# Electric Propulsion

# Strategic Research Cluster

HORIZON 2020

**SPACE**

EPIC Workshop – 24 October 2017 - Madrid
Florence Béroud REA B1 Space Unit

Research Executive Agency

*Content:*

*Implementation of the SRCs*

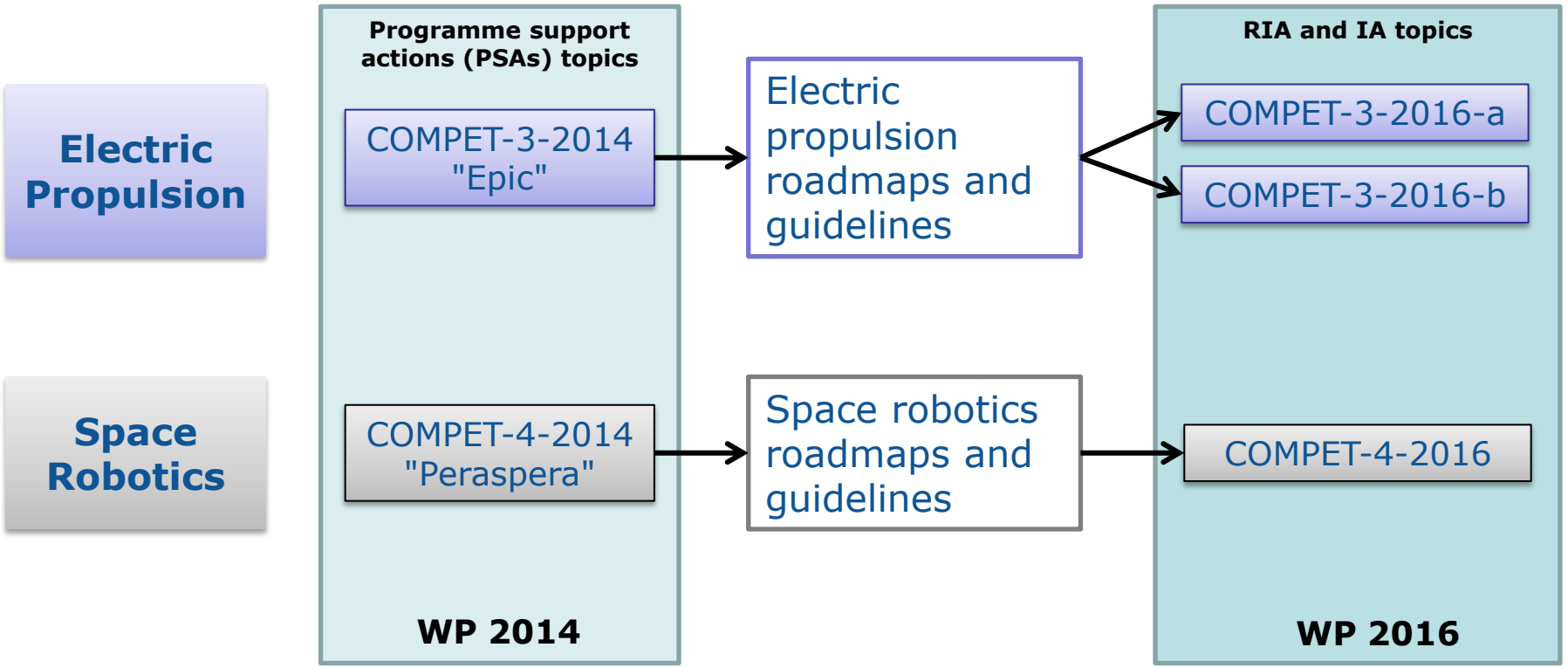
*EP phase I*

*Robotics Phase I*

*Upcoming phases*

*Timeline of SRC and Calls*

# Strategic Research clusters



# EPIC / PERASPERA

## “Programme Support Activity” (PSA)

- Prepares a roadmap and implementation plan for the whole SRC
- Advises the Commission on definition of calls for operational grants
- Drafted the Collaboration agreement which links all partners of the SRC grants
- Facilitates and supervises the coordination of grants in order to achieve the SRC objectives
- Assesses the evolution of operational grants in the SRC context
- Provides advice to REA on technical matters
- Coordinates Dissemination activities of the SRC

# The Collaboration Agreement

- Required for all Complementary Grant Agreements including the PSA

- Signed by all partners of the Grants

- Its purpose is:
  - (i) to define rights and obligations of the Parties relating to their coordination and collaboration under the SRC, and
  - (ii) to implement the provisions of the respective Complementary Grant Agreements for SRC Projects concerning amongst other things Access Rights relating to Complementary Results and Complementary Back-ground.




## Competitiveness of European Space Technology

| Topic | COMPET-3-2014: **In-Space electrical propulsion and station keeping** | CSA |
|---|---|---|

| Project acronym | Project title/keywords | EU contrib. (€) |
|---|---|---|
| **EPIC** | EPIC Electric Propulsion Innovation and Competitiveness / Electric Propulsion, Roadmap, Strategic Research Cluster | 3,496,351.00 |
| | Σ | 3,496,351.00 |

| Topic | COMPET-4-2014: **Space Robotics Technologies** | CSA |
|---|---|---|

| Project acronym | Project title/keywords | EU contrib. (€) |
|---|---|---|
| **PERASPERA (AD ASTRA)** | Plan European Roadmap and Activities for Space Exploitation of Robotics and Autonomy / Space Robotics, Automation, On-orbit satellite servicing, Technology Harmonisation, Roadmapping | 3,437,633.00 |
| | Σ | 3,437,633.00 |

# Calls for proposals
# COMPET-2016



## Strategic Research Clusters

| Topic | COMPET-4-2016: **Space Robotics technologies** | RIA |
|---|---|---|

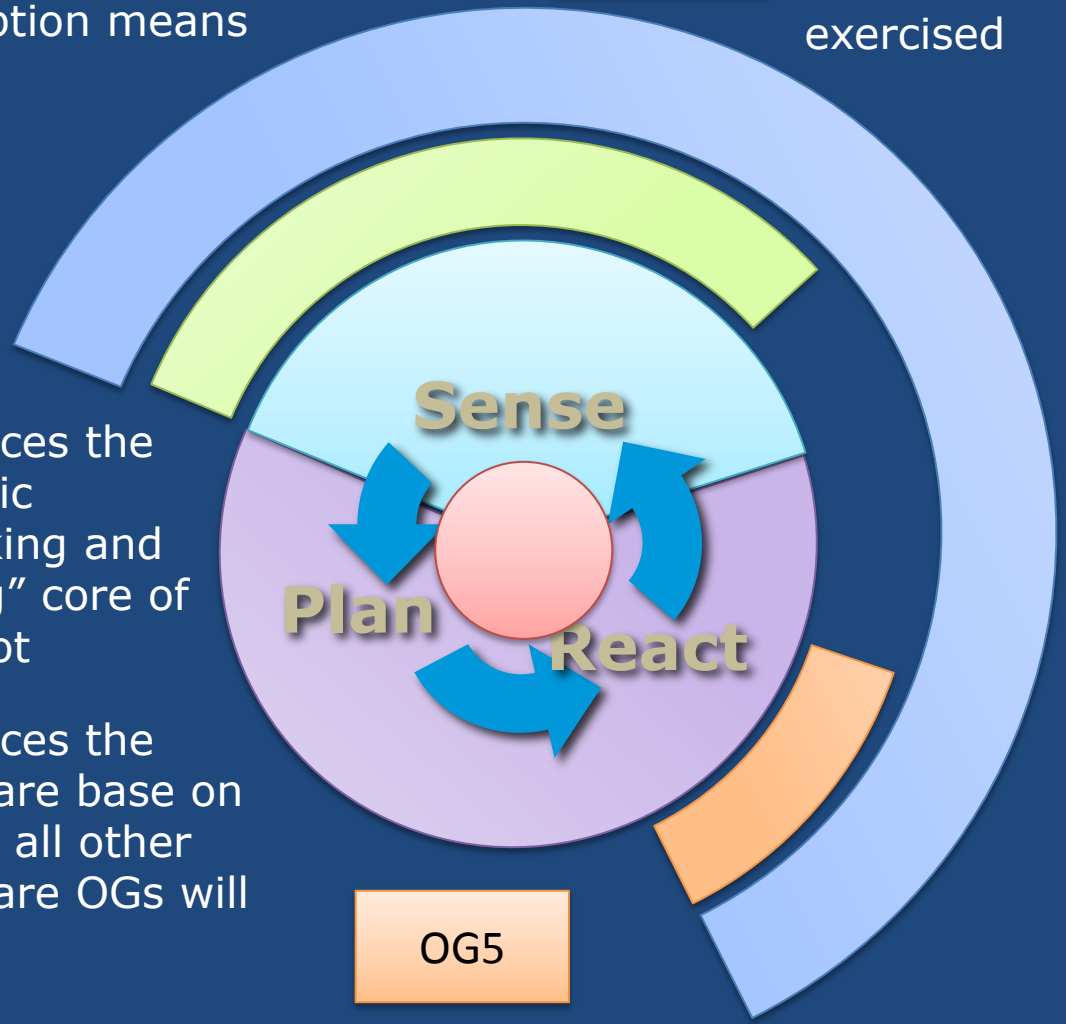
| Project acronym | Project title/keywords | EU contrib. (€) |
|---|---|---|
| **ERGO** | European Robotic Goal-oriented Autonomous Controller/ autonomy, controller, planning, scheduling, guidance, three layer, robotics, planetary, orbital | 3,236,950.00 |
| **ESROCOS** | European Space Robot Control Operating System/ open source robotics operating system | 3,499,995.75 |
| **FACILITATORS** | Facilities for testing orbital and surface robotics building blocks/ validation facilities | 1,000,000.00 |
| **I3DS** | Integrated 3D Sensors suite/ Autonomous Robotic spacecraft, Generic, Plug & Play, interface, pre-processing, sensor suite, INSES, capability | 3,393,663.75 |
| **InFuse** | Infusing Data Fusion in Space Robotics/ Sensing&Perception, Data Fusion | 3,493,952.50 |
| **SIROM** | Standard Interface for Robotic Manipulation of Payloads in Future Space Missions/ modular/scalable/standard interface, payload servicing, end-effector, robotic manipulation | 3,487,442.50 |
| | Σ | 18,112,004.50 |

OG4

Produces the generic suite of perception means

OG6

Provides the physical test environments in which the above OGs can be installed and exercised




OG3

Produces the generic perception core of a robot

OG2

Produces the generic "thinking and acting" core of a robot

OG1

Produces the software base on which all other software OGs will run

OG5

Produces the suite of hardware interfaces by which a robot can interact with man-made environment




## Strategic Research Clusters

| Topic | COMPET-3-2016-a: **In-Space electrical propulsion and station keeping – Incremental technologies** | RIA |
|---|---|---|

| Project acronym | Project title/keywords | EU contrib. (€) |
|---|---|---|
| **CHEOPS** | Consortium for Hall Effect Orbital Propulsion System / Hall effect; Competitiveness; In-space propulsion; Electric propulsion | 10,960,028.89 |
| **GIESEPP** | Gridded Ion Engine Standardised Electric Propulsion Platforms / Cost Effective Electric Propulsion System, Gridded Ion Engines, Dual Mode, Xenon Propellant Management System, LEO, GEO and MEO Propulsion Systems, High Power Systems | 7,499,999.39 |
| **HEMPT-NG** | High Efficiency Multistage Plasma Thruster – Next Generation / European non dependence, Alternative propellants, Green propellants, Dual mode operation, Magnetic plasma confinement, High current cathode, Plasma diagnostic, Plasma modelling, Erosion free thruster | 5,278,391.00 |
| | TOTAL EU Contribution Σ | 23,738,419.28 |

TOTAL Projects Cost EUR 32,808,844.16

***Innovation Actions***
***Planning of reviews every 6 months***
***42 or 48 months projects***
***Phase I: TRL 5/6 for Dual Mode and for Low Power EP systems***
***Prepare for Phase II : TRL 7/8 by 2023/2024***

# Calls for proposals
# COMPET-2016



## Strategic Research Clusters

| Topic | COMPET-3-2016-b: **In-Space electrical propulsion and station keeping – Disruptive technologies** | RIA |
|---|---|---|

| Project acronym | Project title/keywords | EU contrib. (€) |
|---|---|---|
| **MINOTOR** | **MagnetIc NOzzle thruster with elecTron cyclOtron Resonance** // Electron cyclotron resonance, ECR, electric propulsion, thruster, plasma, satellite, disruptive, magnetic nozzle, cathodeless, microwave, propellant | 1,485,809.50 |
| **HIPERLOC-EP** | **High performance low cost electric propulsion system development** // Electrospray Colloid Thruster; micro-satellite electric propulsion; CubeSat electric propulsion; high specific impulse low cost electric propulsion; | 1,385,975.00 |
| **GaNOMIC** | **GaN in One Module Integrated Converter for EP systems** // Electric propulsion, PPU, GaN, digital control, advanced packaging, embedded packaging | 1,544,160.00 |
| | Σ | 4,415,944.50 |

***Research and Innovation Actions***
***Planning of reviews every 6 to 12 months***
***24 or 36 months projects, TRL 4/5 at end of project***

# SRC progress

*Meeting the SRC objectives require the proactive management of an ambitious programme aiming at in-orbit demonstration & Europe's leadership in strategic markets:*

- **All SRC Operating Grants have been kicked-off between November 2016 and January 2017.**
- **They all have had at least one review in the presence of the REA and in the presence of the PSA representatives (ie ESA and Member State Space representatives)**

*Coherence, complementarity and coordination of the Operational Grants are capital for the success of the SRC*

- **For the Robotics SRC the challenge lies in the technical Coordination of the Operational Grants between themselves.**
- **For the EP SRC the biggest challenge is to address the confidentiality of state of the art developments in a highly competitive industrial arena.**

*Feedback on Roadmaps is initiated.*

*Co-organisation of strategic events: Workshops and dedicated Information Days.*

# Upcoming relevant Actions



**SPACE-11-TEC-2018:**
**Generic space technologies**
Sub-topic a) Innovative solutions for very high power systems
Specifically mentions .. high power electrical propulsion (> 20 kW) ..

**2019 - Coordination and Support Action:**
**Programmatic Support Actions for the Strategic Research Clusters**
Extension of EPIC

**SPACE-13-TEC-2019:**
**SRC – In-Space electrical propulsion and station keeping**
Disruptive technologies

**SPACE-28-TEC-2020:**
**SRC – In-Space electrical propulsion and station keeping**
Incremental grants Phase II with objective to reach TRL 7-8 for LEO and Dual Use GEO applications

**SPACE-18-TEC-2019-2020:**
**In-orbit validation/demonstration – Mission design, integration and implementation**

# Disruptive Technologies – 2019 Call

## SPACE-13-TEC-2019: SRC – In-Space electrical propulsion and station keeping

***Specific Challenge:***

*The challenge of this strategic research cluster (SRC) is to enable major advances in Electric Propulsion (EP) for in-space operations and transportation, in order to contribute to guarantee the leadership through competitiveness and non-dependence of European capabilities in electric propulsion at world level within the 2020-2030 timeframe, always in coherence with the existing and planned developments at national, commercial and ESA level.*
*The specific challenge of this action is to enable faster maturation of promising disruptive thruster concepts and technologies, as a necessary step towards demonstration actions.*

European Commission

## SPACE-13-TEC-2019: SRC – In-Space electrical propulsion and station keeping

***Scope:***

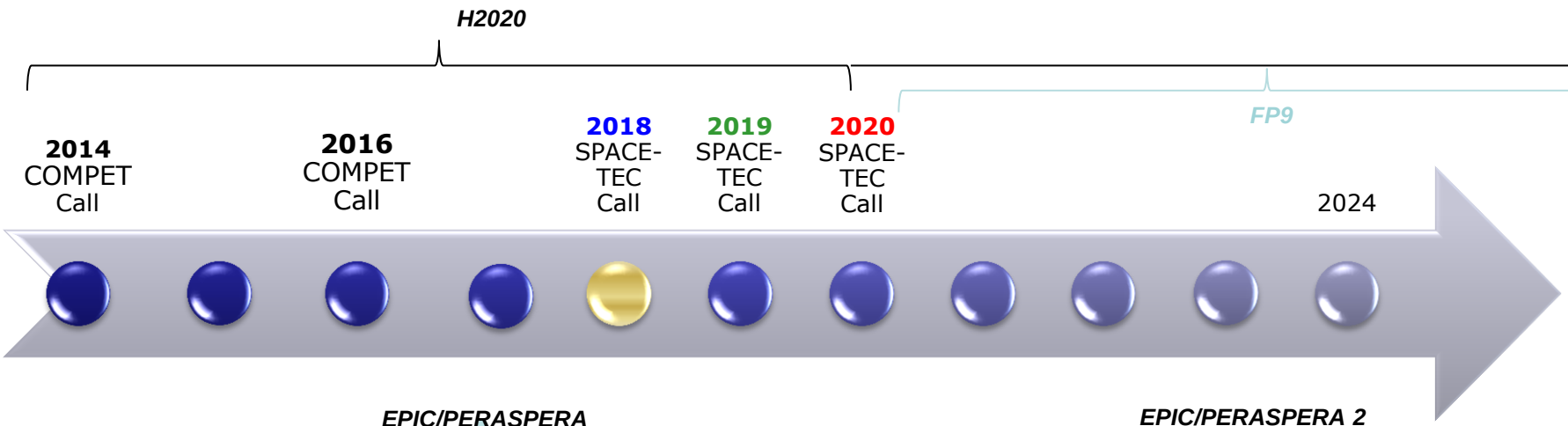
*Proposals shall cover one of the following:*

- *Thruster concepts or technologies for disruptive electric propulsion systems such as Helicon Plasma Thrusters (HPT), Electron Cyclotron Resonance plasma thrusters (ECR), Magneto Plasma Dynamic thrusters (MPD), Pulsed Plasma Thrusters (PPT), micro-propulsion electric thrusters, or any other innovative electric thruster concepts and relevant technologies for disruptive electric propulsion systems.*
- *Transversal concepts and technologies for disruptive electric propulsion systems, such as power condition electronics, direct drive, magnetic nozzles, alternative propellants, testing techniques, materials.*

*Proposals may target any part of the technology readiness levels (TRL) scale:*

- *Breakthrough technologies starting at low or very low TRL (<4), aiming to promote promising and potentially disruptive thrusters concepts in the field of Electric Propulsion.*
- *Promising technologies starting at higher TRL (≥4), enabling significant improvements of Electric Propulsion system performances, cost and fit to the market. Proposal for higher TRL should include the best possible combination of a market analysis and an application impact analysis.*

# Timeline




PSA

EPIC/PERASPERA

EPIC/PERASPERA 2

EP Incremental line

CHEOPS, GIESEPP, HEMPT-NG

SPACE-TEC-2020 Call

EP Disruptive line

GaNOMIC, MINOTOR, HIPERLOC-EP

SPACE-TEC-2019 Call

Robotics

Building Blocks GA: OG1 to OG6

SPACE-TEC2018 Call - Applications: On-orbit servicing and planet exploration

Robotics technologies from SPACE-TEC2020 Call

IOD/IOV missions

2019 SPACE-TEC Call

launch

2020 SPACE-TEC Call

launch

Space

European Commission


# Thank you
# for your attention

**Find out more:**
http://ec.europa.eu/growth/sectors/space/research/horizon-2020/index_en.htm