

R&D Activities/Roadmap under European Commission

H2020 SRC "In-Space electrical propulsion and station keeping"

Thessaloniki, 3rd October 2016

ESPC: Round-Table: "Cost reduction for PPU's in Electric Propulsion".

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- H2020 and the SRCs
- The SRC “In-Space electrical propulsion and station keeping”
- The EPIC PSA
- SRC COMPET-3-2016 call
- SRC evaluation and GAP period
- SRC and EPIC PSA next steps and EPIC Workshops

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Horizon 2020 Space WP 2016-17 structure

EGNSS

Galileo & EGNOS
applications and
infrastructure

Calls for proposals:

- EGNSS applications

Other actions:

- Evolution of EGNSS infrastructure, mission and services

EO

Earth Observation
applications and services

Calls for proposals:

- EO downstream applications
- Evolution of Copernicus services
- EO "big data" shift

COMPET

Competitiveness of the
European Space sector:
Technology and Science
(incl. Space Weather)

Calls for proposals:

- Critical space technologies
- **Strategic Research Clusters**
- EO & SatCom technologies
- Science and Exploration
- Space Weather
- Space Portal
- Technology transfer

Other actions:

- ESA Engineering support
- Horizon prize on low-cost access to space

SST

Space Surveillance
and Tracking support
framework

Other actions:

- Contribution to the SST support framework
- Improving the performance of SST at European level

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What is a Strategic Research Cluster?



Implements **multiannual strategic agendas** in key research areas

Implemented through a system of interconnected grants:

- **“Programme Support Activity” (PSA): EPIC**
 - Prepares a roadmap and implementation plan for the whole SRC
 - Advises the Commission on definition of calls for operational grants
 - Facilitates and supervises the coordination of grants
 - Assesses the evolution of operational grants in the SRC context
- **Several "operational grants":**
 - Address different technological challenges identified in the roadmap.
 - Separate projects but with obligation to coordinate/cooperate within the cluster
 - The expected results of the individual grants would, when taken together, achieve the overall objective of the SRC.

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Strategic Research Cluster

Key feature: coordination between grants

- Formalised in a **collaboration agreement** and in the **workplans** of individual grants
- Key role of PSA to facilitate and supervise coordination

REA responsibility

- Proposal evaluation using independent experts (w. specific SRC brief)
- Contract preparation and management, including monitoring, payment etc.

Commission responsibility

- Preparation of future calls (based on advice from the PSA and REA)
- Overall assessment of the SRC instrument

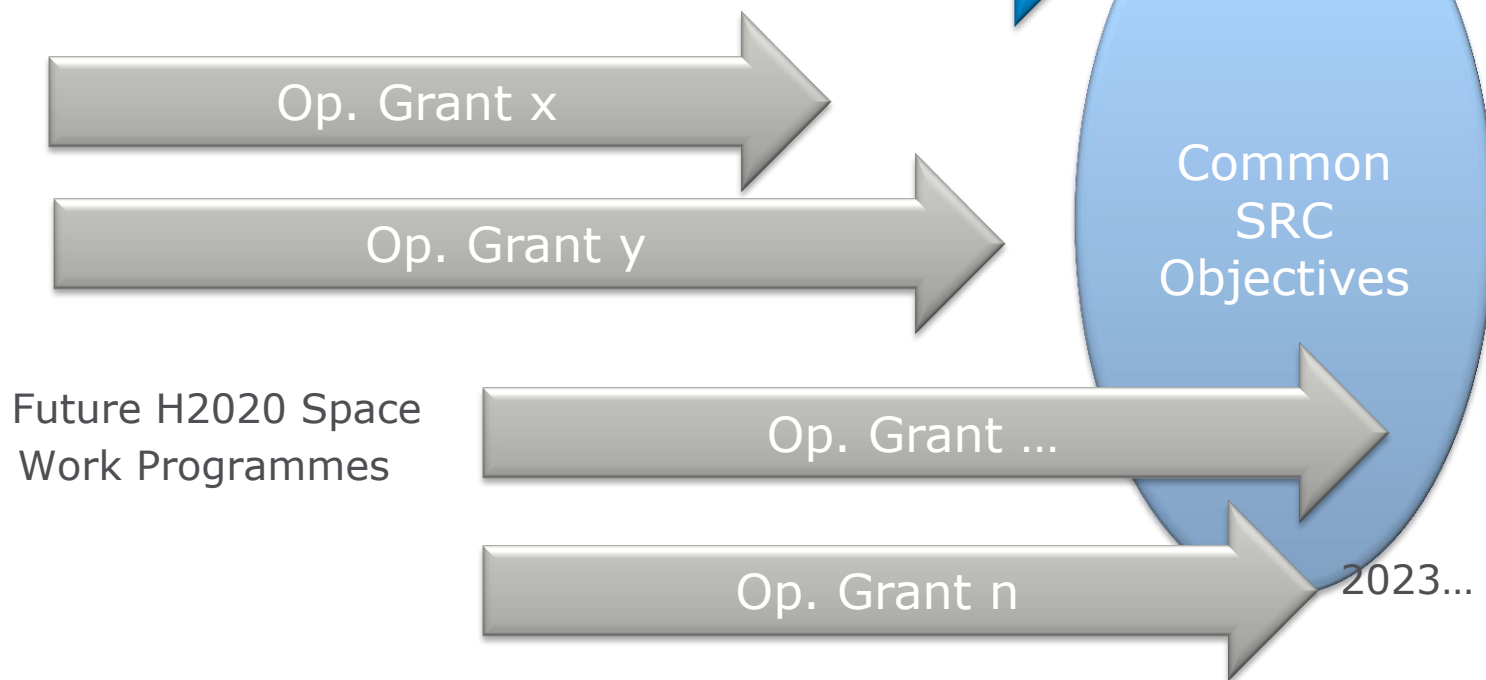
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SRC Concept and Composition

Oct. 2014

2019...

H2020 Space
Work Programme
2016-17



Within each SRC **the beneficiaries** of each awarded grant **will collaborate** for the **purposes of the cluster** with the beneficiaries of the other awarded grants.

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- **EPIC** (grant n. 640199) is the PSA project funded as part of the H2020 Space WP 2014.
- 5 years duration, starting October 2014.
- **EPIC = Electric Propulsion Innovation and Competitiveness**



- Most partners in both projects have been and are funding already through ESA or National Programmes more than substantial research and development in technology and space missions involving electric propulsion.
- All partners are already since many years harmonising (together with all ESA member states) R&D in Technology through the **European Technology Harmonisation Advisory Group (THAG)** → roadmapping and consultation exercises.
- Knowledge, experience and expertise to support the H2020 SRCs.

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EPIC PSA: main tasks



Both PSAs produce a number of deliverables that will allow, mainly:

- Evaluation on the **state of the art** and **needs** of stakeholders
- Definition and refinement of **SRC roadmap** and master plan for implementation
- Definition of **Call topics and related documents** for H2020 Work Programmes for funding of SRC Operational Grants
- SRC **Risk** management
- Definition of the **collaboration** aspects between SRC grants, including the PSA
- **Assessment of the progress** and results of the Operational Grants, in the context of the SRC objectives
- **Dissemination** and education activities

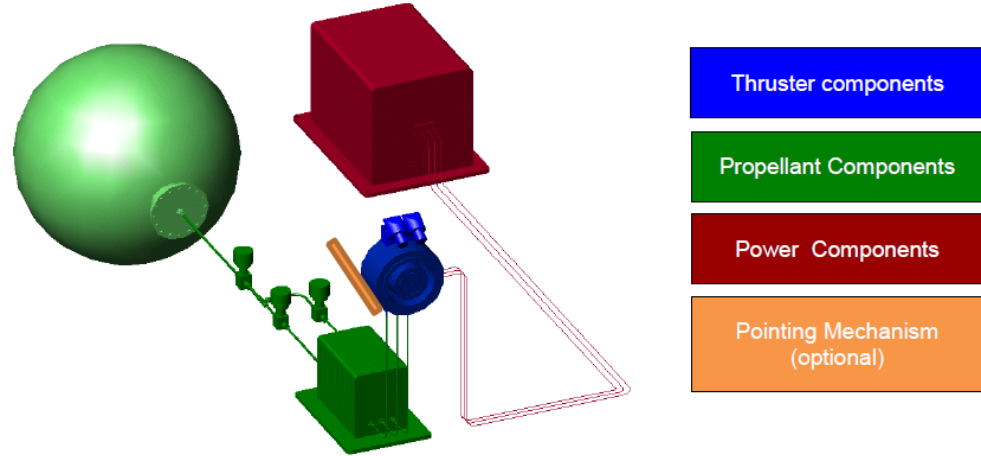
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2016 call Guidelines: High level SRC Roadmap

- For the projects to be developed within the H2020 SRC, the Electric Propulsion System (EPS) **does not** include:

- the thrust orientation mechanisms
- the tanks
- The spacecraft power generation and distribution subsystem



- “EPS”** as used in the H2020 SRC documentation is composed of **the thruster, cathode (where applicable), PPU and fluidic management system only** → Specially important for Incremental line proposals.
- Common aspects to all thruster-based systems are:**
 - Alternative/non-conventional propellants
 - High power testing facilities and diagnostics
 - EPS testing methods – standardisation of EP testing

These common lines are not meant to be separate projects. **All projects should take these common topics into account and propose solutions.**

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COMPET-3-2016: Introduction and Challenge



COMPET-3-2016

SRC In Space Electrical Propulsion and Station Keeping

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.

- This call topic is divided in two “sub-topics”, addressing different Scope and Expected Impact
 - **COMPET-3-2016-a Incremental Technologies**
 - **COMPET-3-2016-b Disruptive Technologies**

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COMPET-3-2016: Scope

COMPET-3-2016-a

In-Space electrical propulsion (EP) and station keeping - Incremental Technologies

SCOPE *Proposals shall enable incremental advances in technologies for Electric Propulsion systems based on:*

- 1 - Hall Effect Thrusters (HET)
- 2 - Gridded Ion Engines (GIE)
- 3 - High Efficiency Multistage Plasma Thrusters (HEMPT)

*Recommended project size
Indicative budget
Type of action*

HET 7.5 to 11 M€

GIE 5.5 to 7.5 M€

HEMPT 4.5 to 5.5 M€

18 M€

**Innovation
Actions**

COMPET-3-2016-b

In-Space electrical propulsion (EP) and station keeping - Disruptive Technologies

SCOPE *Proposals on potentially disruptive concepts in of EP which in the long term could change the landscape, addressing:*

- Transversal technologies for disruptive EP systems (not thrusters) → Maximum 1 proposal
- Technologies devoted to specific disruptive EP thrusters
Maximum 4 proposals

1 to 1.5 M€

5 M€

**Research and
Innovation
Actions**

agreement No 640199
information it contains.

COMPET-3-2016-a Incremental Technologies



- **Incremental technologies** are those considered **mature enough** at the moment to allow for incremental steps **to enable capabilities** such as **dual mode, higher/lower power, Electric Orbit Raising (EOR)**, required by a number of **applications such as telecommunications, LEO / MEO missions, space science and exploration, space transportation** which the current systems (some of them qualified and some with flight heritage) are not able to provide.
- Proposals shall, therefore, enable incremental advances in the already known technologies for **Electric Propulsion systems based on:**
 1. **Hall Effect Thrusters (HET)**
 2. **Gridded Ion Engines (GIE)**
 3. **High Efficiency Multistage Plasma Thrusters (HEMPT)**
- A **maximum of one proposal per aforementioned technology** (1, 2, 3) will be selected, with the target of supporting all three technologies.
- Proposed requested contribution from the EU of **between:**
 1. **HET: EUR 7.5 and 11 million**
 2. **GIE: EUR 5.5 and 7.5 million**
 3. **HEMPT: EUR 4.5 and 5.5 million**

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- A **'disruptive space technology'** is an **emerging technology** that disrupts the status quo of the space sector by **replacing the dominant technology** and provides a **radical improvement in performance** that is perceived as valuable by a customer or part of the market, or it **opens up new opportunities not possible with the incumbent technology**.
- If a disruptive technology can be identified early enough, **accelerating** the development of that technology would help sustain advances in performance.
- Emerging technologies that are potentially 'disruptive' often underperform compared to the dominant technology in early development phases – **the underlying physics may not be fully understood** for example and more R&D is required to properly ascertain performance attributes.

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COMPET-3-2016-b Disruptive Technologies

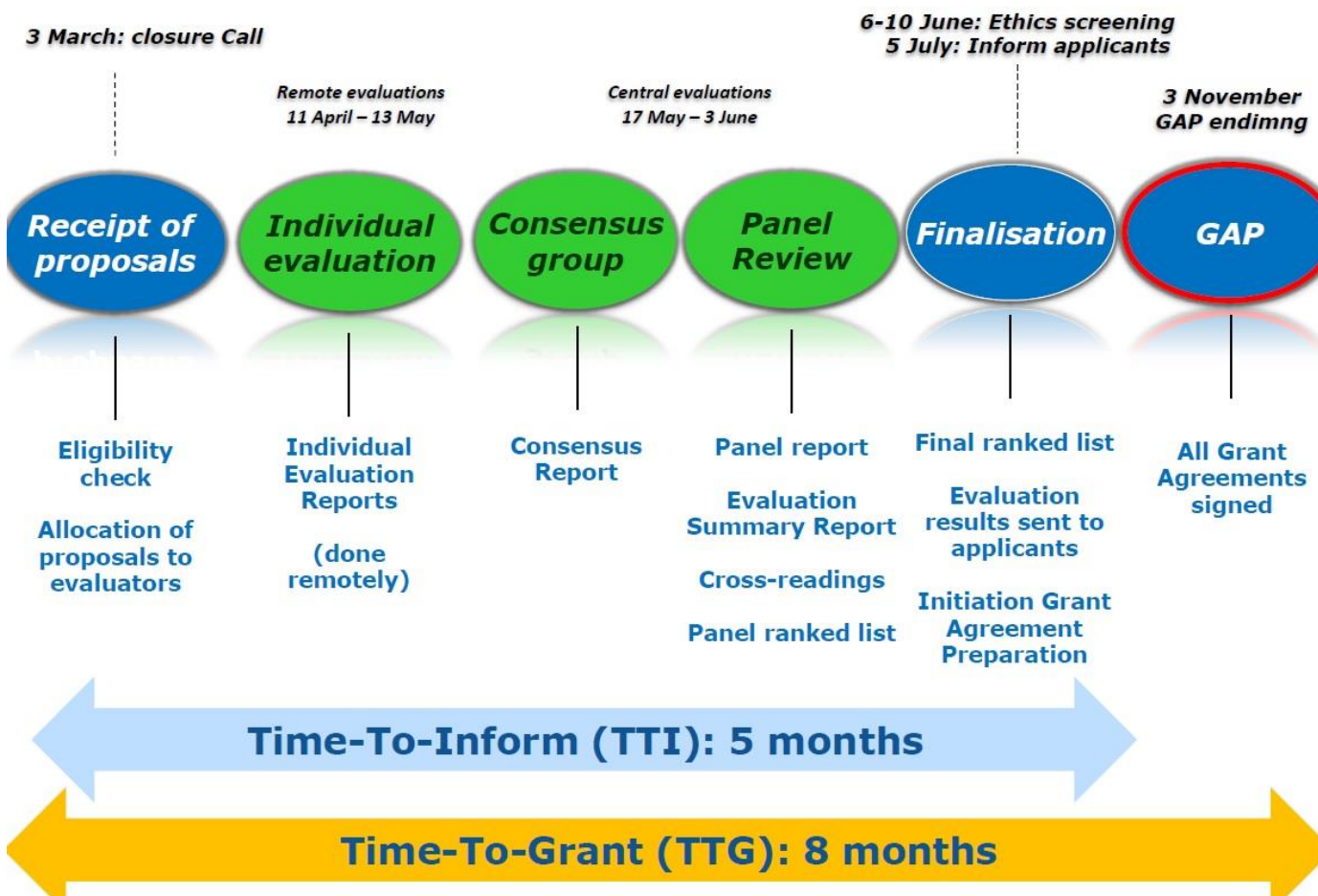
- Proposals are expected on the areas of disruptive technologies for Electric Propulsion and for EP thrusters, that are currently at **low TRL (≤ 4) and not part of the incremental line (COMPET-3-2016-a)**.
 - **Indicatively and non-exhaustively, EP thrusters** based on concepts such as:
 - Helicon Plasma Thrusters (HPT),
 - Electron Cyclotron Resonance plasma thrusters (ECR),
 - Magneto Plasma Dynamic thrusters (MPD),
 - Pulsed Plasma Thrusters (PPT),
 - micro-propulsion electric thrusters, etc.
 -
 - **Transversal** relevant technologies for **disruptive electric propulsion systems**, such as, indicatively:
 - direct drive,
 - **radical new PPU architectures,**
 - dedicated spacecraft power system architectures and/or materials
 -
- Proposals for disruptive technologies **shall NOT address incremental thruster technologies** (e.g. micro-GIE, etc.).

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COMPET-3-2016

Proposals evaluation and GAP period

Overview evaluation +GAP 2016



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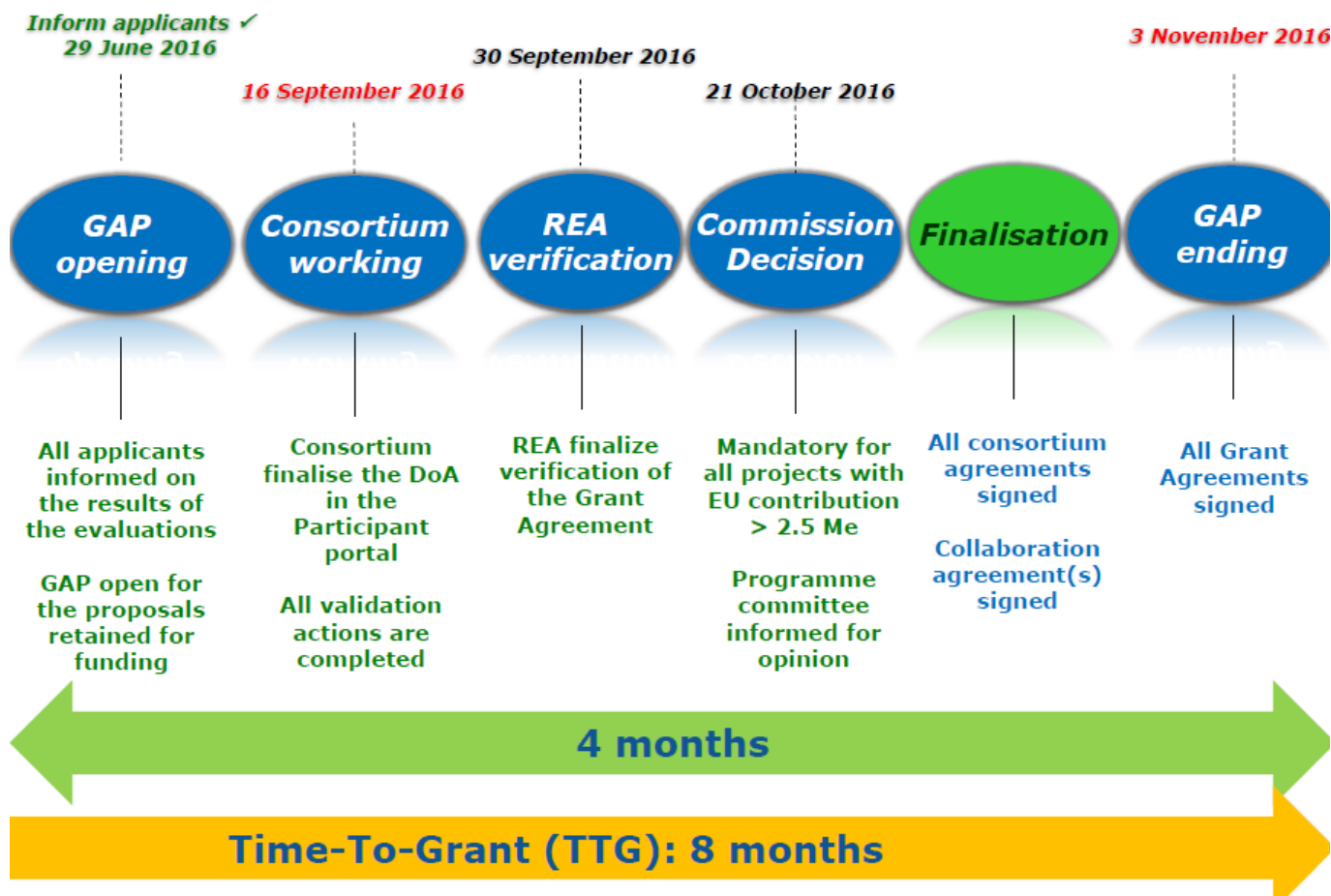
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COMPET-3-2016

Proposals evaluation and GAP period



GAP 2016 milestones



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COMPET-3-2016

Proposals selected into GAP period

- The list of proposals selected is still preliminary pending on minor evolution and adjustments of the proposals due to the special nature and objectives of the Electric Propulsion SRC, and the Collaboration Agreement and Grant Agreement (GA) signature.
- Grant Agreement Preparation process does not constitute a formal commitment for funding.
- The proposals selected under COMPET-3-2016-a (Incremental Technologies) are the 3 proposals presented: **CHEOPS, HEMPT-NG, GIESEPP**.
 - Incremental Technologies proposals include PPU activities for each particular type of thruster and mission as part of the EP Subsystem.
- The proposals selected under COMPET-3-2016-b (Disruptive Technologies) have been 3 proposals from the 18 presented: **GaNOMIC, HiperLoc-EP, MINOTOR**.
 - One Disruptive Technology proposal, is fully devoted to Transversal technologies for PPUs (GaNOMIC).

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Next steps in the SRC.... and Workshops



- 2017: KO and implementation of SRC COMPET-3-2016 OGs,
- 2018: Consultation for the next version of the SRC Roadmap,
- 2018: Preparation of next Work Programme,
- 2019: Preparation of proposals for the next H2020 SRC call on 2019 (or 2020) Work Programme for Incremental and Disruptive Technologies.
- 2017-2019: Participation in the EPIC Workshops and H2020 Info Days

2Q 2017/ Madrid EPIC Workshop

- progress of PSA and SRC
- **presentation of 2016 OGs**

3Q 2018/ London EPIC Workshop

- progress of PSA
- **progress of 2016 OGs**
- Consultation on update of EPIC Roadmap (open to all interested stakeholders)

Sept/Oct. 2019/ ESTEC EPIC Workshop

- Final presentation of PSA
- **results of 2016 OGs**
- Consolidated 2nd Issue EPIC Roadmap and view for 2020 WP SRC topic

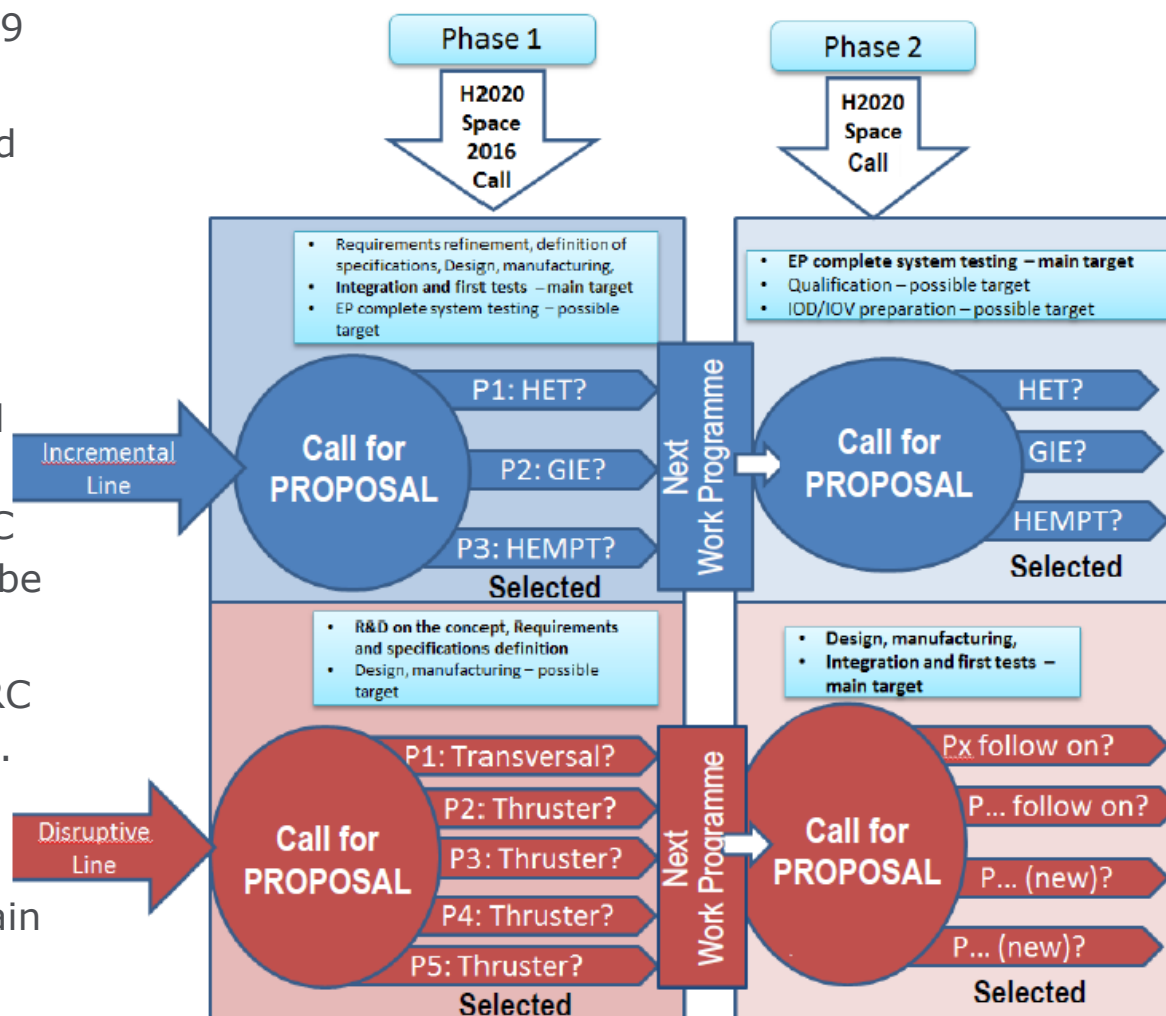
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SRC Next call and Roadmap update



- Next H2020 EP SRC Call on 2019 (or 2020) Work Programme
- Incremental Technology line and Disruptive Technology line will remain as two separate topics with its particularities in the Roadmap.
- Next phase OGs will be selected based on a new Work Programme, proposed by the EC (with support from the PSA) to be adopted by the PC.
- The tentative budget for this SRC call is not defined yet by the EC.
- Continuation or/and establishment of new projects, expected funding, etc. will remain OPEN until the future Work Programmes are adopted.



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Many thanks for your attention

For more information on the EPIC PSA activities, please refer to:

[@EPICCh2020](http://www.epic-src.eu)

For more information on the H2020 space activities, please refer to:

[@EU_H2020](http://ec.europa.eu/growth/sectors/space/research/horizon-2020/index_en.htm)