Horizon 2020
ICT Robotics Work Programme 2016–2017

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euRobotics Brokerage Day – Brussels – 18 November 2015

Outline of Work Programme 2016–17

Robotics Unit

Background and process

Overview of the 2016–17 Work Programme

Main elements of the next call

Additional information

Robotics Unit

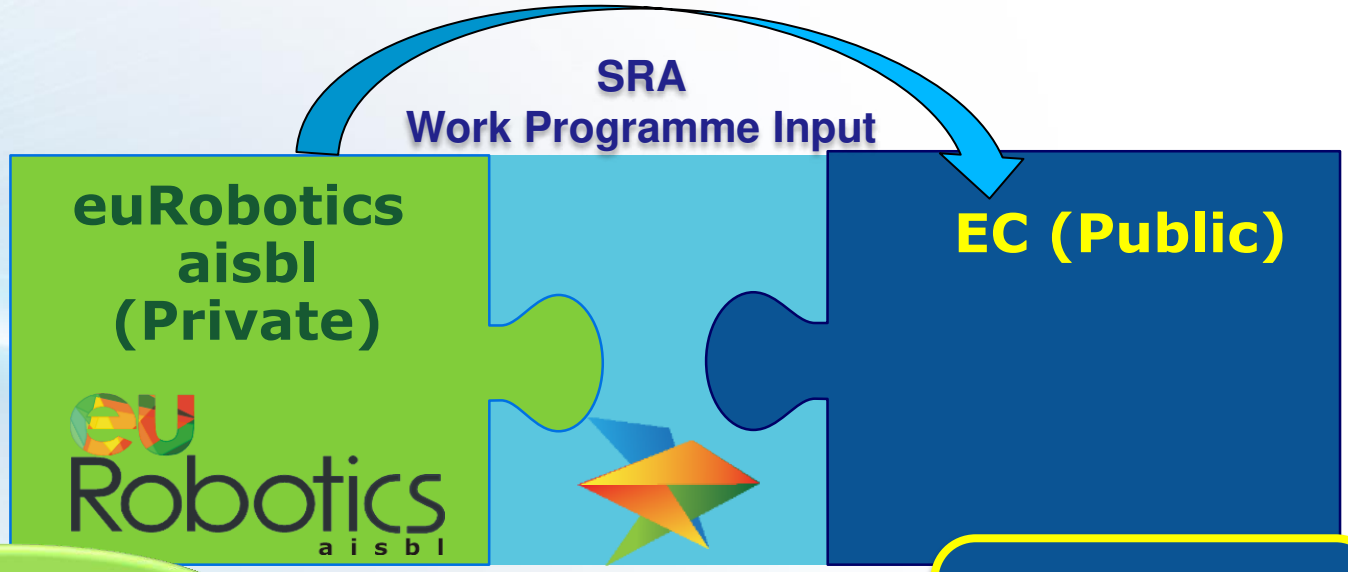
- Dedicated unit created over eleven years ago (FP5-FP6-FP7-H2020)
- More than 100 ongoing projects
  - over 700 partners
  - over €500m funding
- €70m–€80m funding for new projects per year
- Usually 1 call for proposals per year, up to 200 proposals, about 20 new projects
- Emphasis in FP6 and FP7 on perceiving, understanding, acting – cognitive, intelligent enabling technologies
- The EC provided almost €160m funding for robotics research and innovation through the Horizon 2020 ICT Work Programme 2014–2015

Background & process

- The Work Programme process involved the SPARC Robotics PPP from the beginning
- Built on the priorities of the SPARC Strategic Research Agenda and Multi-Annual Roadmap (MAR)
- The private side of SPARC, euRobotics, consulted the constituency, collected and processed the elements and provided them to the public side, the EC
- Further refining during the process

→ The first Work Programme that derives from the SPARC partnership

PPP in Robotics – SPARC



Industry

Academia

End-Users

Work Programme

Call implementation

http://sparc-robotics.eu/about/

SRA = Strategic Research Agenda
MAR = Multi-Annual Roadmap (to be updated)

VISION
GOALS

GUIDANCE
HOW TO

Essential reading for proposers, providing detailed definitions of technologies and abilities and illustrative examples of the selected priorities. Proposals are expected to demonstrate their contribution to this roadmap.

SPARC and the constituency

- The call organisation and operations are run by the European Commission
- The evaluation and selection of proposals does not involve euRobotics, the private side of the SPARC PPP – done by the Commission with the help of independent experts
- Proposers need not be euRobotics members
- Membership gives no advantage or preferential treatment in the evaluation
- But membership gives an opportunity to be involved in shaping future funding directions

Overview of the ICT Robotics Work Programme 2016–2017

Work programme – general

- **Main approach: to generate new robotics and autonomous systems (RAS) technical capabilities and system abilities and to move research results out of the laboratory and into the marketplace, engaging with SMEs and end-users**
- **The technical capabilities targeted**
  - **systems development; interaction; mechatronics and perception/navigation/cognition**
- **The system abilities targeted**
  - **configurability; adaptability; interaction capability; dependability; motion capability; manipulation and grasping; perception; decisional autonomy and cognitive ability**

Work programme – general

- **Mix of technology-driven research, development and innovation to keep Europe at the cutting edge of research and market-driven R&D&I to accelerate take-up and deployment, including by SMEs**
- **Flanking measures to improve the market and regulatory climate at EU level through e.g. addressing non-technical market barriers (entrepreneurship, ethical, legal, socio-economic issues in a pro-active and forward-looking perspective, skills and training) and through a high-profile robotics competition**

Robotics WP 2016–17 – four topics

1. **ICT-25-2016-2017**
   Advanced robot capabilities research and take-up
2. **ICT-26-2016**
   System abilities, development and pilot installations
3. **ICT-27-2017**
   System abilities, SME & benchmarking actions, safety certification
4. **ICT-28-2017**
   Robotics competition, coordination and support

Additional robotics-related topics in other parts of the WP

1. **IoT-01-2016 Large-scale pilots**
   Pilot 5: Autonomous vehicles in a connected environment
2. **SFS-05-2017**
   Robotics Advances for Precision Farming
3. **FOF-12-2017**
   ICT Innovation for Manufacturing SMEs (I4MS)

H2020 ICT-25-2016-2017

Advanced robot capabilities research and take-up

RIA

a

Open, generic, all topics and disciplines

€2–4m

b

Step changes: systems development, HRI, mechatronics, perception, navigation and cognition

€2–4m

€15m / €15m

2016

20/10/2015

12/4/2016

2017

14/12/2016

25/4/2017

IA

c

Open, end user-driven application development, areas with significant market potential

>TRL5

€2–4m

d

End user-driven innovation actions v. market entry barrier

€2–4m

€15m / €19m

H2020 ICT-26-2016

System abilities, development and pilot installations

RIA

a
System abilities: Dependability, social interaction, cognitive
€2–4m

b
Multiple-actor systems (different environments, autonomy)
€2–7m

€24m

2016

20/10/2015

12/4/2016

IA

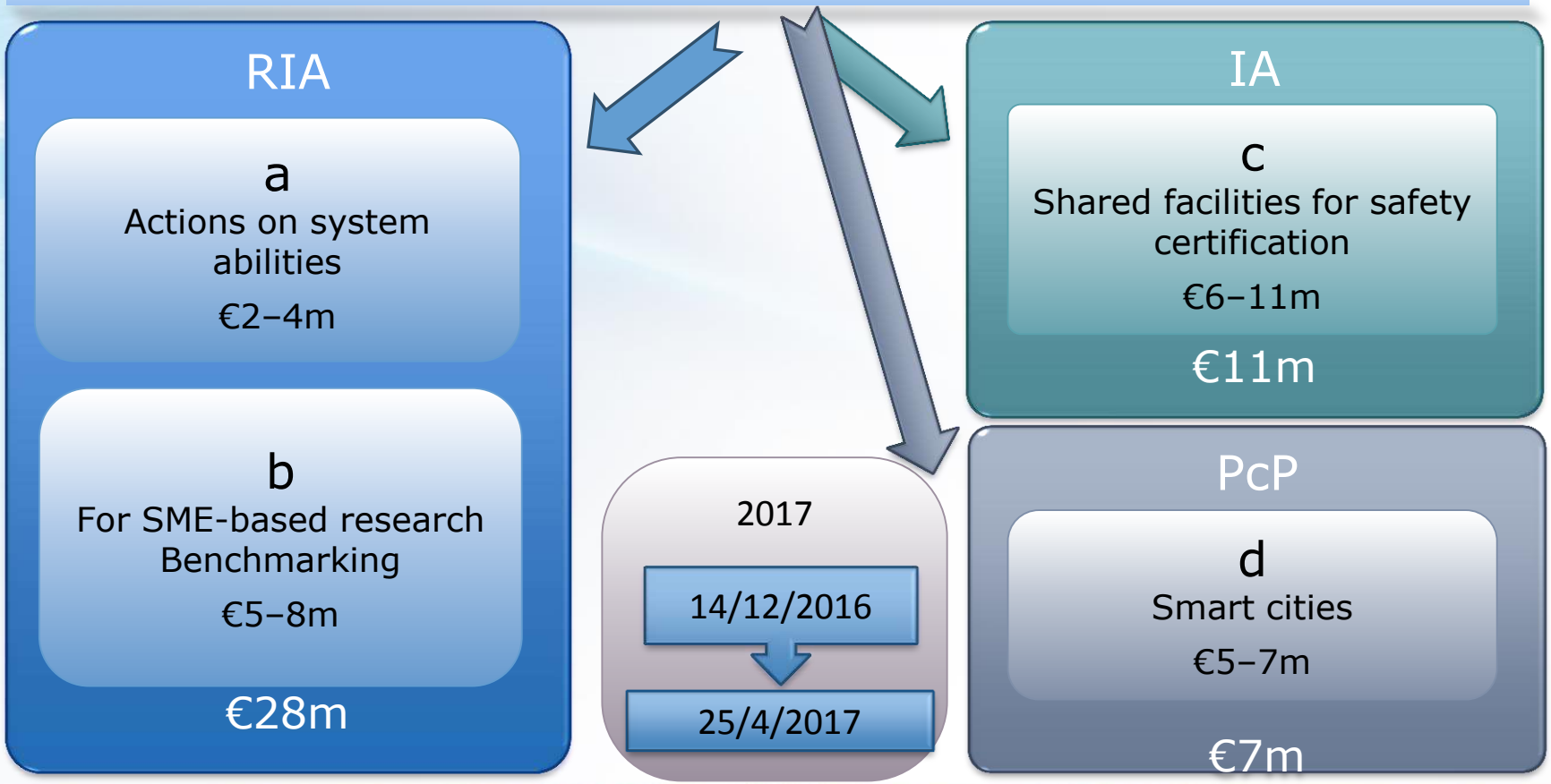
c
System development technology
€5–8m

d
Pilot installations for robot testing
€7–10m

€18m

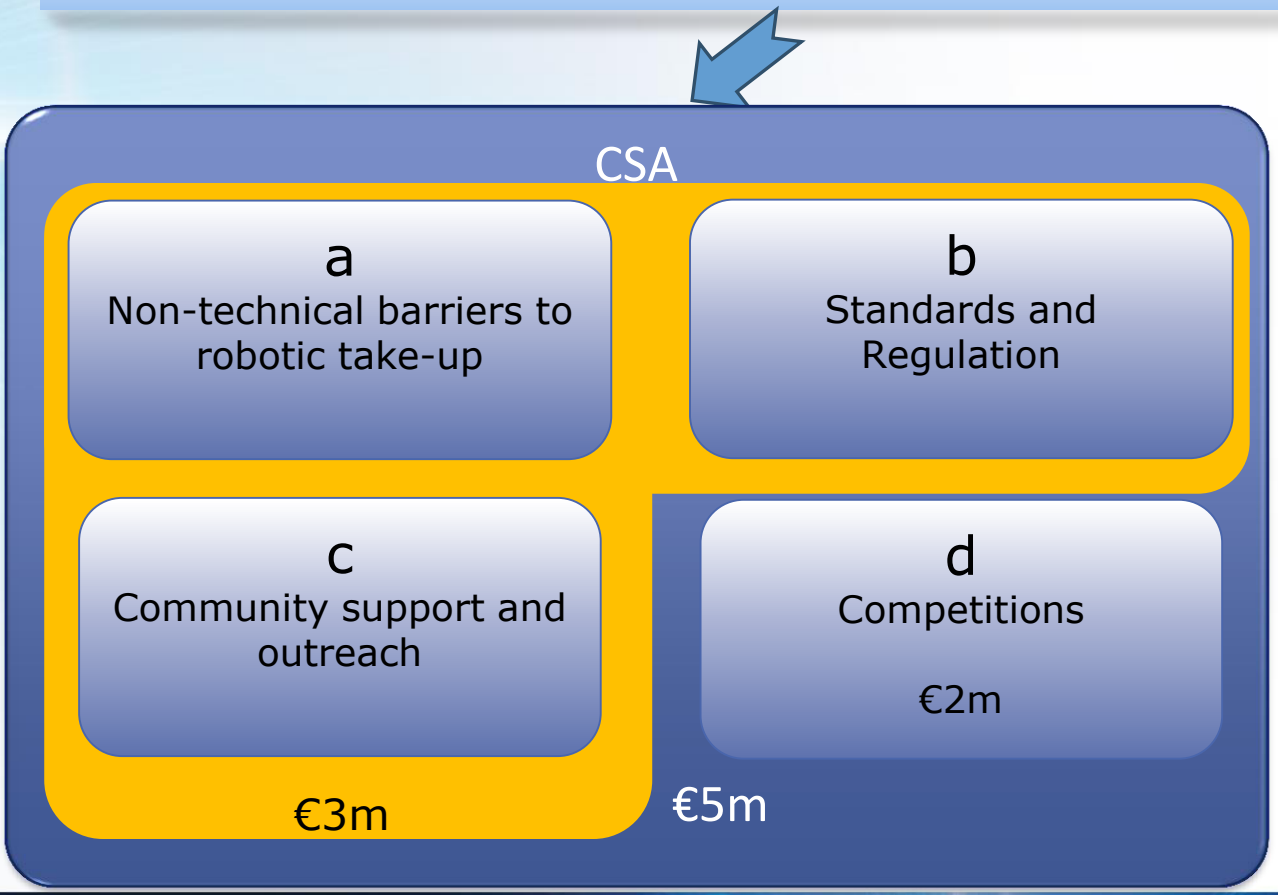
H2020 ICT-27-2017

System abilities, SME & benchmarking actions, safety certification



H2020 ICT-28-2017

Robotics competition, coordination and support



2017

14/12/2016

25/4/2017

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ICT-25-2016 Advanced robot capabilities research and take-up (1)

- Easy deployment of smart robots in everyday life is still beyond the technical capability of most current laboratory prototypes
- Specific challenge: to develop robots that respond more flexibly, robustly and efficiently to the everyday needs of workers and citizens in professional or domestic environments
- The actions will address the whole value chain
  - generic technology
  - developing RAS building blocks in the form of key technical capabilities
  - market-led prototypes involving end-users

ICT-25-2016 Advanced robot capabilities research and take-up (2)

- **Research and Innovation Actions** (RIAs) addressing generic advances and technical capabilities

  a. Open, generic forward-looking research into novel technical advances in robotics – open to all robotics-related research topics and disciplines.

  - Proposals are expected to address technical topics which cut across application domains and which can be developed further with a view to achieving high future impact on markets or societal sectors in Europe.

ICT-25-2016 Advanced robot capabilities research and take-up (3)

- **Research and Innovation Actions** (RIAs) addressing generic advances and technical capabilities

  b. Technology research and development to achieve **step changes** in the capabilities of the following high **priority RAS technologies**: systems development; human-robot interaction; mechatronics; perception, navigation and cognition.

  - Step changes are sought through either a multiplicative improvement in technical capability – for example achieving a difference in order of magnitude in the number of everyday objects a robot can recognise or handle – or a categorical advance – for example moving from rigid to intuitive human-robot interfaces.

ICT-25-2016 Advanced robot capabilities research and take-up (4)

- Innovation Actions (IAs) driven by end-users
  - c. Improving the deployment prospects of RAS through **end-user-driven application developments** in domains and application areas with significant **market potential.**
    - **To address system development beyond TRL 5.**
    - **The outputs will not be purely technological; actions will generate economic and operational data that will provide a valuable basis for setting operating parameters and for reducing commercial risks for future investors**
  - **d. Filling technology or regulatory gaps** through end-user-driven innovation actions, where the gap represents a challenging market entry barrier.
    - **Proposals to address a gap in either technical capability or system ability.**
    - **The targeted gap and the required steps to tackle the gap must be clearly identified in the proposal.**

ICT-25-2016 Advanced robot capabilities research and take-up (5)

- **Main centre of gravity to be identified** – whether a, b, c or d targeted in the proposal
- Proposals are expected to require an EU contribution of typically €2–4 million
  - This does not preclude submission and selection of proposals requesting other amounts
- At least one action to be supported from each bullet

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ICT-26-2016 System abilities, development and pilot installations (1)

- Important to characterise the overall performance of an RAS in terms of its ability to perform system functions which traverse specific technological capabilities.
- To increase the system ability levels in terms of configurability, adaptability, motion, manipulation, decisional autonomy, dependability, interaction, perception and cognitive ability.
- Such system abilities provide a basis for setting performance metrics and for specifying desired levels of system performance.

ICT-26-2016 System abilities, development and pilot installations (2)

- **Multiple-actor systems** are composed of many actors which are able to operate independently but together can perform system functions.
- These actors may be autonomous entities, people, or static systems, including embedded sensor networks and cloud services, working together in the operational environment.
- The challenge is to develop complete, robust systems through the interaction of these many actors to carry out the system function.

ICT-26-2016 System abilities, development and pilot installations (3)

- Integrated sets of common tool chains and real-world test installations are increasingly needed to support the development of complex robotics systems.
- Need for open development and dissemination of common development tools and the provision of wide access to realistic testing environments for the end user community, especially SMEs
  - Although robot testing and innovation facilities are starting to emerge in Europe, they are underdeveloped in terms of their infrastructure and the facilities they offer

ICT-26-2016 System abilities, development and pilot installations (4)

a. Research and Innovation Actions (RIAs) on system abilities

- Advancing the state of the art in the level of **smart robotics system abilities**
- Focus is on the technical challenges; research actions will address cross-cutting technology issues that will make a significant contribution to the needs of applications and domains with the highest impact on markets
- Proposals are expected to address at least one or a combination of the following prioritised abilities: **robot dependability, social interaction ability and cognitive ability**
- Proposals requesting a grant of typically €2-4 million (does not preclude submission and selection of proposals requesting other amounts).

ICT-26-2016 System abilities, development and pilot installations (5)

b. RIAs on multiple-actor systems

- Developing **advanced multiple-actor systems** utilising actors which can operate individually, as members of a team and within a network of other assets in semi-structured, unstructured, dynamic or harsh environments
- Interaction of diverse independent actors
- Proposed multiple-actor systems are expected to demonstrate autonomy over an extended time scale and clearly identify service level gains (compared with current systems) in the application area chosen by the proposal
- Systems must be built around identified end-user needs; performance to be measured using relevant end-user metrics.
- Proposals requesting a grant of typically €2–7 million (does not preclude submission and selection of proposals requesting other amounts)

ICT-26-2016 System abilities, development and pilot installations (6)

c. Innovation Actions (IAs) on systems development technology

- Open development and dissemination of **integrated sets of tool chains and building-block applications** which support the construction of complex robotics systems.
- This will result in a European-level ecosystem of development tools using commonly agreed ways of describing robot systems and system building blocks and their interaction.
  - flexible and able to accommodate a diverse range of end application requirements in a broad range of different domains
- Proposals must aim at developing such an ecosystem, provide mechanisms for its dissemination and stimulate community engagement in its development and subsequent deployment

ICT-26-2016 System abilities, development and pilot installations (7)

c. Innovation Actions on systems development technology

- Key is support for modularity, composability, re-usability, ease of use and the adoption of existing and emerging standards within both the system and its components
- The action is expected to build on existing systems and structures
- The action may involve financial support to third parties in line with the conditions set out in Part K of the General Annexes of the Work Programme ('cascading')
  - consortium to define the selection process of additional users and suppliers for which financial support will be granted (typically €50k–€250k per party)
- Proposals requesting a grant of typically €5–8 million (does not preclude submission and selection of proposals requesting other amounts)

ICT-26-2016 System abilities, development and pilot installations (8)

d. Innovation Actions on pilot installations for robot testing

- To develop and deploy access mechanisms and supporting infrastructure for single-site pilot installations outside the laboratory for robot testing, based on the needs of end users.
- Proposals will build on an installation supported through existing EU, regional, national or commercial funding to develop a European accessible facility prioritised against emerging market domains and application areas.
- In order to ensure real-world conditions, pilot installations to be based on existing infrastructures such as farms, hospitals, care homes, mines, nuclear sites, undersea sites, collapsed buildings etc.
- Access mechanisms and infrastructure should provide a low access threshold for SMEs, public bodies and ROs

ICT-26-2016 System abilities, development and pilot installations (9)

d. Innovation Actions on pilot installations for robot testing

- Proposals are expected to provide a support infrastructure including as a minimum: instrumentation of the site; simulation support to allow off-site testing; access to the end user and local site experts, and metrics relating to the functional goals of the end user
- Safety certification processes, the development of appropriate performance evaluation measures and application-specific benchmarks are also to be addressed.
- The proposal should identify application-relevant standards and, where relevant, the types of human interaction expected, including the level of social interaction.

ICT-26-2016 System abilities, development and pilot installations (10)

d. Innovation Actions on pilot installations for robot testing

- Where appropriate, proposals should consider providing sharable standard platforms (hardware and software) to allow organisations offering individual modules or technologies to access the site, rather than limiting access to groups able to deliver whole systems.
- Proposals should clearly show how they will assess and, where appropriate, disseminate the results and market impact from trials carried out on the installation.
- Proposals are encouraged to highlight how deployed system dependability can be enhanced through interaction with the installation.

ICT-26-2016 System abilities, development and pilot installations (11)

d. Innovation Actions on pilot installations for robot testing

- The action may involve financial support to third parties in line with the conditions set out in Part K of the General Annexes of the Work Programme ('cascading').
  - consortium to define the selection process of additional users and suppliers for which financial support will be granted (typically €50k–€150k per party)
- Third party support is expected to cover the development of end user solutions for use at the pilot installation as well as the development of related service-side support that would enable the deployment of the end user application.
- Proposals requesting a grant of typically €7–10 million (does not preclude submission and selection of proposals requesting other amounts)

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ICT-27-2017 System abilities, SME & benchmarking actions, safety certification

a. Research and Innovation Actions on system abilities

- Proposals are expected to address at least one or a combination of the following prioritised abilities: perception ability which is immune to natural variation (e.g. changing weather conditions); decisional autonomy; increasing dependability levels to the level of graceful degradation; systems that are able to self-verify correct behaviour in safety critical tasks
- Cf. ICT-26a
- Call to open on 14 December **2016**

ICT-27-2017 System abilities, SME & benchmarking actions, safety certification

b. Research and Innovation Actions on for SME-based research and for benchmarks

- Proposals are expected to address one of the following:
  - **To stimulate SMEs in the robotics sector to develop novel and challenging technology and systems applicable to new markets; proposals should provide SMEs with access to technical and non-technical support services and technology that are relevant to the new market being addressed**
  - **Development and implementation of robotics application-relevant benchmarks and metrics to assess progress in technologies and systems**
- May involve financial support to third parties
- Call to open on 14 December **2016**

ICT-27-2017 System abilities, SME & benchmarking actions, safety certification

c. IAs on shared facilities and safety certification

- Development of testing protocols for shared space cooperative and collaborative systems leading to viable safety certification standards
- Proposals must cover a range of domains and applications where safety certification is a market barrier
- May involve financial support to third parties
- Call to open on 14 December **2016**

ICT-27-2017 System abilities, SME & benchmarking actions, safety certification

d. Pre-commercial procurement action

- Demand-driven PCP actions in the area of smart cities
- Actions will aim at but not be limited to one or several of the following topics: waste management, transport (with focus on smart mobility), the provision of city-wide utilities and services, the provision of healthcare, social care and education (including social innovation)
- Actions will be expected to show how the PCP instrument and procurers will be mobilised to develop new robotics related solutions in a smart cities context
- Call to open on 14 December **2016**

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ICT-28-2017 Robotics competition, coordination and support

a. Non-technical barriers to robotics take-up

- Promotion of entrepreneurial skills specific to robotics and provision of non-technical early-stage support for SMEs and spinouts
- Addressing non-technical market barriers (e.g. ethical, legal and socio-economic issues affecting take-up)
- Promotion of responsible research and innovation in robotics and assessment of societal readiness for robotics products
- Strategies to anticipate new skills requirements, to reduce skills shortage and to provide responses to economic change through training, skills development and education

b. Standards and regulation

- Coordination of standards harmonisation and regulation
- Dialogue with regulatory bodies

ICT-28-2017 Robotics competition, coordination and support

c. Community support and outreach

- To improve information exchange, to provide open access resources, to communicate outcomes of EC-funded projects, to improve the public level of understanding and societal uptake of robotics

d. Competitions

- Robotic competitions to speed up advance towards smarter robots, demonstrating progress and raising public awareness

The call for ICT-28-2017 to open on 14 December **2016**

RIA

TYPE	2016	2017
RIA	▪ OPEN ▪ Step change in prioritised technologies	▪ OPEN ▪ Step change in prioritised technologies
RIA	▪ Dependability ▪ Social interaction ability ▪ Cognitive ability	▪ Advanced perception ▪ Decisional autonomy ▪ Increasing dependability ▪ Self-verifying & self-correcting systems
RIA	▪ Multiple-actor systems	▪ SME-based research ▪ Benchmarking

IA – PcP – CSA

TYPE	2016	2017
IA	▪ End-user driven	▪ End-user driven
IA	▪ System Development technology ▪ Pilot installations - robot testing	▪ Shared facilities for safety certification
PcP		▪ Smart cities
CSA		▪ Non-technical barriers to robotics take-up ▪ Standards & Regulation ▪ Community support and outreach ▪ Competitions

Additional topics

1. **IoT-01-2016 Large-scale pilots**
   Pilot 5: Autonomous vehicles in a connected environment
2. SFS-05-2017
   Robotics Advances for Precision Farming
3. FOF-12-2017
   ICT Innovation for Manufacturing SMEs (I4MS)

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3. FOF-12-2017
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SFS-05-2017 Robotic Advances for Precision Farming

- Opening 4 October **2016**
- Closing 14 February **2017**
- Research and Innovation Actions; budget €7 million
- To help attain high levels of precision in modern farming through the smart use of robotics
- To develop and demonstrate new robotics technologies in real-world scenarios involving such as automated mobility around irregular farmland areas, accurate sensing of crop and livestock conditions, and dextrous manipulation of farmed produce

Additional topics

1. IoT-01-2016 Large-scale pilots
   Pilot 5: Autonomous vehicles in a connected environment
2. SFS-05-2017
   Robotics Advances for Precision Farming
3. **FOF-12-2017**
   ICT Innovation for Manufacturing SMEs (I4MS)

FoF-12-2017 ICT Innovation for Manufacturing SMEs

- Opening 20 September **2016**
- Closing 19 January **2017**
- Innovation Actions; total budget for all actions under the topic (not just robotics) €32 million
- Including robotics: new robot systems that are cost effective at lower lot sizes, with the benefit of long-term improvements in productivity, the ability to work safely in close physical collaboration with human operators; and that are intuitive to use and adaptive to changes in task configuration

Additional information

Background documents, events

1. SRA & MAR
   - MAR being updated for the call

   http://sparc-robotics.eu/about/
2. Q&A document (continually updated) on the Participant Portal
3. IoT-01-2016 – Pilot 5 Information Day – Brussels – 3rd December
   - Details will follow on http://ec.europa.eu/digital-agenda/en/internet-things

THANK YOU