision systems. Yaskawa Slovenia is a robotic specialist, in particular for welding. Revoz company as a Renault car production facility uses the biggest number of robots.
Agenda of the workshop	<ul> <li>14.00 - 14.05 : Teaser. Marko Munih, UL FE</li> <li>14.05 - 14.20 Position sensors for robotics. Janez Novak, RLS</li> <li>14.20 - 14.35 : Machine Vision in Slovenia. Jure Skvarč, Kolektor Orodjarna, BU Vision</li> <li>14.35 - 14.50 : Innovative approaches of Yaskawa Slovenia. Hubert Kosler, Yaskawa</li> <li>14.50 - 15.05 : Evolution towards flexible manufacturing. Tomaž Blatnik, Revoz_</li> <li>15.05 - 15.20 : Learn where Slovenia is heading in robotics and get connected. Peter Wostner, SVRK - Government Office for Development</li> <li>15.20 - 15.30 : Q&amp;A</li> </ul>
What should participants prepare?	Participants should identify 1 example of their past experience with the robotics related to Slovenia.
Workshop website link	http://robo.fe.uni-lj.si/ERF2016_RS_workshop

Session title	The 2016 euRobotics Technology Transfer Award
Room	YASKAWA (Kosovel Hall) - Foyer II
Hours	14.00 - 15.30
Organiser(s)	• Martin Haegele, Head of Department Robot and Assistive Systems, Fraunhofer IPA, Stuttgart
Motivation and objectives	The euRobotics Technology Transfer Award, now in its 13th edition, is seen as one of the ERF's most prominent activities. Successful technology transfer describes the process of converting scientific findings from research laboratories into innovative products, processes and services by the commercial sector. Resulting from the Call for Application that ended 7 February 2016 four finalists will present their examples of successful technology transfer in robot technology and automation that result from cooperative efforts between research and industry. A jury composed of representatives from industry and research will determine the winners of the "2016 euRobotics Technology Transfer Award". The winners will be announced and the award given during the "Lunch Break with Awards" session on March 23.
Agenda of the workshop	<ul> <li>14.00 - 14.10 : Introduction and Overview on Submissions, intro of Jury Martin Haegele</li> <li>14.10 - 14.30 : Finalist 1 presentation (each 15 min), Q&amp;A</li> <li>14.30 - 14.50 : Finalist 2 presentation</li> <li>14.50 - 15.10 : Finalist 3 presentation</li> <li>15.10 - 15.30 : Finalist 4 presentation</li> <li>Note: The finalists will become known only after the selection process is completed.</li> </ul>
What should participants prepare?	The finalists will each have worked out a presentation following a suggested structure: Motivation and goals of the research and development effort, state of the art, concise project approach, results of research and development, achieved innovation and commercial impact, cooperation between research and industry, IPR.
Workshop website link	N/A

Session title	The New H2020 Robotics Projects in the SPARC Strategy
European Commission	HORIZ ON 2020 N 2020 The Partnership for Robotics in Europe
Room	ABB (E1-2) - Foyer II
Hours	14.00 - 15.30
Organiser(s)	Cécile HUET, European Commission, Luxembourg
Motivation and objectives	Don't miss the official presentation of the new H2020 Robotics projects and their contribution to the SPARC strategy! In 90 minutes you will have the full overview of the newly selected 19 projects and in the accompanying poster session you will have the opportunity to meet with the project representatives for more in-depth information and developing networks and synergies among projects and with the community as a whole.
Agenda of the workshop	1) Introduction and portfolio overview by the EC 2) Pitch from each Project representative in 3 slides, 4 minutes: MY PROJECT WILL MAKE A CHANGE
	-> AMBITION -> APPROACH -> IMPACT
	3) Poster session in the exhibition (location tbd)
What should participants prepare?	After getting the overview of all the projects, the participants are strongly encouraged to discuss with the projects representatives at the poster session to learn more about their projects and experience as participants in H2020 projects.
Workshop website link	Session URL: https://ec.europa.eu/digital-agenda/news-redirect/29250 More information on: https://ec.europa.eu/digital-agenda/en/news/new-robotics-projects- 2015-announced

Session title	Aerial Robotics for Inspection and Maintenance (ARIM)
Room	SCHUNK (E3-4) - Foyer II
Hours	14.00 - 15.30
Organiser(s)	<ul> <li>Anibal Ollero, Universidad de Sevilla, Spain</li> <li>Ekkehard Zwicker, Alstom Inspection Robotics, Switzerland</li> </ul>
Motivation and objectives	The interest of the application of Aerial Robotics to Inspection and Maintenance is very evident today, including industrial plants, the energy generation and distribution, and the infrastructures. The robotics inspection technologies are also diverse ranging from the classical visual and infrared inspection to the recent inspection by contact and maintenance functionalities being developed in new H2020 projects. In the workshop we will analyse the application needs and the possibilities and current limitation of the technologies. The Workshop involves leaders in the development of aerial robotic technologies, companies providing inspection and maintenance services and end users. It will contribute to the Road Map in both Aerial Robotics (Robot Categories, Aerial Robotics) and Application of Robotics to Inspection and Maintenance (Commercial Domain, Subdomain Inspection and Maintenance).
Agenda of the workshop	The workshop will consist of three short round tables dealing with Innovative technologies, Applications to Industry Plants and Application to Infrastructures and Energy Systems.
	<ul> <li>14.05 - 14.35 : Innovative Technologies</li> <li>AEROARMS project. Aerial robotic manipulation and inspection by contact: A. Ollero (U Sevilla), K. Kondak (DLR), B. Siciliano (U. Napoli), A. Sanfeliu (UPC);</li> <li>AEROWORKS project. Cooperative inspection: G. Nikolakopulos (U. Lulea), M. Fumagalli (U Twente)</li> <li>PLATFORMS: Dario Floreano (EPFL) Adaptive drone morphologies; K. Alexis (UNR), Hybrid platforms; J.Ruiz and Y. Rodriguez (Elektra), Hardware &amp;software for new platforms; R. Lozano (U. Compiegne), Control for new platforms</li> </ul>
	<ul> <li>14.35 - 14.55 : Industry plants</li> <li>E. Zwicker (Alstom Inspection Robotics), Inspection of oil and gas plants</li> <li>B. Revaz (SENSIMA), Sensors for plant inspection</li> <li>W. Su (TN Systems, TÜV), Plant inspection</li> <li>J. Lindström (ProcessIT Innovations), Process industry infrastructure inspection</li> <li>Discussion</li> </ul>
	<ul> <li>14.55 - 15.15 : Inspection of infrastructures and energy systems</li> <li>P. Chrobocinski (AIRBUS), AEROBI project, bridge inspection</li> <li>T. Mannelqvist (Skellefteå Kraf, Sweden), Inspection of wind turbines</li> <li>S. Bogdan (U.Zagreb, Croatia), Wind generation remote inspection</li> <li>P. Morin (ISIR, UPMC, France), Electric towers inspection</li> <li>Discussion</li> </ul>
	15.15 – 15.30 : General Conclusions and inputs for the SPARC Roadmap

What should participants prepare?	Participants will prepare a short presentation pointing out the most relevant new technologies (Innovative Technologies Round Table) and Applications (Industry Plants, Infrastructure and Energy). They should also provide inputs for the European Robotics Road Map
Workshop Website link:	<ul> <li><u>http://www.aeroarms-project.eu/</u></li> <li><u>http://www.aeroworks2020.eu/</u></li> </ul>



Session title	Robotics for European SMEs in the Context of Industry 4.0
5	ROBO TT robot technology transfer network
Room	TECHNALIA (M1) - Foyer I
Hours	14.00 - 15.30
Organiser(s)	<ul> <li>Anders Billesø Beck, DTI, Danmark</li> <li>Thilo Zimmermann, GPS, Germany</li> </ul>
Motivation and objectives	The fourth Industrial Revolution was a main theme at this year's World Economic Forum in Davos and the topic has reached worldwide attention.
	Digitising European Industry is a major topic in Europe and part of the "Digital Agenda for Europe". Other countries use different terms for the future of manufacturing that just has started.
	Presentations in this WS will focus on experience and real application of methods that can be summarised under the term of the Industry4.0 and discuss questions like:
	What will be the role of robotics in the era of Digitalization? Who is pulling, who is pushing and who will survive the fourth industrial revolution? And what does that mean for European SMEs in manufacturing?
Agenda of the workshop	<ul> <li>14.00 - 14.05 : Introduction by moderator Anders Beck</li> <li>14.05 - 14.15 : "Digitising European Industry", an EC representative</li> <li>14.15 - 14.20 : Vivid Q+A</li> <li>14.20 - 14.30 : The bask experience of Industry 4.0, Iñaki Maurtua, Tekniker</li> <li>14.30 - 14.35 : Vivid Q+A</li> <li>14.35 - 14.45 : The future of manufacturing in the UK, Jeremy Hadall, MTC</li> <li>14.45 - 14.50 : Vivid Q+A</li> <li>14.50 - 15.00 : Industrial digitalization in SMErobotics, Björn Kahl, GPS</li> <li>15.05 - 15.25 : Panel discussion</li> <li>15.25 - 15.30 : Conclusion by the moderator</li> </ul>
What should participants prepare?	Participants do not need to be prepared for this workshop. Participation in the Q+A parts as well as in the panel discussion is however most welcome.
Workshop website link	www.smerobotics.org/public-relations/workshops.html

Session title	Robotics in the Western Balkans
Room	SPARC (Linhart Hall) - entrance from Foyer I or Foyer II
Hours	16.15 - 17.45
Organiser(s)	Uwe HAASS, Consultant, Germany
Motivation and objectives	It is important that Europe is not falling apart into those regions which have high tech industries, high employment and wealth, and those with mostly manual labour, low wages, and high unemployment. Hence we need a strategy to develop a successful robotics industry at the periphery of Europe as well. It is important that regional competencies are kept and integrated into robotics. This workshop is to present robotics activities in the Western Balkans and discuss how results will contribute to the Roadmap of European Robotics.
Agenda of the workshop	<ul> <li>16.15 - 16.20 : Welcome, Uwe L. Haass, Munich Each of the following presentations is structured into: (i) presentation of organisation, (ii) work on robotics, (ii) suggestions for development and cooperation in Europe.</li> <li>16.20 - 16.40 : Presentations from University of Zagreb, Croatia, Faculty of Electrical Engineering and Computing, Department of Control and Computer Engineering:</li> <li>AMOR - Autonomous Mobile Robotics, Ivan Marković, www.fer.unizg.hr/ ivan.markovic</li> <li>LARICS - Laboratory for Robotics and Intelligent Control Systems, Matko Orsag, <u>http://larics.rasip.fer.hr/</u></li> <li>LABUST - Laboratory for Underwater Systems and Technologies, Nikola Mišković, <u>http://labust.fer.hr</u></li> <li>16.40 - 16.50 : University of Sarajevo, Elektrotehnički fakultet, Sarajevo, Bosnia and Herzegovina, Adnan Tahirović, <u>http://people.etf.unsa.ba/~atahirovic/</u></li> <li>16.50 - 17.00 : NENASAL, Gradiška, Republika Srpska, Bosnia and Herzegovina, Neven Savanovic, <u>www.nenasal.net</u></li> <li>17.00 - 17.10 : BioSense Institute, Robotics and Mechatronics Group, Novi Sad, Serbia, Saša Marjanović, <u>http://biosense.rs/index.php/en/research/groups/ mechatronics</u></li> <li>17.10 - 17.20 : Mihajlo Pupin Institute Robotics Laboratory, Beograd, Serbia, Aleksandar Rodić, <u>http://www.pupin.rs/RnDProfile/index.html</u></li> <li>17.20 - 17.30 : University of Niš, Faculty of Electronic Engineering, RLAB, Niš, Serbia, Goran Đorđević, <u>http://robot.elfak.ni.ac.rs</u></li> <li>17.30 - 17.45 : Discussion and work on a memorandum for future development and cooperation</li> </ul>
What should participants prepare?	Participants from the Western Balkans also those working in other locations than the presenters can bring posters and/or flyers and introduce themselves. All participants should contribute to a memorandum for the development and cooperation and prepare strategies for concerted actions.
Workshop website link	Contact the organiser for the memorandum which will be drafted after ERF 2016.

Session title	Georges Giralt PhD Award Presentations
Room	YASKAWA (Kosovel Hall) - Foyer II
Hours	16.15 - 17.45
Organiser(s)	Gerhard KRAETZSCHMAR, Bonn-Rhein-Sieg University, Germany
Motivation and objectives	The Georges Giralt PhD Award in Robotics (GGA) is the most prestigious PhD award in the robotics area in Europe. The award winner gets the opportunity to publish her/his thesis as a volume in the Springer STAR series.
	Excellent PhD theses that have been submitted and defended at a European university or research institution within the 2015 calendar year are eligible for the award. A selection committee consisting of 26 distinguished academic members of the European research community evaluates the submissions in two rounds and selects up to four finalists, who are invited to give a 20-minute presentation on their thesis at the European Robotics Forum in Ljubljana. The selection committee will make its final decision about the 2016 Georges Giralt PhD Award winner after the presentations.
	The winner will be announced and the award given during the "Lunch Break with Awards" session on March 23.
Agenda of the workshop	<b>16.15 – 16.20</b> : Introduction and Overview on Submissions, Prof. Gerhard Kraetzschmar, Bonn-Rhein-Sieg University
	<b>16.20 – 16.40</b> : Thesis Title 1, Finalist 1, Finalist 1 University
	<b>16.40 – 17.00</b> : Thesis Title 2, Finalist 2, Finalist 2 University
	<b>17.00 – 17.20</b> : Thesis Title 3, Finalist 3, Finalist 3 University
	<b>17.20 – 17.40</b> : Thesis Title 4, Finalist 4, Finalist 4 University
	<b>17.40 – 17.45 :</b> Closing Remarks, Prof. Gerhard Kraetzschmar, Bonn- Rhein-Sieg University
	<b>Note:</b> The finalists will become known only after the selection process is completed.
What should participants prepare?	The speakers will be finalists for the 2016 version of the Georges Giralt PhD Award in Robotics. At the time of printing, the theses submitted for consideration for the award are still under evaluation by the Georges Giralt PhD Award Committee (GGAC). The finalists will present a short (15-20 min) overview and summary of their theses.
Workshop website link	For further inquiries, send email to the Chair of the Georges Giralt PhD Award Committee, Prof. Gerhard Kraetzschmar

Session title	Step Change Results from FP7 Projects
Room	ABB (E1-2) - Foyer II
Hours	16.15 - 17.45
Organiser(s)	<ul> <li>Olivier DA COSTA, Cécile HUET, Franco MASTRODDI, European Commission, DG CONNECT, Unit A2 – Robotics</li> </ul>
Motivation and objectives	The objectives of the session are: 1) To demonstrate the contribution of EU funding to the field of Robotics 2) To foster the dissemination and exploitation of the project results Each project will be given 15 minutes to pitch its unique contribution, what difference it has made, what concrete impact it will have (from the direct use of the project results to future perspectives). If possible, the presentation by the coordinator (or PI) (5') will be supplemented by the presentation from an end-user (member or not of the consortium) (5') and by Q&A (5').
Agenda of the workshop	<ul> <li>16.15 : ARCAS - Aerial Robotics Cooperative Assembly System (www.arcas-project.eu), Prof. Aníbal Ollero, coordinator, University of Seville.</li> <li>16.30 : RoboHow - Web-enabled and Experience-based Cognitive Robots that Learn Complex Everyday Manipulation Tasks (www.robohow.eu), Prof. Michael Beetz, coordinator, Technische Universität Bremen.</li> <li>16.45 : CORBYS - Cognitive Control Framework for Robotic Systems (www.corbys.eu), Prof. Zlatko Matjacic, University Rehabilitation Institute, Ljubljana.</li> <li>17.00 : SAPHARI - Safe and Autonomous Physical Human-Aware Robot Interaction (www.saphari.eu), Dr. Alin Albu-Schäffer, DLR-Institute of Robotics and Mechatronics, Prof. Sami Haddadin, end-user, Kastanienbaum GmbH.</li> <li>17.15 : ALIZ-E - Adaptive Strategies for Sustainable Long-Term Social Interaction, (www.aliz-e.org), Dr. Rosemarijn Looije, TNO, Utrecht.</li> <li>17.30 : Wrapping up, lessons learned and way forward</li> </ul>
What should participants prepare?	We encourage participants to reflect on their past experiences with FP7 robotics program in order to possibly highlight a few success stories.
Workshop website link	https://ec.europa.eu/digital-agenda/en/news/european-robotics- forum-2016

Session title	Robotics for Logistics and Transport
Room	SCHUNK (E3-4) - Foyer II
Hours	16.15 - 17.45
Organiser(s)	<ul> <li>Achim J. LILIENTHAL, Örebro University, Sweden</li> <li>Jesús ALFONSO, ITA, Spain</li> <li>Todor STOYANOV, Örebro University, Sweden</li> </ul>
Motivation and objectives	This workshop is being organised by the euRobotics Topic Group for robots in logistics and transport. The main objective is to bring together researchers from academia and industry, in order to discuss the major challenges and opportunities for Robotics in Logistics and Transport.
Agenda	16.15 – 16.20 : Introduction
of the workshop	<ul> <li>16.20 - 17.15 : Invited contributions from industry and academia <ul> <li>State of the Art of Autonomous Robots in Industrial Logistics Applications <ul> <li>Risks and Challenges for the Future, Wolfgang Echelmeyer, Reutlingen Research institute</li> </ul> </li> <li>Bluebotics - ANT® Navigation for Logistics - Challenges and Experiences, Nicola Tomatis, Bluebotics</li> <li>Autonomous Logistic Systems for Smart Factories, Sören Kerner, Fraunhofer IML</li> <li>KUKA Mobile Robotics - Solutions and Challenges, Uwe Zimmermann, KUKA</li> <li>Planning of Mobile Assistant Units in Assembly Lines for Performing Material Supply Operations, Niki Kousi, LMS Patras University</li> <li>Towards Autonomous Robots for Inventories and Logistics, Jordi Pages, Pal Robots</li> <li>Parallel Cable Robotics for Improving Maintenance and Logistics of Large-Scale Products, Jon Agirre Ibarbia, Tecnalia</li> <li>Multiple AGV Systems for Factory Logistics: the PAN-Robots Project, Cesare Fantuzzi, UNIMORE</li> </ul> </li> <li>17.25 - 17.45 : Round Table - What Are the Main Barriers for Robotics</li> </ul>
What should	Applications in Logistics and Transport
participants prepare?	During the round table, we will discuss the main scientific and technical barriers w.r.t robotics in logistics and transport applications, with inspiration from the invited talks, and the open questions identified at the 2015 workshop. Participants should prepare by reading the conclusions of the 2015 workshop <u>http://web.itainnova.es/eurobotics/erf-2015-workshop-robotics-for-logistics-and-transport/</u>
Workshop website link	http://web.itainnova.es/eurobotics/erf-2016-workshop-robotics-for-logistics- and-transport/

Session title	How Do We Surpass Current Barriers to Efficient Deployment of New Robotics in Industry?
Room	TECHNALIA (M1) - Foyer I
Hours	16.15 - 17.45
Organiser(s)	<ul> <li>Jon AZPIAZU, SINTEF, Norway</li> <li>Lars Dalgaard, DTI, Denmark</li> <li>Adam Dabrowski, PIAP, Poland</li> </ul>
Motivation and objectives	A key element when bringing some of the newer robotic applications into industry is to do it in an efficient way. Quite often researchers focus on bringing our research into TRL 5 or 6, but we underestimate the effort required to raise these prototypes into TRL 9. Often also, the requirements set for doing a prototype validation or demonstration are not the same as for an actual system in an operational environment in terms of reliability, robustness and so on. In order for robot research to have a bigger impact, we should try to make the road between research and industry more agile. Some of the questions that we will try to answer during the workshop are: • Which are the main barriers why many cool research papers never arrive to industry?
	<ul> <li>What issues need to be taken into account while doing research so that the results can be taken more efficiently to industry?</li> <li>How can we accelerate the timeline from a research prototype to an industrial-grade system?</li> <li>What does industry demand that is not correctly tackled by research?</li> </ul>
Agenda of the workshop	<ul> <li>"Introduction to the workshop and motivation - the R5-COP project", Jon Azpiazu, SINTEF, Norway</li> <li>"Dealing with configurability of robot systems", Tapio Heikkilä, VTT, Finland</li> <li>"We have the solution! - And the problem was?", Matti Tikanmaki, Probot OY, Finland</li> <li>"Deploying Mobile Service Robot Systems - lessons from the DTI Mobile CoWorker paradigm", Lars Dalgaard, DTI, Denmark</li> <li>"Reconfigurable mobile robots in industry: can experience in security robotics help in industrial use cases?", Adam Dabrowski, PIAP, Poland</li> <li>"Towards real life autonomous UGVs for search and rescue", George Nikolakopoulus, LTU, Sweden</li> <li>"Towards robust autonomous robot operations", Jon Azpiazu, SINTEF, Norway</li> <li>"Industrial applications in search and rescue with UGVs", Jonas Wikstrom, Swedish Space Corporation</li> <li>Brainstorming summary and discussion</li> </ul>
What should participants prepare?	Participants will be asked to provide with concepts and ideas for the brainstorming session. It would be useful if participants have access to some device (smartphone, tablet, laptop) able to connect to the Internet. Other means of participation will be provided in case this is not available.
Workshop website link	http://r5-cop.eu/en/events/erf2016/

Session title	Digitising the European Industry (DEI); Robotics Innovation Hubs (RIH) RIH - from Regional to European Initiatives
Room	SPARC (Linhart Hall) - entrance from Foyer I or Foyer II
Hours	8.30 - 10.00
Organiser(s)	<ul> <li>Cécile HUET, European Commission</li> <li>Mariusz BALDYGA, European Commission</li> <li>Magdalena SZWOCHERTOWSKA, European Commission</li> </ul>
Motivation and objectives	This session will explain the concept of Robotics Innovation Hubs (RIH) and present existing instantiations funded by FP7-H2020 (Echord++, TT-NET, HORSE and RECONCELL) and an example of a privately funded initiative. It will also explain SPARC's role in contributing to the DEI, in particular the development of the European network of RIH. The discussion following these presentations will address the next steps to develop new RIH all over Europe and develop a network of these hubs, so that any company in Europe will have access to the competence needed to digitize its production, product or service, improving competitiveness, efficiency, quality of service and benefiting from all the other added value brought by robotics technologies.
Agenda of the workshop	INTRODUCTION - Cécile Huet – European Commission (10') HORSE: <u>http://www.horse-project.eu/;</u> Christophe Leroux (CEA), Marie-Luise Neitz (TUM) and Anastasia Garbi (European Dynamics) (10') RECONCELL: <u>http://www.blue-ocean-robotics.com/en/rd/production/reconcell;</u> Ales Ude, head of Department of Automatics, Biocybernetics and Robotics, Jožef Stefan Institute (10') ECHORD ++ - <u>http://echord.eu/;</u> Prof. Chris Melhuish, Director of the Bristol Robotics Laboratory(10') TT-NET - http://tt-net.org/; Kurt Nielsen, Director of Robot Technology at Danish Technological Institute (DTI) (10') Open Robotics Innovation at Siemens - <u>https://www.frontier.spigit.com/Page/Home</u> ; Moshe Schwimmer, Innovation Catalyst, Siemens (10') SPARC & RIH - <u>http://sparc-robotics.eu/;</u> Geoff Pegman, Managing Director, R U Robots Limited (10') DISCUSSION (20') A poster session will follow the session to allow ERF participants to meet the representative of the initiatives presented during the session and learn how you could benefit from their services, or collaborate with them.
What should participants prepare?	From the supply side: Participants who have a competence to offer (knowledge or shared infrastructure: technology or end-user piloting environment) are strongly invited to contribute to the discussion to explain what they have to offer and the way forward to develop RIHs all over Europe. They will also be invited to explain the various needs in terms of financial support, for the various actors around the RIH: the competence center itself, to finance the infrastructure, the start-ups, SMEs willing to digitize their industries, From the demand side: Participants are invited to contribute to the discussion, explaining their specific needs in terms of access to technology, competence or finance. This workshop should pave the way to a roadmap for developing a network of RIH in Europe and contribute to the DEI strategy, including an analysis of the barriers and potential solutions.
Workshop website link	Session URL: <u>https://ec.europa.eu/digital-agenda/news-redirect/29250</u> More information on DEI: <u>https://ec.europa.eu/digital-agenda/en/digitising-european-industry</u> "Securing easy access to digital technologies for all industrial companies, and especially SMEs, wherever they are located in Europe and for any sector – building on and complementing national and regional digital innovation infrastructures"

Session title	Robots for Education
Room	YASKAWA (Kosovel Hall) - Foyer II
Hours	8.30 - 10.00
Organiser(s)	Petra KOUDELKOVÁ DELIMOGES, Aldebaran, France
Motivation and objectives	<ul> <li>Universities, engineering schools, primary and specialized schools have started using robot-enhanced programs as new pedagogical paths. Using robotics in education motivates students for technical studies. It opens new perspectives and enhances our knowledge not only in STEMS but also in other topics such as languages, geography or logic. Last but not least, introducing robots in schools since the very early stage enable children to get used to robotic technologies. This is the basis of a technology-aware population and opens the doors for creative thinking and applications which can eventually lead to utilization of robotics for the betterment of society. The workshop targets this up-to-date issue. It aims to discuss with euRobotics' Topic Group Education members as well as all other interested academics, industrials, public stakeholders and end users the following topics:</li> <li>The current and future utilization of robotic platforms in education, covering the range from the primary, secondary, higher to special education.</li> <li>Advantages, disadvantages and challenges to take up in order to introduce curricula of Education with robots.</li> <li>Next steps: initiatives, possible project proposals</li> </ul>
Agenda of the workshop	<ul> <li>Robotics for Education, Petra Koudelková Delimoges, Aldebaran</li> <li>Teaching children and pupils the basics of Artificial Intelligence and Computer Science, Dr. Gerald Steinbauer, Graz University of Technology</li> <li>Boosting student motivation by programming Nao, Boštjan Resinovič, School Center Celje</li> <li>Round table: Robotics for Education - Perspectives, challenges and the next steps</li> </ul>
vvnat snould participants prepare?	Participants are invited to contribute to the exchanges on proposed topics during the workshop.
Workshop website link	http://robeduerf16.sciencesconf.org

Session title	Transfer of Cognitive Robotics Research to Industrial Applications
Room	ABB (E1-2) - Foyer II
Hours	8.30 - 10.00
Organiser(s)	<ul> <li>Tamim ASFOUR, Karlsruhe Institute of Technology, Germany</li> <li>Anne BAJART, European Commission, Robotics</li> <li>Ales UDE, Jožef Stefan Institute, Ljubljana, Slovenia</li> <li>Norbert KRÜGER, University of Southern Denmark</li> </ul>
Motivation and objectives	The workshop intends to reflect the impact of cognitive robotics research on industrial applications by showing successful transfer examples from research to industry and discussing lessons learnt in previous EU funded research projects in cognitive systems. The goal is to analyse the actual transfer process in the light of today's needs of robotic industry, formulate open problems in terms of industrial requirements and fundamental research questions. In particular, the speakers will address the following questions 1) What technologies that can be attributed to cognitive robotics research were successfully introduced into industrial applications 2) what technologies does the industry expect to get from cognitive robotics research in the next three years. The material presented at the workshop will be made available on the web. A short report will be prepared by the organisers and made available for the related TGs: "Al and Cognition in Robotics", "Perception" and "Robot Companions for Assisted Living".
Agenda of the workshop	<ul> <li>08:30- 09:30: Short presentations (7 minutes each)</li> <li>Welcome: From PACO+ and Xperience to SecondHands; Tamim Asfour, Karlsruhe Institute of Technology</li> <li>Beyond navigation - what else is ready for transfer?; Wolfram Burgard, Uni Freiburg</li> <li>How to apply cognitive abilities in industrial automation and logistics; Michael Suppa, CEO Roboception</li> <li>RTM - Object Modelling, Recognition and Tracking; Johann Prankl, TU Wien</li> <li>Applying Kernel Density Estimation for industrial robotic Tasks; Dirk Kraft and Norbert Krueger, University of Southern Denmark</li> <li>Intuitive programming of sensor-adaptive industrial robot tasks; Sven Schmidt- Rohr, CEO &amp; Co-founder, ArtiMinds Robotics GmbH</li> <li>Some Cognitive Robotics Applications and Challenges at Ocado; Graham Deacon, Ocado Technology</li> <li>Transfer of Cognitive Robotics Research to Industrial Applications - What's Missing from this Title?; David Vernon, University of Skövde, Sweden</li> <li>09:30 - 10:00: Round table discussion</li> </ul>
What should participants prepare?	The speakers will address several questions related to success stories and lessons learnt in previous cognitive robotics research.
Workshop website link	http://h2t-projects.webarchiv.kit.edu/ERF2016/

Session title

Inspection and Maintenance Robotics – Review and Discussion of Systems Deployed by End-Users and Discussion of the Needs for Further Research & Development



Room	SCHUNK (E3-4) - Foyer II
Hours	8.30 - 10.00
Organiser(s)	<ul> <li>Ekki Zwicker, GE Inspection Robotics, Switzerland</li> <li>Hakon Ferkingstad, GASSCO, Norway</li> <li>Tjibbe Bouma, SPRINT Robotics, Netherlands</li> </ul>
Motivation and objectives	The session will give an overview of how robotics is deployed in the process industry today, what the current challenges are and which technological and operational gaps need to be addressed to further boost robotics in this domain The workshop will consist of a series of short presentations given by endusers (asset owners, industrial service providers) and robotic system suppliers presenting successfully deployed robotic systems. The presentations are followed by a panel discussion with representatives from industry (endusers and technology providers) and academia addressing the gaps identified and to be covered by research.
Agenda	Introduction (E. Zwicker, H. Ferkingstad, T. Bouma)
of the workshop	Series of short presentations addressing how robotics is currently deployed in the process industry – The view of Asset Owners, Service Providers and Robotic Technology Providers
	Workshop discussion addressing the consequences for research and industrialization in general and H2020 / SPARC in particular.
	Summary & Conclusion
What should participants prepare?	Within the workshop discussion the participants will be asked to raise their point of view and to contribute to the discussion
Workshop website link	N/A

Session title	Safety Standardization for Medical Robotics (Part 1 & Part 2)
Room	PROJECT 1 (M4) - Foyer I
Hours	8.30 - 10.00 (Part 1); 10.45 - 12.15 (Part 2)
Organiser(s)	<ul> <li>Tamás, HAIDEGGER, Óbuda University, Hungary</li> <li>Paolo, BARATTINI, Kontor 46, Italy</li> <li>Gurvinder, VIRK, Gävle University, Sweden</li> </ul>
Motivation and objectives	This is a two-part workshop. Half of the workshop is dedicated to presentations from leading standardization and research experts in the area of medical robots. The other half of the workshop will build on the presented activities from the first half and take these notions a step further in order to collect inputs from a wide community. It is the aim to bring experts from research and the standardization community together and define future strategies for the rapidly changing and growing area of medical robotics. The field of medical robots including surgical and rehabilitation robotics is expanding with new market viable products implementing latest scientific results. The basic safety and essential performance requirements in this domain are referred to two areas:
	• On one side we need standards to build safe medical robot systems. This is vital because in the medical surgical and rehabilitation field the robot is typically in direct contact with the exterior and interior of the human body and applies forces to the patient in different ways. This also implies the need for safe control systems, training issues and many other factors that can influence the overall 'safety'.
	<ul> <li>On the other side the safety issues have to be weighed by the medical approach considering if the robotics technology is providing at least the same benefit for the patient as the traditional alternatives.</li> </ul>
Agenda of the workshop	<b>8.30 - 09.00 : Presentations: JWG 35 Medical robots for surgery,</b> Tamás Haidegger, Óbuda University. Legal and liability issues in robotics, Andrea Bertolini, Scuola Superiore Sant'Anna.
	9.00 – 10.00 : Round table: participants inputs, discuss standardisation gaps
	<ul> <li>10:45 - 11:15 : Presentations: JWG 36 medical robots for rehabilitation, Jan Veneman, Tecnalia. Stiff Flop FP7 project, Professor Kaspar Althoefer, King's College London.</li> <li>11.15 - 12.15 : Round table: discuss future strategies for standardization in</li> </ul>
	medical robotics
What should participants prepare?	Participants will be asked to contribute cases, controversial issues and technology gaps in relation to safety and standards.
Workshop website link	https://clawar.org/event/workshop-erf16

Session title	Digitising the European Industry (DEI) - Access to Finance and SMEs Perspectives
Room	SPARC (Linhart Hall) - entrance from Foyer I or Foyer II
Hours	10.45 - 12.15
Organiser(s)	<ul> <li>Cécile Huet - European Commission</li> <li>Mariusz Baldyga - European Commission</li> <li>Magdalena Szwochertowska - European Commission</li> </ul>
Motivation and objectives	The EU has put in place a series of measures within the framework of the Horizon 2020 programme to support European companies, also in the robotics sector. Grants and financial instruments (e.g. loan guarantees, loans and equity) have been incorporated in a framework, in order to help better exploit complementarities across instruments and facilitate the transfer of research results to the market in the form of products or services. Financial instruments provide an innovative way of investing in growth-enhancing robotics companies and activities.
	Financial innovation investments beyond H2020 grants for the robotics constituency support the objectives of the DEI strategy. The opportunities offered by financial instruments through EIB and EIF under Horizon2020 (InnovFin) and the Juncker investment package (EFSI: European Fund for Strategic Investments) will be presented. Research and Innovation investments under the Regional Innovation Strategies for Smart Specializations (RIS3) from the European Structural and Investment Funds (ESIF) (e.g. through Innovation Vouchers or Seals for Excellence) are also in the scope of the workshop. Other EU innovation instruments, such as offered by HORIZON2020 and COSME (SME and FTI instruments) will be presented.
Agenda of the workshop	<ul> <li>5' Introduction by the moderator</li> <li>45' Presentations workshop (financial instruments -EC/EIF/EIB)</li> <li>30' Round table discussion</li> <li>10' Conclusions and next steps</li> </ul>
What should participants prepare?	Participants are invited to contribute to the discussion to explain what they have to offer and the way forward to digitising the European Industry. They will also be invited to explain their needs in terms of finance. This workshop should raise the awareness of the EU financial instruments and explore different paths of financing via intermediary banks, VCs or business angels.
Workshop website link	https://ec.europa.eu/digital-agenda/news-redirect/29250



Session title	Opportunities and Challenges of the European Network of Competence Centers on Robotics
Room	YASKAWA (Kosovel Hall) - Foyer II
Hours	10.45 - 12.15
Organiser(s)	<ul> <li>Christophe Leroux, CEA Tech, France</li> <li>Francesco Maurelli, TUM Munich, Germany</li> <li>Ali Muhammad, VTT, Finland</li> <li>Brane Semolic, TCS with LENS Living Lab, Slovenia</li> </ul>
Motivation and objectives	<ul> <li>The objectives of the workshop are to inform the participants about existing and planned physical infrastructures for easy access to robotics in several places across Europe. The workshop will give a short introduction and highlight the benefits for the community, which include:</li> <li>Organized "one stop shop" to support introduction of robots in small and medium-sized companies</li> </ul>
	<ul> <li>Organized access to the necessary technologies and knowledge providers</li> <li>Organization of the international professional virtual communities in the field of robotics,</li> <li>Popularization of robotics, their perspectives and related solutions</li> </ul>
Agenda of the workshop	<ul> <li>10.45 - 11.00 : EU Network of Competence Centres (CoC) on robotics - Horse Project business case (Dr. Christophe Leroux, CEA Tech, France)</li> <li>11.00 - 11.15 : CoC TUM business case (Dr. Francesco Maurelli, TUM Munich, Germany)</li> <li>11.15 - 11.30 : Innovation hubs (Dr. Muhammad Ali, VTT, Finland)</li> <li>11.30 - 11.40 : CoC as part of industry innovation ecosystem - TCS&amp;3L business case (Dr. Brane Semolic, TCS&amp;3L, Slovenia)</li> <li>11.45 - 12.15 : Round table: what are CoC's critical success factors (CSFs)</li> </ul>
What should participants prepare?	Participants should identify the list of the CoC's critical success factors (CSFs) – from the views of industry and academy (to be written on a poster)
Workshop website link	www.horse-project.eu

Session title	AI and Cognition in EU Robotic Projects: Current Landscape and Future Priorities
Room	ABB (E1-2) - Foyer II
Hours	10.45 - 12.15
Organiser(s)	<ul> <li>Alessandro Saffiotti, Örebro University, Sweden</li> <li>Markus Vincze, Technical University Wien, Austria</li> <li>Vincent C. Müller, Anatolia College, Greece</li> </ul>
Motivation and objectives	<ul> <li>While many current EU projects are dealing with the use of AI and Cognition technologies in robotic systems, these efforts are not always sufficiently connected. One of the goals of the AICoR topic group in euRobotics is to increase awareness, communication and cross-fertilization among EU projects which are related to AI and Cognition in robotics.</li> <li>This workshop will pursue this goal, but it will also go one step further in using current experience to set future strategic directions for EU projects on AI and Cognition in Robotics. These directions should be pushed in the euRobotics MAR and in future EU calls. The seeding material for the discussion will be a set of brief (5 minute) presentations of running or recently completed relevant EU projects. Each presentation will have to answer a set of key questions, published on the workshop web site two weeks before the event.</li> <li>This workshop is organized by the SPARC topic group AICoR (AI and Cognition in Robotics) in collaboration with EUCoG (the European Association for Cognitive Systems).</li> </ul>
Agenda of the workshop	<ul> <li>10.45 : Introduction and objectives</li> <li>10.50 : Presentations of EU projects (speakers)</li> <li>11.20 : Flash presentations of EU projects (all participants)</li> <li>11.30 : Round table discussion: current landscape, overlaps, gaps and burning problems</li> <li>12.00 : Open floor discussion: strategic directions for AICoR and contributions to H2020 roadmap</li> <li>12.15 : End of workshop</li> </ul>
What should participants prepare?	Speakers will prepare short presentations guided by the set of questions mentioned above. Other participants who have been involved in recent EU projects related to AI and Cognition in Robotics are welcome to make a 60 second statement about their project, answering the same questions.
Workshop website link	http://aass.oru.se/Agora/ERF2016/
Session title	Autonomous Robotic Systems for Inspection and Structural Assessment of Civil Underground Infrastructures
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Room	SCHUNK (E3-4) - Foyer II
Hours	10.45 - 12.15
Organiser(s)	<ul> <li>Angelos Amditis, Institute of Communication and Computer Systems (ICCS)</li> <li>Konstantinos Loupos, Institute of Communication and Computer Systems (ICCS)</li> <li>Juan G. Victores, Universidad Carlos III de Madrid RoboticsLab (UC3M)</li> </ul>
Motivation and objectives	The aim of this workshop is to present the recent developments and future challenges of the autonomous robotic inspection systems. The focus will be on structural assessment of civil infrastructures such as highway and train tunnels, metro stations and underground storages. The main robotics and sensor analysis technologies will be presented and discussed. The view of end-users of the tunnelling sector will also will taken into account.
Agenda of the workshop	<ul> <li>10.45 - 10.50 : Welcome and Introduction (A.Amditis, ICCS (GR), J. G. Victores, UC3M (E), F. Fedi, Finmeccanica (I))</li> <li>10.50 - 11.05 : State-of-the-art on robotics tunnels' inspection (C. Balaguer, UC3M (E))</li> <li>11.05 - 11.20 : Future trends on civil robotics (T. Bock, TUM (D))</li> <li>11.20 - 11.35 : Computer vision methodologies and algorithms for tunnel structural assessment (K. Loupos, ICCS (GR))</li> <li>11.35 - 11.50 : Ultrasonic technologies for measuring crack width and depth in high accuracy (Luca Belsito, CNR (I))</li> <li>11.50 - 12.05 : End-users point of view: Tunnels' inspection and assessment (P. Wright, CH2M Hill (UK))</li> <li>12.05 - 12.15 : Discussion and brainstorming</li> </ul>
What should participants prepare?	Participants will receive several links related to projects, labs and organizations involved in the topics of the workshops as well as several links for the latest related paper. They will also be asked to send suggestions and possible future applications in the field of civil infrastructures inspection.
Workshop website link	<ul> <li>http://robo-spect.eu/index.php/test/28-erf2016</li> <li>https://www.linkedin.com/groups/7445986</li> <li>https://twitter.com/robo_spect</li> </ul>

Session title	Digitising the European Industry (DEI): Digital Skills and Workforce
Room	SPARC (Linhart Hall) - entrance from Foyer I or Foyer II
Hours	14.00 - 15.30
Organiser(s)	<ul> <li>Anne Bajart – European Commission</li> <li>Bjoern Juretzki – European Commission</li> <li>Magdalena Szwochertowska – European Commission</li> </ul>
Motivation and objectives	This workshop will introduce a pillar of the new EC policy "Digitising the European Industry": filling the skills gap and preparing the workforce for the digital transformation of the industry. It will more specifically cover the topic of automation and robotics, and how
	the wide development of those technologies will deeply transform the job market and the work environment in the coming years.
	Digitisation will create the need for new highly specialised skills but will also imply the re-skilling of a significant part of the workforce. The work place organisation and structure will as well be impacted by those changes, such as Human-Machine interaction and cooperation for example.
Agenda of the workshop	<ul> <li>14.00 - 14.10 <ul> <li>Welcome</li> <li>Digitising the European industry: Digital Skills and Workforce - EC representative</li> </ul> </li> <li>14.10 - 15.10 <ul> <li>Of mice and men: jobs in the digital age - Prof. Nicolas van Zeebroeck, Solvay Brussels School of Economics and Management</li> <li>Robotic systems in manufacturing: Empirical insights on employment and productivity effects - Angela Jäger, Christian Lerch, Cornelius Moll, Fraunhofer ISI</li> <li>Implications of Human Robot Collaboration on workforce qualification - Dr Klaus Petter, KUKA College</li> </ul> </li> <li>15.10-15.30 : Round table; Wrap-up and conclusions</li> </ul>
What should participants prepare?	Speakers will cover various aspects of the digital skills and workforce issue, identifying the main challenges and presenting ideas. It will be followed by a round table, welcoming questions from the audience as well. The goal is to gather the most complete view and list possible actions to be taken at the European level.
Workshop website link	<ul> <li>More information to be found on:</li> <li>https://ec.europa.eu/digital-agenda/en/digitising-european-industry</li> <li>https://ec.europa.eu/digital-agenda/en/robotics</li> </ul>

Session title	Digitising the European Industry (DEI): Platforms
Room	YASKAWA (Kosovel Hall) - Foyer II
Hours	14.00 - 15.30
Organiser(s)	<ul> <li>Antonio Puente – European Commission</li> <li>Mariusz Baldyga – European Commission</li> </ul>
Motivation and objectives	This workshop will introduce the Second Pillar of the new EC policy "Digitising the European Industry": leadership in platforms for digital industry. The objective is ensuring the availability of state-of-the-art open and interoperable platforms that any business can use to make its products, processes and services ready for the digital age. More specifically, platforms must support the needs of European Industry for
	safety, standardisation, scalability, transferability and integration of robotic technologies from multiple suppliers, maintenance, and upgrade throughout the entire production chain and over the whole product lifetime.
	The workshop will consists of:
	<ul> <li>An introduction to the concept of digital platform by the EC and how it can help digitising the European Industry and making it more competitive.</li> </ul>
	Presentations on three potential digital platforms by selected experts
	<ul> <li>A debate about which robotic platforms would be needed to support "Digitising the European Industry" as well as how these concepts can contribute to the Roadmap of European Robotics.</li> </ul>
Agenda of the	14:00-14:05 : Welcome
workshop	14:05-14:20 : Digitising the European industry: Platforms – EC representative
	14:20-15:05 : Presentations by speakers on
	<ul> <li>Robotic operating systems (presented by expert to be confirmed)</li> </ul>
	<ul> <li>Platforms for human-robot collaboration: collaborative robotics and safety (presented by expert to be confirmed)</li> </ul>
	Humanoids as robotic platforms (presented by Dr.Giorgio Metta - IIT)
	<b>10:05-10:25</b> : Round table: what needs to be solved in the next 5 years?
	10:25-10:30 : Wrap-up and conclusions
What should participants prepare?	Speakers will provide background material to inspire the debate. They will cover various novel aspects of robotic technology that would benefit from better regulation, higher standardisation and interoperability to allow implementing these technologies in the European Industry.
Workshop website link	https://ec.europa.eu/digital-agenda/en/news/european-robotics- forum-2016

Session title	SPARC Workshop on Cognitive Robotics: Actions for Promoting the Deployment of Cognitive Systems in Industry
Room	ABB (E1-2) - Foyer II
Hours	14.00 - 15.30 (Part 1); 16.15 - 17.45 (Part 2)
Organiser(s)	<ul> <li>David VERNON, University of Skövde Sweden</li> <li>Markus VINCZE, Technische Universität Wien, Austria</li> </ul>
Motivation and objectives	<ul> <li>SPARC - The Partnership for Robotics in Europe - brings together euRobotics aisbl and the European Commission. It is supported by a project that was launched in February 2016 which, along with its many other activities, has five goals to promote the deployment of cognitive systems in industry:</li> <li>I. Identify industrial priorities</li> <li>Create a catalogue of cognitive systems algorithms</li> <li>Create a RockEU2 cognitive architecture schema</li> <li>Develop a framework linking cognition and autonomy</li> </ul>
	5. Develop offware engineering guidelines for cognitive robotics This workshop is the first opportunity for the robotics, cognitive systems, and AI communities to engage and become involved in the achievement of these goals. The workshop will be a facilitated brainstorming exercise. There will be five parallel breakout sessions, one for each goal. The attendees will choose which of the five breakout sessions they want to attend, during which they will provide three answers to a small number of focused questions. A facilitator will then collect these answers and, together with the participants, sort them into consistent groups. These collective answers will then be presented to the full meeting. After all the participants have had an opportunity to discuss the issues raised and give their own views, we will then identify the follow-up actions needed to move this process forward, effectively and efficiently.
Agenda of the workshop What should	<ul> <li>14.00 - 14.20 : Introduction to objectives &amp; methodology</li> <li>14.20 - 14.30 : Identification of breakout groups</li> <li>14.30 - 15.30 : Five parallel breakout group brainstorming sessions</li> <li>15.00 - 15.00 : Coffee break</li> <li>16.15 - 17.05 : Five 10-minute feedback presentations</li> <li>17.05 - 17.35 : Moderated open discussion</li> <li>17.35 - 17.45 : Identification of short-term goals and follow-up actions</li> </ul>
participants prepare? Workshop	Intending participants are encouraged to browse through the preparatory material on the workshop website.
website link	O

Session title	Enlarging the Scope of Miniaturised Robotics
Room	SCHUNK (E3-4) - Foyer II
Hours	14.00 - 15.30
Organiser(s)	<ul> <li>Michaël GAUTHIER, Institute FEMTO-ST, France</li> <li>Patrick COURTNEY, tec-connection, Germany</li> </ul>
Motivation and objectives	<ul> <li>This workshop will reinforce the connections of the TG on Miniaturised Robotics with two other communities:</li> <li>the EPoSS platform dealing with Smart Systems Integration;</li> <li>the Laboratory Robotics Topic Group.</li> </ul>
	Smart systems provide elementary components which can be integrated in robot developing new robotics capabilities in several fields such as manufacturing and biomedical fields. Laboratory robotics deal with automation in life sciences. Miniaturised robots may provide micro-assembly methods to build new highly integrated smart systems or micro-robotic systems useful in life sciences laboratories.
Agenda of the workshop	<b>14.00 - 14.15</b> : Introduction to and news from the TG on Miniaturised Robotics, N. Andreff , FEMTO-ST, France
	<b>14.15 - 14.35</b> : An overview of micro-nanorobotics achievements and challenges, A. Sill, OFFIS, Germany
	<b>14.35 - 14.55</b> : Internet of micro-Things, representative of EPoSS platform
	<b>14.55 - 15.15</b> : Miniaturised robotics needs in the pharmaceutical industry, P Courtney, tec-connection, Germany
	<b>15.15 - 15.30</b> : Open discussion on potential joint actions
What should participants prepare?	Participants will contribute to the open discussion to propose new links between the three networks. This workshop is also a unique opportunity to get to know the content of the EPoSS platform which may contribute to the robotics community and to present a larger view of miniaturised robotics to EPoSS participants.
Workshop website link	N/A

Session title	Make Your Consortium Grow: Financial to Third Parties in H2020 – Tips & Hints
Room	PROJECT 1 (M4) - Foyer I
Hours	14.00 - 15.30
Organiser(s)	<ul> <li>Marie-Luise Neitz, TUM, Germany</li> <li>Francesco Maurelli, TUM, Kosmo Strategio, Germany</li> </ul>
Motivation and objectives	An increasing number of Horizon 2020 calls include cascading funding (financial support to third parties, FSTP) in order to allow for a light touch integration of representatives of relevant target groups at any time to address the needs of a project. Cascading funding is a huge opportunity for the joining partners, but it also means a challenge for the partners coordinating such a project. These challenges include the definition of the call targeted towards specific stakeholder groups, their successful motivation, the attraction of strong evaluators (from industry and research, with full consideration of ethical issues, gender aspects, legal requirements etc.). The workshop is focused on hands-on issues, knowledge transfer from successful coordinators of past Open Call projects, and an open discussion about the challenges in implementing the new scheme (risk management).
Agenda of the workshop	<ul> <li>00.00 : Welcome from the organisers, open call mechanism</li> <li>00:10 : Overview of projects and calls with FSTP, Cécile Huet, EC</li> <li>00.20 : Potential of cascading funding to address the interests of SMEs, Marie-Luise Neitz, TUM</li> <li>00.35 : Presentation of successful Open Call projects (FP7 and H2020), from robotics and related fields, with a focus on the traps and pits: <ul> <li>Fortissimo and Fortissimo II, Mark Parsons, UoEdinburgh</li> <li>Echord and Echord++, Francesco Maurelli, TUM</li> <li>Horse and EuroCPS, Christophe Leroux</li> </ul> </li> <li>00.50 : World cafe on selected challenges in Open Call management (10 minutes in each group): <ul> <li>risk management and safeguarding cash-flow for SMEs; moderator: Marie-Luise Neitz</li> <li>relevant stakeholders, partners and consortia, gender aspects; moderator: Christophe Leroux</li> <li>open call platform; moderator: Francesco Maurelli</li> </ul> </li> </ul>
What should participants prepare?	Participants will benefit most from this workshop if they provide some project ideas which include cascade funding and raise specific topics related to the implementation and management of open calls. <b>For potential applicants:</b> think about the types of calls you would be interested in applying for, not only about the topic, but also about the process.
Workshop website link	N/A

Session title	Digitising the European Industry (DEI): Smart Regulation for Smart Industry
Room	SPARC (Linhart Hall) - entrance from Foyer I or Foyer II
Hours	16.15 - 17.45
Organiser(s)	<ul> <li>Anne Bajart - European Commission</li> <li>Bjoern Juretzki - European Commission</li> </ul>
Motivation and objectives	This workshop will introduce the new EC policy "Digitising the European Industry", in particular the pillar on "smart regulation for smart industry". There is a need at European level for clear and fit to purpose regulation in the digital world. The current open legal issues in advanced robots and autonomous systems are barriers for business growth and a wider use of such systems by citizens and industry. Issues of concern are for example obviously the liability of autonomous systems and their insurance but also more widely the safety issues related to their use or the testing and certification of such systems.
Agenda of the workshop	<ul> <li>16.15-16.25 : Welcome <ul> <li>Digitising the European industry: Smart regulation for smart industry – EC representative</li> </ul> </li> <li>16.25-17.25 : Presentations <ul> <li>Liability and Insurance in Robotics. A Law and Economics Approach – Dr Andrea Bertolini - Scuola Superiore Sant'Anna (SSSA),</li> <li>Damage done by Robot: some thoughts on the legal framework - Prof. Dr. Thomas Klindt - Nœrr LLP</li> <li>European Parliament Working Group on the ethical and legal dimensions of robotics – Dr Mihalis Kritikos - European Parliament</li> </ul> </li> <li>17.25-17.40 : Round table</li> <li>17.40-17.45 : Wrap-up and conclusions</li> </ul>
What should participants prepare?	Speakers will cover various aspects linked to smart regulation and autonomous systems, identifying the main challenges and presenting ideas. It will be followed by a round table, welcoming questions from the audience as well.
Workshop website link	<ul> <li>More information to be found on:</li> <li><u>https://ec.europa.eu/digital-agenda/en/digitising-european-industry</u></li> <li><u>https://ec.europa.eu/digital-agenda/en/robotics</u></li> </ul>

Session title	Ethical Legal and Socioeconomic (ELS) Issues in Robotics
Room	YASKAWA (Kosovel Hall) - Foyer II
Hours	16.15 - 17.45
Organiser(s)	<ul> <li>Christophe Leroux, CEA LIST, France</li> <li>Vincent C. Müller, Anatolia College/ACT</li> </ul>
Motivation and objectives	The workshop will be the opportunity to share information about ELS in robotics. The workshop is divided into two sessions presenting two different approaches on ELS issues. The first session is dedicated to the results of RockEU CA, the second is about building ethical and legal rules into robots.
	• <b>1st session : RockEU results.</b> This CA is finishing in July 2016. This session will present the results of the actions undertaken on ELS issues in robotics since the beginning of the CA. The session will gather people from different horizon: roboticists, socio economist, jurists. It will be a good opportunity to debate about ethical issues, jobs and robotics, and current regulations concerning robotics. It will be a chance to discuss about the next actions planned to overcome difficulties. It will consist of 3 presentations to stimulate a debate with the assistance. Remarks will be synthesized to improve the document that will be produced by the RockEU CA to possibly serve as references to the SPARC PPP.
	• <b>2nd session : Building ethical and legal rules into robots.</b> Robots move into closer interaction with humans in industry and into homes and become more autonomous. In this situation, we need robots that follow ethical rules and avoid harm to humans. Robots also have to follow legal rules and regulations, especially on safety. The session will present examples of these problems and work towards standards with which the regulatory demands to robotics can be met to support high acceptance of robotics and a secure investment environment. The session will consist of a series of very short talks with discussion. Each topic will be covered by one speaker from industry and one from academia.
Agenda of the workshop	<b>1st session (3/4 hour)</b> <b>16.15 – 16.55</b> : (a) Introduction by C Leroux, CEA; (b) Robotics and employment, U. Zierahn, (ZEW); (c) Mindmap & Roadmap on Ethical issues, A Winfield (UWE); (d) Regulations and robotics, B Bottalico (Pavia) <b>16.55 – 17.00</b> : Round Table Discussion
	<b>2nd session (3/4 hour)</b> <b>17.00 - 17.40</b> : (a) Introduction and objectives; (b) Workplace & safety (risks, regulations) + short discussion; (c) domestic safety + short discussion; (d) Autonomous cars (risks, responsibility) + short discussion; (e) Drones (esp. privacy) + short discussion <b>17.40 - 17.45</b> : Conclusions
What should participants prepare?	Participants should be ready to share their point of view on ELS issues
Workshop website link	Material will be made available on RockEU website and on ERF 2015 ELS workshop page: <a href="http://www.pt-ai.org/ELS-ERF2015">http://www.pt-ai.org/ELS-ERF2015</a>

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Session title	Wearable Robots Moving Out of the Lab
Room	SCHUNK (E3-4) - Foyer II
Hours	16.15 - 17.45
Organiser(s)	<ul> <li>Jan VENEMAN; Tecnalia Research and Innovation, Spain</li> <li>José PONS; Spanish Research Council, CSIC, Spain</li> </ul>
Motivation and objectives	This session intends to support the European development of Wearable Robotics by bringing together academia and the potential user industries, such as medical, logistics, construction, manufacturing, a.o. The session will provide a short overview of the product and research state of the art and directions in research, and have presentations from representatives of user industries. The core of the session will be a forum discussion with involvement of the audience on the key issues to address in Wearable Robotics to serve the market. This information will be used for the Multi Annual Roadmap, to detail the section on Wearable Robotics, drafted by a newly formed Topic Group Wearable Robotics.
Agenda of the workshop	<ul> <li>16.15 - 16.35 : Introduction of organizers on Scope, State of the Art and Emerging Directions of Wearable Robotic products and research.</li> <li>16.35 - 17.00 : Contributions of invited Wearable Robotics Producers and User Industries on desired directions and user interests.</li> <li>17.00 - 17.45 : Forum discussion with audience involvement on defining important challenges in the field.</li> </ul>
What should participants prepare?	Participants should think about expected novel applications of Wearable Robotics (exoskeletons, exo-suits, prosthetics, worker support robots) and on the challenges this poses to technology developers and researchers.
Workshop website link	www.Balance-fp7.eu

Session title	After the Entrepreneurship Workshop: Success Stories and Lessons Learnt
Room	TECHNALIA (M1) - Foyer I
Hours	16.45 - 17.45
Organiser(s)	<ul> <li>Jon Agirre Ibarbia, Tecnalia Research &amp; Innovation</li> <li>Renaud Champion, Primnex</li> <li>Geoff Pegman, R U Robots</li> </ul>
Motivation and objectives	Since 2012 at the ERF held in Odense we have organized a series of workshops for promoting Entrepreneurship and supporting young entrepreneurs in Robotics. From that first experience we had held the workshop in Lyon (2013), Rovereto (2014) and Vienna (2015). From our point of view they were very nice experiences not only for the entrepreneurs taking part in the workshop but also for coaches and juries (Business Angels, Venture capitalists, incubators' or robotic cluster' responsibles). It is also supposed to be an important milestone for creating awareness among the European Robotics community. At the next ERF to be held in Ljubljana (21 – 23 March 2016) we would like to organize a special workshop "After the Entrepreneurship workshop: Success stories and lessons learnt", that will consist on different short presentations from former participants at the ERF Entrepreneurship workshop explaining their evolution, experience and as conclusion some recommendations at different levels (University and research organisations, entrepreneurship supporting organisations, investors, Industry, public administrations (regional, national and EC,). After the presentations an open discussion will be held.
Agenda of the workshop	<b>16.45 - 16.50</b> : Introduction
	<ul> <li>16.50 – 17.25 : Presentations by selected former participants of the ERF Entrepreneurship workshop</li> <li>17.25 – 17.45 : Round Table Discussion</li> </ul>
What should participants prepare?	N/A
Workshop website link	N/A

Session title	Construction Robotics – The Future of the Building Industry
Room	PROJECT 1 (M4) - Foyer I
Hours	16.15 - 17.45
Organiser(s)	<ul> <li>Andreas, MUELLER, Institute of Robotics, Johannes Kepler University Linz, Austria</li> <li>Sigrid Brell-Cokcan, Association for Robots in Architecture</li> </ul>
Motivation and objectives	Construction and demolition have so far seen the least use of robotic technology to date. On the other hand there are many points indicating that investing in Construction Robotics is timely. The construction industry suffers from a large worker turnover and an increasing shortage of labour force due to unattractive work conditions. This will be a major problem for the European construction industry. At the same time, offsite manufacturing is a growing sub-sector of the construction sector that is increasingly looking at automation and advanced robotic manufacturing.
	Introduction of robotic technology will play a significant role in making construction more attractive and cost saving. The required technology exists. But there is yet a long way ahead.
	The idea of this workshop is to pinpoint the hotspots within the construction sector that are most relevant for potential robotic solutions, to identify the main obstacles (technological, legal), to consolidate the relevant technology and due adaptation/ specialisation/combination. To this end, five presentations will present use cases of successful application of robotics in construction followed by a round table discussion.
	As the Construction Robotics Topic Group is engaged in the preparation of the European Robotics Roadmap, the outcome of the workshop will provide further input for the roadmap.
Agenda of the workshop	<ul> <li>16.15 - 16.35 : Carlos Balaguer: Robots for tunnel inspection</li> <li>16.35 - 16.50 : Thomas Bock: 35 years of Construction Automation and Robotics</li> <li>16.50 - 17.15 : Gareth Pierce: Automated non-destructive testing for construction and nuclear decommissioning</li> <li>17.15 - 17:30 : Andreas Müller: Lightweight and mobile robots - potential application in construction</li> <li>17.30 - 17.45 : Round table discussion: What are the specific challenges for construction robotics? What are key factor for and against it?</li> </ul>
What should participants prepare?	Participants are asked to prepare a few bullet points on where they see 1) the demand, 2) the obstacles, 3) the potential technological/legal/policy issues, and 4) short and medium term solutions for construction robotics. The round table shall allow participants to present examples where robotic solutions have already been applied successfully as well as where they failed or are deemed unfeasible.
Workshop website link	www.robotsinarchitecture.org

#### PROGRAMME Entrepreneurship Workshop

Session title	Entrepreneurship Workshop - 22 March 2016
Room	TECHNALIA (M1) - Foyer I
Hours	8.00 - 15.30
Organiser(s)	<ul> <li>Jon Agirre Ibarbia, Tecnalia Research &amp; Innovation</li> <li>Renaud Champion, Primnex</li> <li>Geoff Pegman, R U Robots</li> </ul>
Motivation and objectives	The Entrepreneurship workshop provides the ability for small innovative companies to pitch their ideas for the next big thing in robotics to a panel of technology investment experts. As well as the chance to win a cash prize, entrants stand the chance to gain valuable skills in how to pitch an investment idea together with the potential to gain interest in their company from the investment community. The workshop will take place over three sessions. The first is a "speed dating" session at which all the entrants are invited to individually pitch
	their ideas to the panel of investment judges. This session will result in five entrepreneurs going forward to the next session. The second session is a coaching session in which the selected entrants are given coaching by experienced financiers and entrepreneurs in how to most effectively pitch their ideas to potential finance providers. In the final session, each potential entrepreneur will make a public presentation of their idea in front of a panel of private finance providers. The panel will then consider the presentations and declare a winner of the ERF Entrepreneurship award.
	Sponsorship: This event is sponsored by the European Commission DG CONNECT through the RockEU CA project, TECNALIA Research & Innovation and euRobotics aisbl.
Agenda of the workshop	<ul> <li>08.00 - 10.00 : Speed dating session (Closed, only for applicants)</li> <li>10.30 - 12.15 : Coaching session (Closed, only for the 5 selected applicants)</li> <li>12.15 - 14.00 : Lunch</li> <li>14:00-15:30 : Judging session (Open to all ERF attendants)</li> </ul>
What should participants prepare?	N.R.
Workshop website link	https://eu-robotics.net/cms/index.php?idcat=170&idart=3559

Session title	Robots for Harsh Environment - Special Features and Lessons Learned
Room	YASKAWA (Kosovel Hall) - Foyer II
Hours	8.30 - 10.00
Organiser(s)	Ladislav VARGOVCIK, ZTS VVU KOSICE a.s., Slovakia
Motivation and objectives	<ul> <li>Operations in harsh environment represent a typical application of robots protecting human health and life from danger.</li> <li>But cases like Fukushima, terrorist attacks on chemical plants or space applications are showing that abilities of present-day robots are still significantly limited. That is why sharing of experience and information about successful solutions is significantly important.</li> <li>Under "harsh environment" is understood environment with radioactivity, chemicals, dust, mud, extreme temperatures, explosive gasses, etc.</li> <li>There are two kinds of results expected in this session: <ul> <li>information about successful technologies for harsh environmental robotics</li> <li>definition of technological gaps as topics for H2020 research</li> </ul> </li> <li>Both of them also as an input for MAR.</li> </ul>
Agenda of the workshop	<ul> <li>08.30 - 08.35 : Introduction by the moderators</li> <li>08.35 - 09.30 : Presentations <ul> <li>Operation in confined and hazardous environments with snake-arm robots, Andrew Graham, OC Robotics</li> <li>Robots for Harsh Environment - special features and lessons learned, Joel Vanden Bosch, Cybernetix, CEA</li> <li>MiRoR - A Miniaturised robotic machining system for in-situ maintenance interventions in harsh industrial installations, Dragos Axinte, University of Nottingham</li> <li>Robotic solutions for harsh environment in nuclear power plants, Ladislav Vargovcik, ZTS VVU KOSICE</li> </ul> </li> <li>09.30 - 09.50 : Round Table Discussion</li> <li>09.50 - 10.00 : Conclusions for the roadmapping process under SPARC/Horizon 2020</li> </ul>
What should participants prepare?	Participants will be asked to participate in a lessons learnt session on current SoA and on a definition of the near future challenges applicable in H2O20 calls.
Workshop website link	www.erf2016-harshroboticssession.eu

Session title	How Interactive Robots May Support Small-Batch Machining in Industry
Room	ABB (E1-2) - Foyer II
Hours	8.30 - 10.00
Organiser(s)	<ul> <li>Ernesto Gambao, Centre for Automation and Robotics. Universidad Politecnica de Madrid, Spain</li> <li>Dragoljub Surdilovic, Fraunhofer IPK, Germany</li> <li>Tapio Heikilla, VTT Technical Research Centre of Finland LTD, Finland</li> </ul>
Motivation and objectives	The industrial production in Europe is faced with mass customization and short-life cycle of high variants of products. More flexible interactive robotic systems and new models for the employment in the industry are required. The workshop presents and discusses a variety of novel approaches to enhance standard industrial robotic systems to become more flexible, intuitive programmable, and interactive including physical contact with human and the environment in small batch machining. Several novel aspects from interactive programming, novel affordable sensing, compensation for errors and uncertainties, control of interaction etc., and the integration in modern industrial robot systems will be critically evaluated. The main application fields concerns small to micro SMEs, as well as customized manufacturing in the large industry.
Agenda of the workshop	<ul> <li>08.30-08.40 : Interactive robots for small-batch machining, Mr. Gerhard Schreck, Fraunhofer IPK. Germany</li> <li>08.40-08.50 : Sensor systems for teaching and control, Dr. Tapio Heikilla, VTT Technical Research Centre of Finland LTD. Finland.</li> <li>08.50-09.00 : Novel affordable sensor for interactive robots, Dr. Holger Kabelitz ME Messysteme GmbH. Germany</li> <li>09.00-09.10 : Machining path compensation using an industrial robot, Dr. Ilya Tyapin, University of Agder. Norway</li> <li>09.10-09.20 : EROSA an Open Software Architecture for technology based robot software solutions, Mr. Stefan Anton, Easy-Rob 3D Robot Simulation Tool, Germany</li> <li>09.20-09.30 : Control of interaction, Dr. Dragoljub Surdilovic, Fraunhofer IPK. Germany</li> <li>09.30-09.40 : Advanced programming and human-robot Interaction, Prof. Ernesto Gambao, Centre for Automation and Robotics. Universidad Politecnica de Madrid, Spain</li> <li>09.40-09.55 : Round Table Discussion</li> <li>09.55-10.00 : Conclusions</li> </ul>
What should participants prepare?	Participants will be asked to participate in a round table on the topic of the workshop. Experiences of research and industry applications of machining robots will contribute to identify future research topics and implementation of real solutions for the use of interactive robots for small-batch machining in industry. Participants of EU projects in the topic are welcome to share experiences.
Workshop website link	http://www.hephestosproject.eu

Session title	Guidelines, Methods and Evaluation Infrastructures for the Market Deployment of Companion Robots
Room	TECHNALIA (M1) - Foyer I
Hours	8.30 - 10.00
Organiser(s)	<ul> <li>Fabio BONSIGNORIO, The BioRobotics Institue, SSSA and Heron Robots, Italy</li> <li>Filippo CAVALLO, The BioRobotics Institue, SSSA, Italy</li> <li>Paolo DARIO, The BioRobotics Institue, SSSA, Italy</li> </ul>
Motivation and objectives	Future service robotics will help and assist persons of all ages in daily activities in their workplace, at home and in other environments. They will have to be able to perform a multitude of roles thanks to their capabilities to act and interact physically, emotionally, socially and safely with humans. Still, grounding aspects as reliability, availability, adaptability, safety, security and maintainability are not addressed and appropriately evaluated in adequate settings in order to demonstrate a consolidated technical feasibility. What kind of methods and infrastructure, do we need? This workshop is organized by the TG on robot companions and by the TG on benchmarking and competitions and will contribute to SRA and MAR updates.
Agenda of the workshop	<ul> <li>Tentative list of invited speakers (To Be Finalised):</li> <li>Paolo Dario, The Biorobotics Institute, SSSA</li> <li>KUKA/Industry representatives</li> <li>Arturo Baroncelli, Comau</li> <li>Andrea Bertolini, SSSA</li> <li>Roberta Battaglia, Robot-Era</li> <li>Chris Melouish, Bristol Robotics Lab</li> <li>The final agenda will be published on the website</li> </ul>
What should participants prepare?	Participants will be involved in a (online and by other media) discussion before the workshop. The best ideas will be included in the plenary discussion during the workshop and afterwards.
Workshop website link	http://www.robot-era.eu/robotera/index.php?pagina=pagine_ personalizzate&blocco=92&id=284

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Session title	EU Programmes: New Funding Opportunities for Robotics Projects
Room	SPARC (Linhart Hall) - entrance from Foyer I or Foyer II
Hours	9.00 - 11.00
Organiser(s)	<ul> <li>Franco Mastroddi, European Commission, Luxembourg</li> <li>Cécile Huet, European Commission, Luxembourg</li> </ul>
Motivation and objectives	Within H2020, robotics appears not only ICT but also in several other topics related to e.g. Factories of the Future, agriculture, marine, health, transport, space as well as in cross-cutting topics like FET, Internet of Things, Access to SME finance, etc. Systematic information on the presence of robotics across these different topics is not readily available, and there is a risk that the research community may miss opportunities. This session will provide an overview of all the different funding opportunities across the whole H2020 work programme 2016-2017.
Agenda of the workshop	<ul> <li>09.00 - 09.25 : Overview of all H2020 funding opportunities for robotics, Cécile Huet, European Commission</li> <li>09.25 - 09.40 : Make your consortium grow: Financial Support to Third Parties in H2020 - Tips &amp; Hints. Marie-Luise Neitz, TUM, Germany</li> <li>09.40 - 10.00 : PICKNPACK food packaging robot (KBBE-Food programme), Dr Erik Pekkeriet, Wageningen UR, Netherlands</li> <li>10.00 - 10.20 : Robo-Mate exoskeleton for manual workers (NMP programme). Dr Leonard O'Sullivan, Univ. of Limerick, Ireland.</li> <li>10.20 - 10.40 : R5-COP on agile manufacturing (ECSEL programme). Lars Dalgaard, Danish Technological Institute</li> <li>10.40 - 11.00 : Q&amp;A and exchange of experiences</li> </ul>
What should participants prepare?	The workshop will present (a) overview of different H2O2O topics and instruments where robotics may be funded, including the new "FSTP" instrument (b) examples of projects emerging from calls beyond the core robotics topic.
Workshop website link	<ul> <li><u>http://ec.europa.eu/programmes/horizon2020/en/h2020-section/robotics</u></li> <li><u>https://ec.europa.eu/digital-agenda/en/news/robotics-brokerage-event-open-robotics-and-autonomous-systems-calls</u></li> <li><u>http://ec.europa.eu/digital-agenda/en/news/european-robotics-projects-beyond-robotics-unit-erf-2015</u></li> <li><u>https://ec.europa.eu/programmes/horizon2020/en/h2020-section/access-risk-finance</u></li> <li><u>Mttp://cordis.europa.eu/search/result_en?q=/result/relations/categories/resultCategory/code%3D'brief', 'report'%20AND%20'robot'%20AND%20 programme/pga%3D'FP7-SME'</u></li> </ul>

Session title	Healthcare Topic Group Activity
Room	SCHUNK (E3-4) - Foyer II
Hours	9.00 - 10.30
Organiser(s)	<ul> <li>Christophe Leroux, CEA LIST, France</li> <li>Thierry Keller, Tecnalia, Spain</li> </ul>
Motivation and objectives	Healthcare is one of the major priorities in Europe. ICT and robotics are key enablers to address the socioeconomic challenges. The TG is highly involved in the elaboration of the MAR of SPARC PPP. The workshop will present the actions undertaken and propose next actions. A debate is organized about the financing possibilities for robotics in healthcare applications.
Agenda of the workshop	09.00 – 09.45 : Actions of 2015 and next actions - C Leroux, T Keller 09.45 – 10.15 : Identification of issues regarding robotics for Healthcare (financing, priorities, organization of the TG) 10.15 – 10.30 : Wrap up – summary of next actions
What should participants prepare?	All people interested in R&D&I in robotics for Healthcare (assistive, rehabilitation and surgical robotics) are expected to attend. People are asked to share their experience, propose their view and make suggestions to improve the organization of financing of R&D&I in robotics for Healthcare. Last versions of the SRA and MAR are available on the euRobotics website.
Workshop website link	Document produced by the Topic Group can be asked for from Christophe Leroux

Session title	Robotics & Internet of Things
Room	SPARC (Linhart Hall) - entrance from Foyer I or Foyer II
Hours	10.45 - 12.15
Organiser(s)	Cécile Huet, European Commission
Motivation and objectives	<ul> <li>IoT and Robotics are expected to revolutionize industries and services. This workshop will address the interplay between the two: namely, how can robotics benefit from IoT and the major role robotics will play as one of the "things" in IoT. The workshop is expected to address the technological and the industrial dimension.</li> <li>The presentations will address: <ol> <li>The robotics perspective: what can robotics offer to IoT?; expected IoT contribution to robotics</li> <li>The IoT perspective: the IOT aspects – state of the art; what can IoT offer to Robotics; expected robotics contribution to IoT</li> <li>The critical role of Al in the IoT-ROBOTICS context</li> <li>Strategic perspectives: Disruptions in industry, services and markets expected from (IOT + Robotics)</li> </ol> </li> <li>The following discussion will address the future cooperation, in particular to contribute to digitization of industry</li> </ul>
Agenda of the workshop	<ol> <li>Internet of Robotic Things – Convergence of Technologies in the Digital Economy Dr. Ovidiu Vermesan Chief, Scientist at SINTEF, chair of the AIOTI alliance WG01 focused on boosting the IoT technological advancements and converging the shaping and development of new dynamic business models and IoT ecosystems"</li> <li>Adopting IOT for robotics in HORSE and future perspectives; Anastasia Garbi, Head of R&amp;D, European Dynamics SA - <u>http://www.horse-project.eu/</u></li> <li>Connecting Robots with IOT using OSGi; Kai Hackbarth, Evangelist Prosyst Software (BOSCH), Member Board of Directors OSGi alliance</li> <li>Advanced future manufacturing for the automotive industries: IoT and Robotics Thomas Stark, Daimler AG</li> <li>IoT and Robotics: the AI dimension; Professor Michael Beetz Bremen University (TBC)</li> <li>Additional presentations (TBC) DISCUSSION: next steps</li> </ol>
What should participants prepare?	Participants are encouraged to contribute to the debate addressing the cooperation between IoT & Robotics: Challenges, expectations, strategy, benefit, European position in the international landscape, etc.
Workshop website link	• Session URL: https://ec.europa.eu/digital-agenda/news-redirect/29250

Session title	Marine Robotics
Room	YASKAWA (Kosovel Hall) - Foyer II
Hours	10.45 - 12.15
Organiser(s)	<ul> <li>Massimo CACCIA, CNR-ISSIA, Italy</li> <li>Ahmed CHEMORI, LIRMM-CNRS, France</li> <li>Vincent CREUZE, GDR Robotics, LIRMM, France</li> <li>Eleni PATOUNI, CMRE, Italy</li> </ul>
Motivation and objectives	This workshop will be dedicated to marine robotics. It follows the three successful previous editions (at ERF 2013, ERF 2014, and 2015).
	The goal is to discuss and formulate the point of view of the marine robotics community about the topics addressed by the ongoing call and further evolution. With this in mind, it will be organised as a round table regarding the keywords of the ongoing calls. Short presentations will be given by some participants to trigger open discussion to formulate a report upgrading the Marine Robotics roadmap and relationships with market and application domains.
Agenda of the workshop	<ul> <li>10.45 - 10.50 : Introduction by the organizers</li> <li>10.50 - 11.25 : Brief presentations <ul> <li>Thomas Vogele (DFKI, Germany)</li> <li>Giovanni Indiveri (University of Salento - ISME node, Italy)</li> <li>Antonio Pascoal (ISR-IST, Univ. Lisbon, Portugal)</li> <li>Nikola Miskovic (University of Zagreb, Croatia)</li> <li>Gabriel Oliver (University of Balearic Islands, Spain)</li> <li>Yvan Petillot (Heriot Watt University, UK)</li> <li>Gabriele Ferri (NATO STO – CMRE, Italy)</li> </ul> </li> <li>11.25 - 12.05 : Round table</li> </ul>
What should participants prepare?	Participants should prepare a short presentation (max 5 minutes) of their point of view about the keywords of the ongoing call, relations between marine robotics and market and application domains, and area covered by marine robot domain. These presentations will introduce or be part of the open discussion. Participants are encouraged to contact the organizers in order to schedule their presentation in the workshop.
Workshop website link	http://www.issia.cnr.it/workshop/erf16

Session title	Laboratory Robotics - Robots in the Service of Science, Healthcare, New Product Development and Industry
Room	ABB (E1-2) - Foyer II
Hours	10.45 - 12.15
Organiser(s)	Patrick COURTNEY, tec-connection, Germany
Motivation and objectives	Laboratory Robotics is a neglected application of robotics which nonetheless is a European strength worth some €3bn pa with valid business models and rapidly evolving needs and enabling a number of industries. This workshop will: • highlight current state of the area - needs and trends • present current strengths, e.g. liquid handling • present current needs, e.g. materials handling • present results from ongoing projects • bring suppliers users and technology group together The session will further contribute to the white paper on laboratory robotics in Europe and the Roadmap of European Robotics.
Agenda of the workshop	<ul> <li>10.45 : Opening comments Patrick Courtney</li> <li>10.50 : Transferring liquids with a robot - How hard can it be? Ian Shuttler, Head of Strategy, Tecan, CH</li> <li>11.10 : Robot Scientists, the Replication Crisis, and Cancer, Ross King, University Manchester UK</li> <li>11.30 : Robot hands: from Iab to kitchen, Rich Walker, Shadow Robot, UK</li> <li>11.45 : Food robotics - automating skills, Koorosh Khodabandehloo, Business and Manufacturing Consultancy</li> <li>12.05 : Panel discussion</li> </ul>
Workshop website link	http://elrig.org/call-white-paper-european-robotics-research/





Session title	Interdisciplinary Methods for Therapeutical and Diagnostic Human Robot Interaction
Room	SCHUNK (E1-2) - Foyer II
Hours	10.45 - 12.15
Organiser(s)	<ul> <li>Marta Capiluppi, Department of Computer Science, University of Verona, Italy</li> <li>Agnieszka Wykowska, Luleå University of Technology, Sweden, Technical University Munich, Germany</li> </ul>
Motivation and objectives	This session aims at bringing together researchers from various fields: robotics, cognitive neuroscience, psychology and industry to discuss novel approaches in robot-assisted therapy and diagnosis for special needs. The highlight will be put on interdisciplinary methods that allow for novel solutions tailored to the needs of the end users. Moreover, the two sides of human robot interaction, the human side and the robot side, will be explored, with the aim of integrating the approaches in the different fields involved. Starting from the current methods for therapy and diagnosis of different diseases and current technology of integrating cognition in robots, this session wants to start a collaborative field, in which such methods and technologies have a common aim. The workshop will also discuss possible applications of robot-assisted therapy and diagnosis, both for cognitive and for physical diseases.
Agenda of the workshop	<ul> <li>10.45 - 10.55 : Marta Capiluppi, University of Verona, "New challenges for robotics in therapy and diagnosis of cognitive impairments"</li> <li>10.55 - 11.10 : Agnieszka Wykowska, Technische Universität München and Luleå University of Technology, "Objective methods of social cognitive neuroscience for robots better tuned to the workings of the human brain"</li> <li>11.10 - 11.25 : Hagen Lehmann, Istituto Italiano di Tecnologia, "Interdisciplinary robot assisted ASD Therapy: The application of humanoid robots in interaction games"</li> <li>11.25 - 11.40 : Andras Lorincz, Eotvos Lorand University, "Personalization as smart tool based co-annotated self-tracking"</li> <li>11.40 - 11.55 : Marco Lombardo, Behaviour Labs s.r.l.c.r Robotics Life s.r.l., "TREAT, Therapeutic Robot in Experimental Autism Therapy"</li> <li>11.55 - 12.15 : Round table discussion on possibilities for the application of robotic in therapy and diagnosis of different cognitive impairments</li> </ul>
What should participants prepare?	Participants will be asked to express their opinion on the future of the therapy with robots, regarding possible applications and research trends. Furthermore, participants will be asked to contribute with their expertise on specific methods that can potentially be useful in designing novel therapy protocols. To this end, participants are asked to bring success stories in this field. Moreover, during the round table discussion, some guidelines will be discussed on how to integrate the topics regarding therapy and diagnosis with robots in the next H2020 calls.
Workshop website link	https://metropolis.scienze.univr.it/altair/events/workshop-on-robotic- therapy/

Session title	Ontologies for Robots
Room	TECHNALIA (M1) - Foyer I
Hours	10.45 - 12.15
Organiser(s)	<ul> <li>Jacek Malec, Lund University, Sweden</li> <li>Saadia Dhouib</li> <li>Tamas Haidegger</li> <li>Alexander Perzylo</li> <li>Moritz Tenorth</li> </ul>
Motivation and objectives	There is intensive research and development activity in providing and making use of semantically meaningful information in robotic systems. In particular, besides the widespread use of semantic technology by academia, there is a growing interest in it, in the context of possible or actual industrial applications. We intend to summarize the current state of (European) robotic ontology ecosystem, find out commonalities, agree upon ways of result exchange and discuss possible business models for this kind of "product" or "service". The workshop will give room to representatives of academy, industry (notably, ABB and KUKA), and standardization bodies (IEEE Ontologies for Robotics
	and Automation group).
Agenda of the	<b>10.45</b> - <b>10.50</b> : introduction (5 min)
workshop	<b>10.50 - 11.40</b> : presentations by the participants (50 min)
	<ul> <li>academia (20 mins)</li> </ul>
	• standardization (10 mins)
	<b>11.40</b> - <b>12.00</b> : discussion about the industrial use of robotic ontologies, moderated by industry representatives (20 mins)
	<b>12.00 - 12.15</b> : summary, conclusions, plans for the future (15 min)
What should participants	We ask the participants to be prepared to discuss: 1. use cases (EU-financed research projects, existing or planned industrial
prepare:	applications): any suggestions before the workshop will be appreciated by the organizers
	2. expected business models
	3. forecast of the development of semantic technology in robotics (planned or demanded) for the coming 1-5 years
Workshop website link	http://cs.lth.se/jacek-malec/ontologies-for-robots-an-erf2016-workshop/

Session title	Recent Progress in Research Reproducibility in Robotics: A Critical Enabler of Research Exploitation
Room	SPARC (Linhart Hall) - entrance from Foyer I or Foyer II
Hours	14.00 - 15.30
Organiser(s)	• Fabio BONSIGNORIO, The BioRobotics Institute, SSSA and Heron Robots, Italy
Motivation and objectives	Significant progress has been made in the replicability of results in robotics research and their objective evaluation and comparison in recent years. A RAM special issue composed of replicable experiments and guest-edited by some of the proposers has been published at the end of 2015 and the 2015 IEEE Summer School dedicated to same topics has been held. This workshop aims to share the recent developments and to discuss how to cope with the still open issues. This workshop is meant as a gathering of the TG on benchmarking and competitions members.
Agenda of the workshop	<ul> <li>Tentative list of invited speakers (To Be Finalised):</li> <li>Pedro Lima, ISR-IST, Portugal - Topic: Novel Benchmarking methods</li> <li>Matteo Matteucci, Politecnico di Milano, Italy - Topic: Benchmarking and competitions</li> <li>Olivier Michel, Cyberbotics Ltd., Switzerland - Topic: Robotics Simulation Benchmarking Illustrated in Webots</li> <li>Vincent C. Mueller, Amerikaniko Kollegio Anatolia, Greece - Topic: Intelligence testing in humans and robots</li> <li>Angel P. Del Pobil, Universidad Jaume I, Spain - Topic: Benchmarking visuomotor coordination with robot heads</li> <li>Comau Representative</li> <li>ABB representative</li> <li>KUKA representative</li> </ul>
What should participants prepare?	Participants will be involved in a (online and by other media) discussion before the workshop. The best ideas will be included in the plenary discussion during the workshop and afterwards.
Workshop website link	<ul> <li><u>http://www.heronrobots.com/EuronGEMSig/gem-sig-events/rrr-and-benchmarking-ERF2016</u></li> </ul>

Session title	H2020 SRC Space Robotics Technologies
Room	YASKAWA (Kosovel Hall) - Foyer II
Hours	14.00 - 15.30
Organiser(s)	Daniel NOELKE, German Aerospace Center (DLR) - Space Administration, GERMANY
Motivation and objectives	The PERASERA consortium developed a roadmap as an input to the EC's Horizon 2020 Strategic Research Cluster "Space Robotics Technologies".
	This session will give a first look on proposed activities for the 1st call within this cluster. The different operational grants topics for the common building blocks will be presented, perfectly prepared to meet the challenges of the next decade in space robotics applications. The speakers are asked to point out the demands on the technology development and complexity of this interdisciplinary work programme.
Agenda of the workshop	<b>14.00 – 14.05</b> : Introduction, Daniel Noelke, PERASPERA delegate
	<b>14.05 – 14.15</b> : OG1 - Space Robot Control Operating System, <b>ESRoCOS</b> , Thomas Voegele, DFKI
	<b>14.15 – 14.25</b> : OG2 - Autonomy Framework, <b>AFAR</b> , Philippe Bidaud, ONERA
	<b>14.25 – 14.35</b> : OG3 - Common Data Fusion Framework, <b>InFuse</b> , Jeremi Gancet, Space Applications
	<b>14.35 – 14.45</b> : OG4 - Inspection Sensor Suite, <b>InSeS</b> , Vittorio Nurzia, OHB Systems
	<b>14.45 – 14.55</b> : OG5 - Modular Interfaces for Robotic Handling of Payloads, <b>SIROM</b> , Javier Viñals, SENER
	<b>14.55 – 15.05</b> : OG6 - Validation Platforms and Field Tests, <b>FACILITATORS</b> , Giovanni Binet, GMV
	<b>15.05 – 15.30</b> : Panel Discussion: How will the SRC approach boost space robotics? Moderator: Gianfranco Visentin, PERASPERA coordinator
What should participants prepare?	N/A
Workshop website link	www.h2020-peraspera.eu

ABB (E1-2) - Foyer II
14.00 - 15.30
<ul> <li>Dr. Makris Sotiris (LMS, University of Patras), Greece</li> <li>Dr. George Michalos (LMS, University of Patras), Greece</li> <li>Iñaki Maurtua (IK4-TEKNIKER), Spain</li> <li>Ramez Awad (Fraunhofer IPA), Germany</li> </ul>
Continue the dialogue among the projects themselves, as well as with the community about the methodologies, technologies and platforms used and the results to be developed.
Introduce early results from ongoing research projects (e.g. SYMBIO-TIC, FourByThree). Early results are characterized as being developed within the first year of the project and as having been validated as a simple proof of concept in the lab (TRL3). The purpose is to give the researcher/inventor feedback with regard to her/his results, e.g. potential enablers, multiplicators, restrictions, etc.
Present developed technologies for safe and/or intuitive human robot interaction (e.g. novel series-elastic actuator). Developed technologies are to be elaborated using a project's demonstrator as an example application (TRL 5/6). The purpose is to inform the community of emerging technologies that may soon be available on the market.
14:00-14:20 : Early Results from just started projects
14:20-14:55 : Novel Safety Technologies
14:55-15:30 : Novel Interaction Technologies
For more information, click <u>here</u> .
Attendees from industry are asked to think of at least one manufacturing use case, where they want to implement Human-Robot-Collaboration and fill out the following template for that use case: <u>http://www.project-leanautomation.eu/fileadmin/ERF2016/ERF2016_UseCase_Teamplate.dotx</u>
They can either send their use case to Ramez Awad or bring it with them to the workshop and hand it in personally. All information will be handled confidentially!
<ul> <li>ERF2014 - Hybrid Production Systems: <a href="http://www.eu-robotics.net/cms/upload/euRobotics_Forum/ERF2014_presentations/day_3/TP-01_ERF2014_Hybrid_Production_Systems_2014-03-14.v.1.02.pdf">http://www.eu-robotics.net/cms/upload/euRobotics_Forum/ERF2014_presentations/day_3/TP-01_ERF2014_Hybrid_Production_Systems_2014-03-14.v.1.02.pdf</a></li> <li>ERF2015 - Hybrid Production Systems: <a href="http://www.erf2015.eu/presentations/HybridProduction.zip">http://www.erf2015.eu/presentations/HybridProduction_Systems</a></li> </ul>

Session title	Image Guided Robotic Surgery and Interventions
Room	SCHUNK (E3-4) - Foyer II
Hours	14.00 - 15.30
Organiser(s)	<ul> <li>Marta Capiluppi, University of Verona, Italy</li> <li>Stefano Stramigioli, University of Twente, The Netherlands</li> <li>Riccardo Muradore, University of Verona, Italy</li> </ul>
Motivation and objectives	Robotics allows surgeons to improve the quality of many critical tasks and make possible interventions that otherwise would not be possible. Robotic Surgery and Image Guided Interventions is effective any time the sensing subsystem provides all the information the surgeon needs to execute safely, accurately and quickly the surgical tasks. Nowadays robot prototypes can be used to perform autonomous or teleoperated US/MRI-guided insertion of needle/tool and vision-based suturing. The objectives of this workshop are: to provide an updated state of the art review of existing systems around the world, to highlight the relationship between advanced robotic systems and ad-hoc multi-modal user interfaces, to point out the challenges to be addressed on the near future from both the medical point of view and the engineering point of view, to emphasize the economic and social opportunities behind multi-modal robotic surgery and interventions systems.
Agenda of the workshop	<ul> <li>14.00 - 14.10 : Introduction by the organisers</li> <li>14.10 - 14.20 : Riccardo Muradore, University of Verona, "The iSur experience"</li> <li>14.20 - 14.30 : Stefano Stramigioli, University of Twente, "Introducing MURAB"</li> <li>14.30 - 14.40 : Giancarlo Ferrigno, Politecnico di Milano, "The outcomes of the ACTIVE FP7 EU project"</li> <li>14.40 - 14.50 : Elena de Momi, Politecnico di Milano, "Enhanced Delivery Ecosystem for Neurosurgery in 2020"</li> <li>14.50 - 15.00 : Selene Tognarelli, Scuola Superiore Sant'Anna, "Robotic HIFU intervention under US guidance"</li> <li>15.00 - 15.10 : Iina Aaltonen, VTT Technical Research Centre of Finland Ltd, "Can technological solutions support user experience, learning, and operation outcome in robotic surgery?"</li> <li>15.10 - 15.30 : Round table discussion on the future of image-guided robotic surgery and interventions and possible integration in the next H2020 calls via euRobotics.</li> </ul>
What should participants prepare?	Participants will be asked to express their opinion on the future of image-guided robotic surgery and interventions, regarding possible applications and research trends, new funded EU and national projects (participants can also prepare posters or flyers of their success stories). Some guidelines will be discussed on how to integrate these topics in the next H2020 calls.
Workshop website link	https://metropolis.scienze.univr.it/altair/events/erf2016-workshop-on- image-guided-robotic-surgery/

Session title	Believing in Robot's Eyes - Robust Observation of Task Relevant Cues
Room	TECHNALIA (M1) - Foyer I
Hours	14.00 - 15.30
Organiser(s)	<ul> <li>Dr. Michael SUPPA, Roboception GmbH, Germany</li> <li>Prof. Darius BURSCHKA, Technical University of Munich, Germany</li> <li>Prof Achim J. LILIENTHAL, University of Orebro, Sweden</li> </ul>
Motivation and objectives	Perception is the key technology allowing automatic adaptation of the system operation to the environment and robust operation of systems under presence of model or hardware errors. Perception data is used by multiple processing steps for navigation, planning and interaction with other agents. However, sensor readings are prone to errors, ambiguities, bad illumination, limited range and sampling rate, and many other problems The workshop will deal with approaches to increase robustness of the processing pipeline and to increase the reliability of sensory data in order to enable autonomous operation of robots without a human in the loop.
Agenda of the workshop	<ul> <li>14.30 - 14.40 : Introduction of the moderators/Definition of key questions</li> <li>14.40 - 14.50 : "Perception under Bad Illumination in Disaster Scenarios", Prof. Achim Lilienthal, University of Örebro.</li> <li>14.50 - 15.00 : "Perception in On-Orbit Servicing", Martin Lingenauber, German Aerospace Center.</li> <li>15.00 - 15.10 : "Novel Perception Paradigms to Understand the Dynamic World", Prof. Darius Burschka, Technical University of Munich.</li> <li>15.10 - 15.20 : "RoboSherlock: A Knowledge Based, Task-adaptable Perception Framework", Ferenc Balint-Benczedi, University of Bremen.</li> <li>15.20 - 15.30 : "Robust Perception for Industrial Applications", Dr. Michael Suppa, CEO, Roboception GmbH.</li> <li>15.30 - 15.50 : Discussion of the key questions and their implication on the roadmapping process</li> <li>15.50 - 16.00 : Conclusion for roadmapping and take home messages</li> </ul>
What should participants prepare?	Participants should familiarize themselves with the MAR. The questions and relevant EC projects/publications will be published on the workshop website ahead of time in order to enable preparation.
Workshop website link	http://roboception.com/erf2016

Session title	Efficient Robot Programming, Force Control and Passive Reconfiguration Technologies for Fast Set-Up of Robotic Workcells
Room	SPARC (Linhart Hall) - entrance from Foyer I or Foyer II
Hours	16.15 - 17.45
Organiser(s)	<ul> <li>Ales Ude, Jozef Stefan Institute</li> <li>Igor Kovac, Jozef Stefan Institute</li> <li>Christian Schlette, RWTH Aachen</li> <li>Rune Larsen, Blue Ocean Robotics</li> <li>T. Rajeeth Savarimuthu, University of Southern Denmark</li> </ul>
Motivation and objectives	Rapid changes in market demands lead to decreasing product life cycle times and also more frequent products launches. An enterprise has to react fast, efficiently, and in an economically justified way to market changes. More frequent changeovers in product type or in a number of products require new engineering and production methodologies and machinery equipment to enable shorter set-up times of production environments.
	Robots as highly flexible devices have been successfully utilized in many industrial production processes. However, companies are still reluctant to employ robots for many types of tasks. The main hindrances are complexities involved in setting-up robot-based automated solutions because these usually require expert knowledge and also significant time for testing and fine-tuning. Looking at robotic systems in more detail, we can recognise that these problems are due to the long time needed to re-configure and re-programme the robot workcell for a new production task.
	The goal of this workshop is to find out how technologies such as efficient robot programming, sensing, and passively reconfigurable elements can contribute to faster set-up times of robotic workcells. We plan to make the round table discussion available either in video form or as a short report on the workshop webpage. The results of the workshop will elucidate what technologies are needed to shorten set- up times of robotic workcells and where more research is needed in the future.
Agenda of the	<b>16.15 – 16.30</b> : Flexible Production vs. Agile Production, Wolfgang Zitz, Magna Steyr
workshop	<b>16.30 – 16.45</b> : Pick-it - Robot binpicking with 3D cameras for non-vision experts, Peter Soetens, Intermodalics
	<b>16.45 – 17.00</b> : Industry 4.0 - Cyber Physical Systems - Challenges and requirements, Egon Müller, University of Chemnitz
	<b>17.00 – 17.15</b> : New user interfaces for industrial automation based on 3D simulation, Christian Schlette, RWTH Aachen
	<b>17.15 – 17.45</b> : Round table - Implementation of robotic workcells suitable for fast setup of new production processes
What should participants prepare?	To facilitate round table discussion, participants should prepare 1 success story related to shortening of set-up times in automated robot production.
Workshop website link	N/A

Session title	Robotics for Nuclear Applications
Room	YASKAWA (Kosovel Hall) - Foyer II
Hours	16.15 - 17.45
Organiser(s)	<ul> <li>Rustam STOLKIN and Ales LEONARDIS, University of Birmingham, United Kingdom</li> <li>Jeff KUO, National Nuclear Lab, United Kingdom</li> <li>Mathieu GROSSARD, CEA, France</li> </ul>
Motivation and objectives	Nuclear decommissioning is potentially the biggest and most impactful application for real-world service robotics in the coming few years, with huge societal importance. In UK alone, cleaning up the past two-thirds of a century of nuclear waste represents the largest environmental remediation project in the whole of Europe, estimated to need €120-300billion over next 100 years. Worldwide decommissioning costs are of the order €1trillion. At least 20% of this work must be done by robots since the materials are too hazardous for humans, however the robotics technologies that are needed have not yet been developed. Almost every kind of robot is needed (grasping and manipulation of a huge variety of materials, ground vehicles, flying robots, snakebots, SLAM, vision, multi-sensor fusion, human-robot interfaces) often in highly unstructured, cluttered and uncertain environments, which may be chemically, thermally and radiologically harsh, and often with very limited communications bandwidth between safe areas and the remote robot, suggesting a need for increased autonomy capabilities.
Agenda of the workshop	<ul> <li>16.15 - 16.20 : Introduction by the organisers</li> <li>16.20 - 16.30 : UK challenges and activities (Jeff Kuo, National Nuclear Lab)</li> <li>16.30 - 16.40 : US challenges and activities (Rich Voyles, Purdue University &amp; Rod Rimando US Department of Energy)</li> <li>16.40 - 16.50 : French challenges and activities (Philippe Garrec, CEA)</li> <li>16.50 - 17.00 : UK-Japan collaboration (Simon Watson, University of Manchester)</li> <li>17.00 - 17.10 : RoMaNS EU nuclear consortium (Rustam Stolkin, U of Birmingham)</li> <li>17.10 - 17.35 : Round table panel discussion</li> <li>17.35 - 17.45 : Conclusions for a working paper</li> </ul>
What should participants prepare?	Speakers to prepare 10 minutes talks, strictly to time. Prospective participants are also invited to email questions for the panel discussion in advance to Rustam Stolkin.
Workshop website link	http://www.h2020romans.eu/#!workshop/gt6mr_







Session title	Collaboration in Industry 4.0: Human, Robot and Flexible Processes
Room	ABB (E1-2) - Foyer II
Hours	16.15 - 17.45
Organiser(s)	<ul> <li>Dr Ferdinando CANNELLA, AIAL-ADVR - Istituto Italiano di Tecnologia (Italy)</li> <li>Dr Sotiris MAKRIS, LMS - University of Patras (Greece)</li> <li>Dr Matteo ZOPPI, DIMEC - Università di Genova (Italy)</li> </ul>
Motivation and objectives	<ul> <li>Industry 4.0 aims at improving production systems, value chains and business models in the industry. Future production systems will be characterized by individualized products under the conditions of a highly flexible mass production [DOI 10.1515/auto-2015-0068] that drives industry to investigate new solutions for increased flexibility. This research involves flexible robotic equipment, with dexterous grippers design, supported by intelligent and open decision making software platforms within the Industry 4.0 topics namely, interoperability, visualization, decentralization, real-time capability, service orientation and modularity. That means the grippers must have the following capabilities: <ul> <li>Perception as an integrated cognitive capability considering collaborative perception</li> <li>Perception as a way to create intelligent, dexterous "universal" devices for handling or manipulation of products or tools</li> <li>Facing the non-expected situations, and adapt their behaviour in order to better handle them, while taking into account safety aspects</li> <li>Learning, sharing tools, re-using the acquired abilities and competence</li> <li>No physical barriers</li> <li>Transition from the intrinsic to extrinsic dexterity.</li> </ul> </li> <li>Then, after decades where the human being had to adapt the rigid machine rhythms, nowadays the challenge is not only to face the flexibility, but also to develop robots closer to human being.</li> </ul>
Agenda of the workshop	<ul> <li>16.15 - 16.20 : Introduction by the moderators</li> <li>16.20 - 17.30 : Presentations</li> <li>Affordable reconfigurable robotic hand/gripper, <i>Dr Wei Guowu, USM</i>; Dexterous Manipulators and Human Manipulation trade off in industry application, <i>Dr Carlo Canali, IIT</i>; New synergistic dexterity and skills in physical human robot cooperation – towards a multimodal / arms cooperation, <i>Dr Dragoljub Surdilovic, Fraunhofer IPK</i>; Human Robot Collaboration within the ROBO-PARTNER project framework, <i>Dr. Alessandro Zanella (CRF)</i>; On the design of adaptive grippers for the grasping of non-rigid materials, <i>Prof Matteo Palpacelli, UniPM</i>; Cognitive Manufacturing with Soft Items, <i>Prof Vaclav Hlavac, CVUT</i>; Smarm cooperative manufacturing from the outcomes of the SwarmItFIX EU project, <i>Prof. Rezia Molfino, UniGE</i>; Service oriented approach in flexible manufacturing using robots, <i>Mr. George Papanikolopoulos, CASP</i>; Task planning for robotic assembly in flexible manufacturing, <i>Dr Sotiris Makris, LMS</i>; Open dynamic Manufacturing Operating System for Smart Plug – and – Produce Automation70 Components, <i>Dr. Amit Eytan, WePlus</i></li> <li>17.30 – 17.45 : Round table discussion: Industrial robots flexibility and Industry 4.0 in H2020 – survey results</li> </ul>
What should participants prepare?	Participants will be asked to participate in a brainstorming session on current state of art and then to figure out the future scenarios in the flexible industrial production processes. A survey will be carried out via electronic questionnaire in order to collect the common idea about the robot flexibility in the H2020 and address the final discussion.
Workshop website link	<ul> <li>http://www.robo-partner.eu/events/european-robotics-forum-2016-session- collaboration-in-industry-4.0-human-robot-and-flexible-processes</li> <li>http://www.iit.it/it/aia-news.html</li> </ul>

Session title	Robotic Capsule Endoscopy: EU Innovation Initiatives in a Rapidly Emerging Global Market
Room	SCHUNK (E3-4) - Foyer II
Hours	16.15 - 17.45
Organiser(s)	<ul> <li>Prof. Paolo Dario, The BioRobotics Institute, Scuola Superiore Sant'Anna, Pisa, Italy</li> <li>Dr. Gastone Ciuti, The BioRobotics Institute, Scuola Superiore Sant'Anna, Pisa, Italy</li> </ul>
Motivation and objectives	The workshop is intended to address state of the art, research and innovation opportunities and the wide range of open challenges of the emerging field of robotic endoscopic capsules. A few invited speakers will present the medical problems to be investigated and the robotic solutions that are being developed by researchers and by industries. Particular attention will be given to the objectives and expected achievements of the EU EndoVESPA project (ICT-24-2015: Robotics IA – G.A. 688592), started on December 1st, 2015. As a result for the workshop, an executive summary will be produced, proposing a set of guidelines for innovation and research in the field of robotic capsule endoscopy, highlighting also achievements and industrial and research future perspectives. The produced guidelines will contribute to the Roadmap of European Robotics.
Agenda of the workshop	<ul> <li>16.15 - 16.20 : Opening and introduction to the workshop - Prof. P. Dario and Dr. G. Ciuti, The BioRobotics Institute, Scuola Superiore Sant'Anna, Pisa, Italy.</li> <li>16.20 - 17.15 : Robotic endoscopic capsule: presentations by selected invited speakers</li> <li>16.20 - 16.35 : Robotic endoscopic capsule: achievements and challenges - Prof. P. Dario, The BioRobotics Institute, Scuola Superiore Sant'Anna, Pisa, Italy.</li> <li>16.35 - 16.50 : Capsules and novel flexible endoscopic devices: clinical needs and medical perspectives - Prof. A. Arezzo, University of Turin, Turin, Italy.</li> <li>16.50 - 17.05 : Robotic capsule endoscopy: market analysis and commercial perspective - Dr. B. Magnani, Ekymed S.r.I., Pisa, Italy.</li> <li>17.05 - 17.15 : A new approach for active capsule endoscopy: closed-loop robotic magnetic locomotion - Dr. G. Ciuti, The BioRobotics Institute, Scuola Superiore Sant'Anna, Pisa, Italy.</li> <li>17.15 - 17.35 : Round table discussion: what are the open challenges and technological needs to be solved in the next 5 years?</li> <li>17.35 - 17.45 : Conclusions for the roadmapping process under SPARC/Horizon 2020</li> </ul>
What should participants prepare?	Participants will be asked to identify and present their most relevant (selected) research and/or industrial-oriented developments on robotic capsule endoscopy with a poster, highlighting disruptive achievements and open challenges. The most relevant topics will be considered for discussion in the round table session (e.g., as current challenges, how projects should be set up to identify optimum solutions, and how benchmarking should be applied).
Workshop website link	http://www.endovespa.eu/erf2016

Session title	Perception and Cognitive Abilities for Disaster Management Robots
Room	TECHNALIA (M1) - Foyer I
Hours	16.15 - 17.45
Organiser(s)	<ul> <li>Achim J. LILIENTHAL, Örebro Universitet, Sweden</li> <li>Lukas SILBERBAUER, taurob GmbH, Austria</li> <li>Oskar VON STRYK, TU Darmstadt, Germany</li> <li>Bernardo WAGNER, Leibnitz Universität Hannover, Germany</li> <li>Gerald STEINBAUER, TU Graz, Austria</li> </ul>
Motivation and objectives	In the next few years, the deployment of civil robots will extend to increasingly harsh environments in domains including remote inspection and search and rescue. Applications in such environments demand robots with novel perception and cognitive abilities which require approaches different from those that work in structured or semi-structured environments under normal conditions. In this workshop, speakers will present such novel approaches in terms of new hardware, algorithms for scene interpretation and requirements from a non-academic - end user or a system integrator - perspective. A goal of the workshop is to spark extensive discussions and summarize them in domain specific requirements and predictions about future development that will be communicated to relevant topic groups (potentially including Aerial Robots, Autonomous Navigation, Civil Robots, Field/Service Robots in Unstructured Environments, Maintenance and Inspection, Perception, and Telerobotics and Teleoperation).
Agenda of the workshop	<ul> <li>16.15 - 16.18 : Introduction by the moderator (Achim J. Lilienthal, Örebro University)</li> <li>16.18 - 17.30 : Presentations by selected participants (6 times 9 min + 3 min discussion): Stefan Lang, Fraunhofer Wachtberg, Germany / Daniel Serrano, Eurecat Technology Center, Spain and Shashank Govindaraj, Space Applicaton Services, Belgium / Johannes Pellenz, Bundeswehr, Germany / Michael Schmuker, School of Engineering and Informatics, University of Sussex, UK / Stefan Kohlbrecher, TU Darmstadt, Germany / Andreas Ciossek, Cobham Mission Systems, Germany</li> <li>17.30 - 17.45 : Round table discussion (moderated discussion with all participants including drafting a summary and conclusions for the SPARC/ H2020 roadmapping process)</li> </ul>
What should participants prepare?	Participants are asked to prepare input for the round table discussion.
Workshop website link	www.mrolab.eu/pcadmr.html

### LABORATORY VISITS

Date: 20 March 2016; Time: 16.00

**Meeting point:** Faculty of Electrical Engineering (main hall) University of Ljubljana Tržaška 25, 1000, Ljubljana

http://www.robolab.si/how-to-find-us/



University of Ljubljana Faculty of Electrical Engineering

#### 1. Faculty of Electrical Engineering, University of Ljubljana

**Venue:** Faculty of Electrical Engineering, University of Ljubljana, Tržaška 25, 1000 Ljubljana; <u>http://www.fe.uni-lj.si/</u>

**Visit point:** Laboratory of Robotics, Head Prof. Marko Munih (20 min) http://www.robolab.si/

- Two arm telemanipulation system with haptic feedback
- Upper extremity rehabilitation robot cell
- Cybathlon robotic wheelchair

**Visit point:** Laboratory for Autonomous Mobile Systems, Head Prof. Igor Škrjanc (15 min); <u>http://msc.fe.uni-lj.si/</u>

• Autonomous walking rehabilitation system

### LABORATORY VISITS



#### 2. "Jožef Stefan" Institute

Venue: "Jožef Stefan" Institute, Jamova cesta 39, 1000 Ljubljana; www.ijs.si

Transfer: 5 min walking

**Visit point:** Department for Automation, Biocybernetics and Robotics, head prof. Aleš Ude (30 min); <u>http://abr.ijs.si/</u>

- Robot coaching through physical interaction
- Adaptation for smart assembly: generalization of peg-in-hole task
- Robot control: imitation learning and learning of trajectories
- Robotic experiments for computational neuroscience and biomechanical analyses



#### 3. University Rehabilitation Institute, Republic of Slovenia

**Venue:** University Rehabilitation Institute, Republic of Slovenia, Linhartova 51, 1000 Ljubljana; <u>http://www.ir-rs.si/</u>

Transfer: organized bus (15 min)

Visit point: Research & Development unit, head prof. Zlatko Matjačić (20 min) http://www.ir-rs.si/en/Research\_and\_development\_unit/

- CORBYS robot walking rehabilitation robot developed within EU 7FP project CORBYS
- BAR robot balance assessment robot for delivering perturbations during walking
- STS robot sit-to-stand training robotanalyses

#### Bus return transfer to Ljubljana center (15 min)

If you plan to attend please send a message to Prof. Roman Kamnik.

until 16 March 2016 at the latest.

#### **SOCIAL PROGRAMME**

#### Monday, 21 March / 20.00 - 22.30 Welcome Reception/Ljubljana castle

**Meeting point:** 19.30 at the Cankarjev dom, Erjavčeva street (by bus) and back at 22.00.

Tuesday, 22 March / 20.00 - 24.00 Conference Dinner / Festival Hall

**Meeting point:** 19.30 at the Cankarjev dom, Erjavčeva street (by bus) and back at 24.00





#### Note:

ERF 2016 banquet fee will be charged during online registration, 25 EUR members and students (subsidized price), 45 EUR non-members. The PhD Giralt, Technology Transfer and Entrepreneurship Awards will take place during the dinner.

#### More information: http://www.erf2016.eu/index.php/social-program/

#### How to get to the Ljubljana castle:

- by bus: meeting point 19.30 at the Cankarjev dom, Erjavčeva street; return at 22.00
- by walking (15 min) and funicular (2 EUR) (click for directions)
- by walking (25 min) (click for direction)
- How to get to Festival Hall:
- by bus: meeting point 19.30 at the Cankarjev dom, Erjavčeva street; return at 24.00
- by walking (25 min) (click for directions)





#### AWARDS

#### euRobotics Technology Transfer Award 2016

The aim of the "2016 euRobotics Technology Transfer Award" (now in its thirteenth year) is to showcase the impact of robotics research and to raise the profile of technology transfer between science and industry. Outstanding innovations in robot technology and automation that result from cooperative efforts between research and industry are eligible for the prize. Please download the detailed information about this award.

The presentations for the 2016 euRobotics Technology Transfer Award will take place at the European Robotics Forum 2016 in Ljubljana in a dedicated session on 21 March (14:00 – 15:30). Based on both the written application and the presentation, the jury will determine the winners. The awards will be handed on 22 March, starting 20:00, during the Conference Dinner at the Festival Hall (see p.71).

#### 2016 Georges Giralt Ph.D. Award

The aim of the "Georges Giralt Ph.D. Award" is to showcase PhD theses defended in 2015 European universities from all areas of robotics. Outstanding theses with strong theoretical contributions, a focus on professional applications or technology transfer, with a high degree of multi-disciplinarity, or showing how robotics technologies can be 'exported' to new domains, are eligible for the prize.

The presentations for the 2016 Georges Giralt Ph.D. Award will take place at the European Robotics Forum 2016 in Ljubljana in a dedicated session on 21 March (16:15 – 17:45). Based on both the written application and the presentation, the jury will determine the winners. The awards will be handed out on 22 March, starting 20:00, during the Conference Dinner at the Festival Hall (see p.71).

#### **Entrepreneurship Award 2016**

Photo credits: Viennamotion KG

The Entrepreneurship workshop provides the ability for small innovative companies to pitch their ideas for the next big thing in robotics to a panel of technology investment experts. As well as the chance to win a cash prize, entrants stand the chance to gain valuable skills in how to pitch an investment idea together with the potential to gain interest in their company from the investment community (see more on page 48).

The presentations for the Entrepreneur Award 2016 will take place at the European Robotics Forum 2016 in Ljubljana, in a dedicated session on 22 March (14:00-15:30). Based on both the written application and the presentation, the jury will determine the winners. The awards will be handed out on 22 March, starting 20:00, during the Conference Dinner at the Festival Hall (see p.71).
### **TODAY'S ROBOTS SEEN BY ANTIQUE CAMERA'S EYES**

Photos taken with a vintage camera by Wanda Tuerlinckx

Exhibition at Cankarjev dom as part of European Robotics Forum 2016 Ljubljana 21-23 March 2016



### Wanda Tuerlinckx is a professional art photographer from Amsterdam.

She writes: "Why am I taking portraits of robots? Over the last years I have been visiting universities and other organisations in the Netherlands to make portraits of robots to mark and document an important period in science and society where a new drastic technical revolution is taking place that will change life, work and relations of human beings totally. Insiders call it the fourth industrial revolution and say that the scale and complexity of the change that is taking place at the moment has never happened before in human history.

As an artist I am inspired to document and visualise this momentum with an extensive series of various prominent robots and robot systems. To intensify the visual force of portraits and the series I am working with an ancient camera from 1880 using a special paper negative technique and a film lamp."

### PLATINUM SPONSOR

### YASKAWA

Yaskawa Europe GmbH

Description of the exhibit	ADAPTIVE LASER WELDING & WELDING ON THE FLY
	Adaptive laser welding system with integrated welding on the fly is a unique solution developed with YASKAWA robot controller in combination with the MC2000 robot.
	SYSTEM CONSISTS OF: • YASKAWA DX100 • Robot MC2000 • Scanning head HighYAG • IPG Laser 400W
	Adaptive laser remote welding compared to conventional techniques, offers much more precise and faster welding, because the process is applied to the localized diameter of less than half a millimeter in diameter and without intermediate stopping of the robot. In collaboration with the University of Ljubljana, Faculty of Mechanical Engineering, we developed an innovative process for automatic three-dimensional learning, which is based on laser measurement of the work piece, and determining the trajectory of the weld. The developed procedure significantly reduces the programming time of the system therefore opening laser welding to low volume production runs.
	<ul> <li>BENEFITS</li> <li>Welding speed: 8m / min</li> <li>Welding on-the-fly</li> <li>Continuous monitoring of the quality process</li> <li>Automatic learning time: &lt;30 s</li> <li>Accuracy: 0.1 mm</li> </ul>
	Welding on the fly with laser welding technology introduces linear welds to replace spot welds in the automotive industry. The welding process sees an impressive reduction in cycle times. The technology also enables the use of thinner sheet metal which is which plays into the ever growing need for weight reduction in cars.
	The robotic system is synchronized with the processing head and delivers an extremely high precision laser beam at the location of the weld during robot movement.
	Unique to the system is that the welding program is programmed with the teach pendant.
Website link	www.yaskawa.eu.com

### YASKAWA

### **Innovation as a corporate principle**

**Current robotic trends** 

As one of the world's leading solution and systems suppliers for servo drives, frequency inverters and industrial robots, YASKAWA is always at the cutting edge with its innovative developments. Robot technology is currently being defined by three major developments: production from batch size 1, the integration of robot controls into the programmable logic controller (PLC) and jigless robot welding. YASKAWA offers innovative solutions in all three areas. We would like to introduce them in the following:

### Robotics solution for the automated manufacture of individualized cosmetic products

#### Beautiful skin thanks to Balthazar

The Slovenian start-up "AlpStories" has been



implementing a successful business model: the company manufactures cosmetics and wellness products to customer specifications – from batches as small as size 1. This is achieved with the aid of an industrial robot developed in the laboratory environment: YASKAWA's Motoman CSDA10F.

Simon Jereb, Research & Technology Director of AlpStories, explains the concept thus:

"We enable people to put together their own natural cosmetics according to their tastes and needs."

#### **Dual-arm Motoman CSDA10F robot**

The individualization of industrially manufactured mass products was hitherto impractical due to the high unit labour costs. Modern robots now enable different product variations to be integrated into the normal manufacturing process without resulting in declining economies of scale. The dual-arm Motoman CSDA10F robot employed at AlpStories was originally developed for use under laboratory conditions. Thanks to multifunctional tools and grippers, it is highly versatile and able to learn new workflows easily and guickly.

### Automated manufacture of individual products: Industry 4.0

Changing customer requirements and new technical options make the implementation of "mass customization" concepts in many industries increasingly interesting. Especially in Industry 4.0 they are assuming greater importance than ever before. Complex products from batch size 1 and the implementation of micro-series, however, present an enormous challenge for the automation of the required processes. The production line must be highly flexible to permit the conversion of layout and function for a new product. As the AlpStories example shows, this is possible with the use of advanced dual-arm robots. MotoLogix – new interface generation for robot control via PLC

#### Simply get started

Both machines and robots are used in complex production facilities. For a long time, programming, control and error elimination for the two systems had to be carried out separately. YASKAWA now offers MotoLogix, the new generation of the well-established interface Motoman Sync. This allows robots to be integrated directly into the PLC even more simply and without previous knowledge of robots – while still providing all the benefits of a modern control system.

MotoLogix is an innovative solution developed by YASKAWA which allows coordination of all axes of a production facility with the robot motion. It comprises a hardware unit and software for programming the robot via the PLC. The platforms currently supported are Ethernet/IP, Powerlink and Profinet. The interface



### YASKAWA

has a library of function blocks already prepared in all language options, so operating personnel can work directly via the library. According to the conventional method of having robots and machines interact with each other, machines were programmed and controlled via the PLC. The teach-in, i.e. robot programming, was carried out using a teach pendant. With MotoLogix, a teach pendant is no longer required. Full and direct robot control is through the PLC: this is where movements are initiated and tracked. Path control itself is via the robot controller DX200: this ensures the benefits are retained, in particular motion precision and speed stability. So nothing else is required for the initial start-up. With Moto-Logix, PLC skills are sufficient to be able to control robots.

### Potential and limitations of jigless robot welding

#### Jigless showcase technology

Jigless robot welding is one of the most demanding disciplines in the automation industry. Jigless processes offer significant benefits – by reducing the cost of custom tooling and providing flexibility to process part variations with low batch sizes – but make high demands on robotics and the know-how of suppliers and users.

The immense advantages of fully automatic jigless welding with robots have made it a common topic of discussion. On the plus side, the elimination of manual activities and clamping fixtures, enabling greater flexibility and impressive autonomy in so-called "ghost shifts", on the down side the technical complexity of the process and investments involved are cause for reservation.

#### High-tech versus manual work

If one compares jigless with conventional systems, the critical differences become immediately apparent. Jigless cells dispense with clamping fixtures, positioning tables and manual tasks such as clamping and tack welding. In return they require additional robots to ensure the exact positioning of the components, whilst welding robots carry out the joining process itself.

#### YASKAWA: Master of robotics and motion control

Technologically, jigless welding places high demands on robotics. Depending on the complexity of the welding task, the cooperation and coordination of different robots is essential. While handling robots accurately position the components to be welded, welding robots perform the joining. If perfect path behaviour and high precision are called for on the robot side, the control unit must be able to synchronise and coordinate a complete army of robots.

YASKAWA has realised many jigless applications in recent years. It is no longer only the major players in the automotive industry who are exploiting the benefits of the process, but increasingly small and medium-sized enterprises, as Sepp Hautzinger has observed: "We are building more and more jigless systems for innovative SMEs in different industries, primarily in the agricultural and construction machine industry, tank construction and, of course, wherever a high degree of flexibility is required.





#### About YASKAWA:

With an annual sales volume of more than 360 billion Yen, YASKAWA is a world-leading manufacturer of servo drives (Sigma Series), inverter drives (such as the A1000), and Motoman industrial robots. Founded in 1915 in Japan, the company's philosophy has been based on the principle of highest quality for 100 years, making YASKAWA a global leader.

The wide range of YASKAWA's business activities covers drives (inverters), motion control (AC servo motors and drives, machine control), robotics (industrial robots and robotics systems), systems engineering (medium voltage inverters, generators, converters), and information technology (software-based products). VIPA GmbH in Herzogenaurach, which specialises in visualisation and process automation, has also formed part of YASAKWA since 2012. Furthermore, YASKAWA acquired The Switch Engineering Cooperation, which does business in the wind turbine sector, in October 2014.

This makes YASKAWA one of the few global companies able to supply components and solutions for almost all industries from a single source.

Extensive investments in research and development have yielded numerous inventions, patents and innovations. These technological aspirations have enabled the Drives & Motion and Robotics divisions to achieve a leading market position in various industries including manufacturing systems and plant engineering (packaging machines, pumps/compressors, textile machines, digital printing machines, cranes and hoisting gear, equipment for semiconductor and electronics production, machines for producing and processing wood, glass, metal and stone) as well as lift, automotive, assembly and handling technology.

Today, YASKAWA Europe GmbH, based in Eschborn near Frankfurt, operates three divisions – Drives & Motion (drives and control technology), Robotics (industrial robots) and VIPA (automation and control technology) – and services the markets of Europe, Africa, the Middle East and the region of the former Soviet Union.

www.yaskawa.eu.com

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ABB

Description of the exhibit	
	As collaboration between people and robots increases, many new industrial
	applications will become a reality. To illustrate the potential of collaborative
	automation in a memorable way, attendees at the European Robotics
	Forum 2016 will have the opportunity to test their air hockey skills against
	an ABB industrial robot. Aside from a fun experience, the application will
	show visitors the possibilities of combining people, robots and software for
	automation solutions that bring together virtual and physical worlds.
	The demonstration from ABB and IRT3000 magazine is completely made
	The demonstration, from ADD and incroood magazine, is completely made
	of standard components including an ABB IRB 1200 robot controlled with
	an IRC5 controller equipped with a Cognex vision system and Schunk
	mechanical gripper. Only some custom programming was added to create
	the complete demonstration. There are several ways to play against the
	robot, and the level of difficulty can be tailored to visitors of any age or skill.
	Can you protect your own goal and score against the robot?
Website link	www.abb.com



### A collaborative future starts with You and Me.

Today's relentless markets demand automation solutions that are more flexible and agile than ever before. YuMi<sup>®</sup>, the world's first truly collaborative robot, is part of ABB's vision for a future where people and robots work safely and productively side-by-side to unlock entirely new assembly possibilities. It's part of the exciting new reality we call the Internet of Things, Services and People. Is your plant ready? www.abb.com/robotics

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SCHUNK •



Description of the exhibit	Mobile Gripping Systems LWA 4P lightweight arm and SVH 5-finger gripper hand
	The SCHUNK LWA 4P Powerball Lightweight Arm is now available as an intuitively programmable embedded version with integrated control unit. Since all of the electronics is compactly integrated in the foot, the lightweight arm can be manually transported, or on a mobile platform from A to B very quickly. The new mechatronic SCHUNK SVH 5-finger gripper hand designed for service robot applications, is ready for series production. After an intensive concept phase, SCHUNK, the competence leader for clamping technology and gripping systems, has added the anthropomorphic gripper hand to the standardized line of modules for mobile gripping systems.
Website link	www.schunk.com







# High-tech from a family-owned company

SCHUNK gripping systems and precision clamping technology have been shaping the rapid progress of numerous industries for decades. In eight plants, 30 subsidiaries and more than 50 countries of the world, the more than 2,500 employees of our family-owned company are committed to our customers' success everyday – with pioneering spirit and competence, with reliability and passion. And they are always looking out for new standards with future potential.

Visit www.schunk.com

Иссии

Jens Lehmann, German goalkeeper legend, SCHUNK brand ambassador since 2012 for precise gripping and safe holding. www.gb.schunk.com/Lehmann







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Our work is not understood without yours; we want to work together so your company can compete better. Because together, we can develop technologies that transform the present.

The future is technological, let's share it!



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#### **BRONZE SPONSOR**

**DAIHEN** VARSTROJ

**DAIHEN VARSTROJ** 

Description of the exhibit	Maximum speed Robot for Handling with low payloads: FD-H5(H)
	The FD Robot series for Production and Handling applications have several advantages: They fulfill their functions at high speed and accuracy. They are suitable for Grinding and Milling. Also applications like Palletizing and Spraying are possible. The total highspeed automation enables a significant increase of productivity.
	Reduced rear interference radius: increased space in the area of the hinge
	<b>Avoiding collisions:</b> interference detection sensitivity improved (compared to previous model)
	<b>Built-in cable storage:</b> optimally protected, neat cable layout preventing cable from getting caught during robot operation.
Website link	www.daihen-varstroj.si

#### **BRONZE SPONSOR**



#### JOANNEUM RESEARCH

Description of the exhibit	With the use of methods from the field of Industrial Internet (Industry 4.0) JOANNEUM RESEARCH provides an essential prerequisite for the increasing flexibility in production and the associated need to shift from the classical automation towards robotics. Collaborative robotics combines human cognitive abilities and the strengths of robot technology in terms of precision and performance, thus opening up a wide range of possibilities beyond the traditional application of robots. This approach already known from service robotics research is expected to gain increasing significance for classical handling robots. Consequently new challenges emerge in terms of robot kinematics and robot control, human-robot-interaction, environmental perception, artificial intelligence and especially regarding safety and security.
	An essential requirement for the realization is the "Intelligent Sensor technology", which is based on imaging, acoustic, radar and wearable sensors and data glasses. Only the sum of these data and their intelligent evaluation provide a bi-directional real-time feedback system in human-robot interaction (collaboration human-robot and robot-environment). This technology is already used in the European Mars rover "ExoMars 2019". The prediction of human activities and knowledge of spatial planning task the robot can optimize tasks and identify and even prevent potential risk situations at an early stage.
Website link	www.joanneum.at/en.html

### BRONZE SPONSOR

### KOLEKTOR

KOLEKTOR

Description of the	
exhibit	Demonstration model of a flexible production line
	At the event, Kolektor Orodjarna, PC Vision, in collaboration with its partners presents a demonstration flexible production line that enables customized production of a car. Users can select among the following:
	<ul> <li>Two types of chassis (city, off-road);</li> </ul>
	<ul> <li>Three types of car body (sedan, station wagon, cabriolet);</li> </ul>
	Three car body colors;
	Two types of motor.
	Products will be made with 3D printer, therefore, the vehicle dimensions are limited.
	About Kolektor Orodjarna, PC Vision
	Our team has more than 17 years of experience in the field of machine vision and we are the first provider of solutions for optical control in the region. We implemented more than 1000 machine vision systems in different industries.
	Our task is to solve complex problems in the field of automated quality control. To achieve this, we are constantly developing our skills, which include the following:
	<ul> <li>design and manufacture of optical measuring equipment,</li> </ul>
	<ul> <li>development of special algorithms for image processing,</li> </ul>
	<ul> <li>production of applications to solve specific problems of our customers,</li> </ul>
	<ul> <li>development of own software,</li> </ul>
	<ul> <li>cooperation with the leading companies in the field of machine vision and automation,</li> </ul>
	<ul> <li>ensuring long-term support for our clients.</li> </ul>
Website link	www.kolektorvision.com

### **BRONZE SPONSOR**

### **KUKA**

KUKA

Description of the	KLIKA I BR ijwa – machine learning:
CAMBR	A demonstrator for object classification and sorting using machine
	learning techniques.
	Characteristics of objects such as ,area', ,height' and ,color' are detected by a 3D camera. During a training phase, a limited number of example objects including their label (classes: ,left' or ,right') are shown to the system. Only about 10 training examples are required to learn the sorting criteria, due to the limited numbers of characteristics and their possible instantiations. In the following inference phase the algorithm is able to automatically find the correct class based on the previously learned model even for new and previously unseen objects.
	The decision where to place an object is not based on a logical rule, but on a statistic model which makes the decision based on a calculated probability according to the model. Currently, ,Logistic Regression' is used as classification algorithm, but the framework allows using different algorithms and machine learning backends for research purposes in a flexible manner.
	KUKA youBot in a box
	The KUKA youBot in a box is a concept study showing that robotics education and research can be easily and safely performed on a desk without giving up industrial ambition. The KUKA youBot arm is a 5-DOF robot arm with a two finger gripper. In this concept study it is connected to an embedded mini ITX PC board which runs the industrial strength robot operating system KUKA Sunrise. The KUKA youBot is set-up, programmed and controlled through the development environment Sunrise Workbench, which can either run on the embedded PC or on any other separate PC connected via an Ethernet cable to the robot. The programming language is Java, which makes the development of applications easier. Users of the youBot learn to make use of the KUKA Robotics API, KUKA Sunrise and the KUKA Sunrise Workbench, which prepares them for programming and using the full spectrum of KUKA robots in the future.
Website link	www.kuka.com

#### **EXHIBITOR**



#### euRobotics aisbl

Description	
of the exhibit	euRobotics is a European non-for-profit association based in Brussels, which applies innovation and change management strategies to develop the potential of robotics technology for the benefit of the European economy and society. All 250 members with varying and relevant industrial and scientific expertise, build the bonds of cooperation that strengthen and represent the European Robotics community in a number of priorities and objectives:
	<b>a.</b> Within SPARC, the Partnership with the European Commission under the Horizon 2020 framework programme, euRobotics members work in various Topic Groups on the European Roadmap for Robotics. Nowhere else in the world are so many stakeholders engaged in a common strategy which shapes the technological future of a whole continent.
	<b>b.</b> The annual European Robotics Forum has become the most important Robotics networking event in Europe. Networking with regional, national and international stakeholders, as well as political decision makers boosts competitiveness and ensures industrial leadership of manufacturers, providers and end users of robotics technology-based systems and services.
	<b>c.</b> euRobotics supports the wholesale building of value and supply chains for robotics products and services in Europe, with a special support schemes for SMEs and start-up companies.
	<b>d.</b> euRobotics is engaged in accelerating innovation processes in robotics, to ensure the widest and best uptake of robotics technologies and services for professional and private use – from manufacturing to agriculture, from health to personal assistance, transport, logistics, mining, and many other market domains, many of which will bring about disruptive innovations. This includes a special focus on supporting technology transfer and education and training in robotics-related technologies and applications.
	<b>e.</b> euRobotics fosters an appropriate and responsible use of robotics in accordance with European values, notwithstanding the opportunity that. Robotics has in regional innovation clusters to counteract imbalances of prosperity and employment.
	Members are not only a part of this association, but also visible and meaningful actors of a strong European robotics community. This gives them the opportunity to meet other players on the market and learn about new trends and market requirements.
Website link	www.eu-robotics.net



#### **EXHIBITOR**

# FANUC

### FANUC

Description of the exhibit	As the global leader of factory automation, FANUC provides high-technology products and services that help our customers generate the highest, most efficient production output at the lowest total cost of ownership.
	FANUC combines innovative product research and development with the world's largest production capacity, the widest product range, and a dedicated service and worldwide coverage, making us a truly global partner with committed local support.
	FANUC produce:
	1. CNC controls, drives, servo motors and CO2 laser systems are the top choice for the world's leading machine tool manufacturers.
	2. The widest range of robots in the world to cover the needs of diverse applications. and industries. They are a key standard component-totally flexible with application-specific options, straight-forward to integration, and the colour of choice for your automation solutions provider.
	3. Robodrill machining centres, Robocut Wire EDM machines and Roboshot full electric injection moulding machines, FANUC provides highly reliable and compact machines equipped with 100% FANUC components. The ultimate in compactness, precision and reliability.
Website link	www.fanuc.eu



GCtronic

Description of the exhibit	<b>Keywords</b> Educational robotics, miniature robotics, embedded systems, wearable technology, loT
	Company profile
	GCtronic is active in the fields of electronics, robotics, mechatronics and computer science. It proposes services and consulting for development of projects, products, software and system integration. The company sells and supports its own products as well as third party ones. The main expertise is project development and integration; from the global problem to the final solution!
Website link	www.gctronic.com

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**IDMind** 

Description of the exhibit	IDMind will be exhibiting its MBot robot. IDMind developed the MBot robot in the scope of EU FP7 project MOnarCH (Multi-Robot Cognitive Systems Operating in Hospitals). The MOnarCH project ( <u>http://monarch-fp7.eu/</u> ) focus social robotics using networked heterogeneous robots and sensors to interact with children, staff, and visitors, engaging in edutainment activities in the pediatric infirmary at the Portuguese Oncology Institute at Lisbon (IPOL), Portugal.
	The MBot was built over IDMind's omni robot. Besides the sensors for autonomous navigation, the robot integrates different interaction devices: capacitive touchscreen, RGBD cameras, LEDs, video projector and RFID reader. The development process explicitly took into account a set of constraints that are induced by the social nature of the project's use case scenarios.
	MBot is a nimble and dependable robot, with an engaging appearance (children love its appearance), composed of a distinct set of features that makes it an excellent choice for many other applications beyond the project's case-study
Website link	www.idmind.pt

### EXHIBITOR

**EXHIBITOR** 

incubed IT

incubed IT

Description of the exhibit	Smart Shuttle Solutions incubed IT delivers high-level software solutions for intelligent, autonomous and mobile vehicles that can be used for transport and picking activities. incubed IT Smart Shuttles are able to navigate completely freely in dedicated areas without the need for special orientation landmarks.
	They act completely autonomous and flexible, dodging obstacles, doing dynamic re-routing and communicating with one another while driving elegantly. Due to their safety certificate and intelligent behavior, Smart Shuttles are the perfect workmates to complete your tasks. Smart Shuttle Solutions are especially scalable and suitable for any company that seeks to optimize its intralogistic processes.
Website link	www.incubedIT.com

### **EXHIBITOR**

# iniLabs

#### iniLabs

Description of the exhibit	iniLabs invents, produces and sells neuromorphic technologies for research. Its founders have invented some of the key foundations of the field, and it continues to lead the world in applications of neuromorphic engineering through a close collaboration with the Institute of Neuroinformatics at the University of Zurich and the ETH Zurich. iniLabs technologies are now in use at over 100 labs and companies around the world in industries including aerospace, automotive, consumer electronics, industrial vision and security. Through its commercialization joint venture iniVation, it also develops multiple products for end-user applications.
	The main product of iniLabs is the Dynamic Vision Sensor (DVS), a completely new way of doing machine vision. Conventional video cameras use enormously redundant frames, wasting energy, computational power and time. The DVS uses patented technology that works like the human retina: only local pixel-level changes caused by moving in a scene are transmitted. The results are dramatic improvements in speed, power, dynamic range, data storage and computational requirements.
Website link	www.inilabs.com

### **EXHIBITOR**



L-TEK

Description of the exhibit	Today one of the most challenging task in industry is ability to adapt to the new requirements efficiently. Robotics still possess many unsolved issues when talking about structural flexibility.
	New concepts of controlling robotic systems, composed of independent building blocks, will be presented. Autonomous, adaptive and distributed control systems will be our focus. Proof of concept will be shown on a demo prototype. Same movement trajectory of end-effector will be solved with various configurations of building blocks (linear axes + drive + newly developed distributed control units). All control units are autonomous, yet HW & SW identical. They will solve the problem of kinematics with strong cooperation and negotiation, without master control unit. All that within few seconds after re-configuration.
	Few other L-TEK products and services from the field of electronics and oriented toward Industry 4.0 as well as IoT world will be presented and shown.
Website link	www.l-tek.si/EN/

### EXHIBITOR

roborics•

Swiss National Centre of Competence in Research

**NCCR** Robotics

Description of the exhibit	The Swiss National Centre of Competence in Research Robotics (NCCR Robotics) brings together a selection of the top robotics laboratories in Switzerland to advance research, education and technology transfer of future intelligent robots with a focus on Wearable robotics - prosthetic robots and exoskeletons for rehabilitation and training - and Mobile robotics - flying, walking, or swimming robots for rescue missions or transportation, inspection, and human assistance.
Website link	www.nccr-robotics.ch

#### **EXHIBITOR**



Nova Labs

Description of the exhibit	Nova Labs develops innovative tools for robot development, enabling designers to quickly prototype a robot, control it, and scale seamlessly from the first units to thousands.
	Nova Core, our hardware and software framework, implements common robot requirements by off-the-shelf hardware modules and software components, allowing companies and enthusiasts to build complex systems with a plug and play approach. Nova Core provides modules to control different type of motors, sense the world with state of the art sensors, and communicate via several interfaces.
	Nova Middleware makes firmware development straightforward, enabling the development of modular, reusable code, and guarantees real-time communication between modules.
	Nova IDE assists developers in writing, configuring, and inspecting robot code, making firmware development easier than ever.
	Nova Labs is a Spin-off of the Artificial Intelligence and Robotics Laboratory of Politecnico di Milano, with the mission of transfer to the market the results of years of research and development in service robotics.
Website link	www.novalabs.io



#### **EXHIBITOR**

**NTB** 

Interstaatliche Hochschule für Technik Buchs

NTB

FHO Fachhochschule Ostschweiz

Description of the exhibit	This exhibit is showing the competences of the NTB robotics team in the realization of robot systems in different application fields. With the main focus on robot design and systems engineering, the competences space from mechanical design, to electronic development, as well as state of the art control concepts implementation. We show this through applications in surgery, rehabilitation and industrial robotics, as well as with examples of sensors development and actuators development from macro to micro-nano scale.
	An emerging activity is supporting open source hardware and software for robotics. The highlight of our work in this field is EEROS, our open source robotics software framework for real-time, taking into account industrial reliability and safety.
	In order to test and improve the software, an open source hardware design was developed and provided to the community. This will be demonstrated at our booth.
	A deep collaboration with companies, the support of start-ups and the resulting intense technology transfer between research and industry led NTB to develop the necessary skills to be the right partner for the development of finished prototypes with industrial quality.
Website link	www.ntb.ch/robotics

### **EXHIBITOR**



### **OptoForce**

Description of the exhibit	<b>OptoForce</b> provides revolutionary and new technology on the market of force sensing devices. We are measuring the forces based on optical principles. This new, patent protected technology provides unlimited custom solutions, custom shapes therefore we have wide range of product families in case of <b>3D force and 6 axis F/T sensing</b> .
	<b>Robustness, cost efficieny</b> and <b>easy integration</b> are the three main factors that feature and drive our products. We offer our sensors for <b>robot hand</b> <b>manufacturers, system integrator companies, humanoid designers</b> , for <b>exo</b> <b>skeletons</b> and for <b>medical robotics applications</b> . Feel free to come to our booth and try the extreme sensitivity.
Website link	www.incubedIT.com

### EXHIBITOR



### ORTELIO LTD

Description of the exhibit	Ortelio Ltd is a research focused company, working on cloud robotics. We give robots intelligence to take over human tasks.
	We have developed a software platform for distributed execution of robotic software and robot controllers. This is a three-tier system using a ROS-based cloud, a robot API/SDK, and a robotic application store for distribution and execution of apps on Linux-based robots. The platform also enables different types of robots to communicate and exchange information, and thus to learn from each other.
	In the RAPP project ( <u>www.rapp-project.eu</u> ), the platform enables developers to easily create and deliver robotic apps for the elderly. These Robotic Apps (RApps) can use resources in the cloud to perform a variety of Machine Learning and Data Mining tasks. The cloud also serves as a high performance computing entity (in comparison to the robot) where computationally expensive processes of a RApp can be offloaded. A RApp store forms a repository from which robots can download RApps and upload useful monitoring information for use by other RApps (and robots).
	The platform can be used in various other domains and fields, such as medical and clinical, children education and special care, entertainment, research, hotels, museums, agriculture, manufacturing and shop-floor operations, control of drones and unmanned vehicles, monitoring and security, etc.
Website link	www.robotics.ortelio.co.uk

**EXHIBITOR** 



### PAL ROBOTICS

Description of the exhibit	PAL Robotics is attending the European Robotics Forum and will be exhibiting the recently developed robot TIAGo. TIAGo (his name standing for 'Take It And Go') can perform tasks in perception, navigation and grasping. He is designed to be a configurable and adaptive platform for research, especially fitting in the fields of Ambient Assisted Living and light industry. TIAGo will show its abilities at ERF, performing some demonstrations at PAL Robotics booth, and will also interact with attendees. TIAGo will be accompanied by PAL Robotics' mobile base PMB-2. PMB-2 specifications make it ideal for logistics tasks but can also become a base where you can build your robot upon. PAL Robotics will be also spreading information about our humanoid robots REEM-C and REEM, and also the robot that automates inventory, StockBot.	
Website link	www.pal-robotics.com	





### EXHIBITOR

**CRLS**<sup>®</sup>

RLS merilna tehnika d.o.o.

Description of the exhibit	The AksIM <sup>™</sup> is a non-contact high-performance off-axis absolute rotary encoder designed for applications with limited installation space. The compact, low profile readhead detects and evaluates the magnetic field of a thin, axially magnetized ring.
	The 49 mm ring offers 524,288 positions per revolution at a resolution of 19 bits while the larger, 80 mm ring, provides 1,048,576 positions at a resolution of 20 bits. The accuracy of the AksIM <sup>™</sup> magnetic encoder system is better than ±0.1° and the maximum permissible speed is over 10,000 revolutions per minute.
	The low overall system height together with its true absolute functionality and high-speed operation make the new single-track absolute encoder suitable for a wide range of applications including video-surveillance systems measuring the angle of camera rotation, robotic arm joints and motors for detecting position.
Website link	www.rls.si

### **EXHIBITOR**

# Robotnik

Robotnik

Description of the exhibit	Robotnik is a company specialized in Mobile Service Robotics. We offer high-quality services for national and international reach and are certified in:
	<ul> <li>ISO 9001:08 - Design, manufacturing and commercialization of products and systems based on robotics technology.</li> </ul>
	• UNE 166002:06 - R&D management in the development of projects in the field of robotics.
	Our main specialties are:
	Autonomous indoor/outdoor mobile robots and field service robotics applications.
	<ul> <li>Robotics products (mobile robots, mobile manipulators, robot arms, robotic hands and robotic torsos).</li> </ul>
	R&D Robotics projects.
Website link	www.robotnik.eu



#### **EXHIBITOR**

Description of the exhibit	Shadow is one of the UK's leading robotics developers. We have worked with companies and researchers all over the world, looking at new ways to apply robotics technologies to solve real problems. Shadow develops the Dexterous Hand, used globally by researchers advancing the state of the art in robotics - working out how robots can handle, grasp and manipulate objects. This Hand is capable of all of the moments of the human hand, and has the precision and sensitivity to handle soft or delicate objects. Recent technology developments have made the Hand able to understand presented objects and automatically generate grasps for manipulation.
	Shadow also develops other robotic technology, including RoNeX, a scalable hardware infrastructure for building robots, and is active in R&D on agricultural, medical and assistive robotics as well as industrial applications of Dexterous Hands. Shadow are now working with clients and partners to take robotics technology and apply it in areas ranging from medical robotics through logistics, catering and even farming. Please talk to us about how our robotics expertise and technology could accelerate your commercial journey.
Website link	www.shadowrobot.com

### **EXHIBITOR**

# TAUROB

TAUROB

Shadow

Description of the exhibit	As provider of teleoperation solutions for CBRN first responders, EOD teams, fire-fighters and search & rescue teams, taurob's solutions aid in gaining situational awareness in dangerous environments as well as accomplishing tasks such as riskless detection, sample-taking or manipulation of hazardous substances.
	laurob is also experienced in providing versatile, rugged, easy-to-use, easy-to- integrate robots for outdoor projects within the robotic research & education community at a low price.
	Ethernet interfaces allow for easy integration of almost any given sensors and processing units. The platform has excellent rough terrain capabilities. Its variable track geometry facilitates driving through vegetation as well as stair climbing (45°).
	The robots are ROS compatible and will usually be shipped with standardized aluminium-profiles in order to attach any kind of sensors. It is also equipped with at least 3 Ethernet-interfaces and can be easily customized for specific needs.
Website link	www.taurob.com

### **EXHIBITOR**

THE BIOROBOTICS



Scuola Superiore Sant'Anna The Biorobotics Institute

Description of the exhibit	Surgical robotics, micro-nano-robotics, soft robotics, industrial robotics, humanoid robotics, neuro-robotics, prosthetics, neural engineering, rehabilitation engineering, bio-inspired robotics, biomedical signal processing, marine robotics, service robotics and ambient assisted living, educational robotics and their ethical, legal, social and economic implications. The BioRobotics Institute is an integrated system aimed at innovative research, education and technology transfer, and it intends to create new companies in high tech sectors. The scientific research of the BioRobotics Institute is multidisciplinary and involves different disciplines. The high specialization is one of the highlights of our research, which has been active in many international and national research projects.	
	The priority of our research are:	
	Quality scientific production;	
	The impact on social life;	
	Technology transfer.	
Website link	http://www.santannapisa.it/en/istituto/biorobotica/biorobotics-institute	

### EXHIBITOR

University of *Ljubljana* Faculty of *Electrical Engineering* 

### University of Ljubljana

Description of the exhibit	Laboratory of Robotics (Robolab) has long-standing excellence in robotic research and applications in industrial as well as in clinical environment.
	Robolab is focused in evolution of robotic technology for industrial users. Several complex assembly robot cells and solutions were developed and introduced in Slovenian electro and automotive industry. One of the focus areas is robot contact with the environment, for example deburring. Another activity domain present contact and noncontact measurements accompanied with manipulation in various industrial fields. Robolab is also active in the area of construction, where an original large scale robotic telescopic handler was introduced.
	The innovations and development included novel robot devices and solutions for diagnostics and training in rehabilitation and sport. The technologies of haptic man- machine interfaces, wearable motion and psychophysiology sensors are developed and implemented in different applications. Recent achievements come from the upper arm training including also virtual reality, lower-limb prosthesis and exoskeleton control. Motion tracking, diagnostics and dynamic modelling were lately applied in rowing, ski jumping, and preterm new-borns.
Website link	www.robolab.si

### EXHIBITOR



### **UNIZG-FER**

Description of the exhibit	The UNIZG-FER is among the most financially independent and well-governed Faculties of the University of Zagreb. The large and modern infrastructure, with over 40,000 sq. meters of total indoor space is devoted to higher education and competitive industry- worthy R&D. Significant floor-space is devoted to highly specialized precise measurement and normative laboratories, electrical machines' engineering and power and distribution grid engineering laboratories. UNIZG-FER also possesses top-notch robotics equipment, including high performance indoor and outdoor wheeled robotic platforms, sophisticated light-weight robotic arms, aerial vehicles (blimps, quad- and hexrotors, helicopters) as well as marine robots, sonars, etc. Robotics research at University of Zagreb Faculty of Electrical Engineering and Computing (UNIZG-FER) is conducted within three research groups: Laboratory for Underwater Systems and Technologies (LABUST), Laboratory for Robotics and Intelligent Control Systems (LARICS), and Autonomous Mobile Robotics (AMOR) group. LABUST (http://labust.fer.hr) holds expertise in marine robotics: development of marine vehicles; navigation, guidance and control; and cooperative and coordinated formations of marine vehicles. LARICS (http://larics. rasip.fer.hr) is involved in research on intelligent control systems, service robotics, control of multi-agent systems, planning, scheduling and decision making. AMOR group is intensively researching autonomous navigation of wheeled mobile robots in unknown and dynamic environments.
Website link	www.fer.unizg.hr



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## See you in Edinburgh at ERF2017! 22-24 March 2017

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