Research activities in EEE space components within FP7 and Horizon 2020

ESCCON 2016
European Space Components Conference
ESA / ESTEC, 1-3 March 2016

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Space Policy and Research Unit
DG GROW - European Commission

Summary

Research activities in EEE space components

1. FP7 (2007-2013)
5. Conclusions
1 - Research activities in EEE space components

FP7 (2007-2013)

Space in FP7
2007-2013

The indicative breakdown (€ million) of FP7
Cooperation

FP7 → 53.272 M€

The Cooperation Programme breakdown (€ million)

Space in FP7
~ 1.900 M€
(3.6%)
Activities developed in FP7 / SPACE

Space Foundations & CC

Space Research Projects

Operational budgets

21.3 % 293 M€

Technology Projects in FP7 / Space

EU contribution: 192 M€

102 projects

7.7 participants / project

29.9%

4.3%

6.6%

6.9%

7.3%

7.5%

8.2%

12.3%

Topic on European non-Dependence

- Critical Space Technologies (31)
- In-space propulsion (11)
- Robotics (7)
- Space debris (5)
- Sensors and detectors (8)
- IOD-Satellites (5)
- Re-entry technologies (9)
- Materials and Structures (5)
- RF Systems (4)
- Access to space (4)
- Actuators (3)
- Habitats / Human exploration (3)
- S/C electrical power (2)
- Other topics (5)
**What is “non-dependence” ?**

Technology “non-dependence” means assured (non-dependent) access to any technology required to implement Europe’s space missions.

Non-dependence does not mean producing everything in house.

It is not just an ITAR problem, non-export restricted products come with limitations that create undesirable dependence.

It is not only an issue for EEE parts, but affects other technologies and products.

It is not an issue of end products only but affects all capabilities in the complete supply chain.

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**Joint Task Force (JTF) between the European Commission, ESA and EDA**

One of the key objectives of the European Space Policy is to ensure non-dependence on critical space technologies.

The European Commission, the European Space Agency (ESA) and European Defence Agency (EDA) are jointly running the European Non-Dependence process since 2009 that has the objective to map the situation and identify actions for strategic non-dependence in the area of critical space technologies.
Critical Space Technologies in FP7 / Space

Main technologies addressed with FP7 projects on Critical Space Technologies

<table>
<thead>
<tr>
<th>EEE related 54.6 %</th>
<th>Gallium Nitride (GaN) (10.6 M€)</th>
<th>AGAPAC, EUROCIS, AL-IN-WON, GANSAT, SLOGAN</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TeraHertz</td>
<td>MIDAS, TERACOMP</td>
</tr>
<tr>
<td></td>
<td>Processors</td>
<td>DSPACE, MacSpace</td>
</tr>
<tr>
<td></td>
<td>Analog-to-Digital Converters (ADC)</td>
<td>COMETS</td>
</tr>
<tr>
<td></td>
<td>Application-Specific Integrated Circuits (ASIC)</td>
<td>VHSSI</td>
</tr>
<tr>
<td></td>
<td>CMOS imagers</td>
<td>EUROCIS</td>
</tr>
<tr>
<td></td>
<td>Memories</td>
<td>SKYFLASH</td>
</tr>
<tr>
<td></td>
<td>Superconductor Quantum Interferometers (SQUID)</td>
<td>E-SQUID</td>
</tr>
<tr>
<td></td>
<td>Cryogenics electronics</td>
<td>CCR</td>
</tr>
<tr>
<td></td>
<td>Micro-Miniaturized Integrated Circuits (MMICS) + RF MEMS</td>
<td>SATURNE</td>
</tr>
<tr>
<td>Photonics related 16.1 %</td>
<td>High power components</td>
<td>HIPPO</td>
</tr>
<tr>
<td></td>
<td>Electro-photonic ADC</td>
<td>PHAER</td>
</tr>
<tr>
<td></td>
<td>Optical interconnectivity</td>
<td>MERLIN</td>
</tr>
<tr>
<td></td>
<td>Optical clock</td>
<td>SOC2</td>
</tr>
<tr>
<td>Remaining Technologies 29.3 %</td>
<td>Flow and Pressure</td>
<td>µFCU, µPRS</td>
</tr>
<tr>
<td></td>
<td>Materials</td>
<td>SMARTIES, EUCARBON, HYDRA, AERSUS</td>
</tr>
<tr>
<td></td>
<td>Mechanisms</td>
<td>HARMLES, MAGDRIVE</td>
</tr>
<tr>
<td></td>
<td>Structures</td>
<td>DEPLOYTECH</td>
</tr>
</tbody>
</table>

Space RTD projects

- 'Grants'
  - Not overly prescriptive
  - Broad description (not in excess) of call topics
  - Bottom-up

- Policy and Work Programme (DG GROW)
- Evaluation/Implementation (Agencies: REA, GSA, EASME)

- Open competition
  - No geo-return principle
  - Evaluation by independent experts
**Critical Space Technologies**

EU Contribution per country in FP7

Fostering cooperation in Europe at transnational level

Type of participants in FP7/Space projects

- Public Adm.
- Others
- Academia
- Space Research Organizations
- Space Industry
- SMEs

EC Contribution per type of organization

- 15.8 M€
- 11 M€
- 32 M€

EU Contribution

- 42 Universities
- 95 Companies
- 32 Public Research Organizations
999 PROPOSALS submitted in 6 CALLS
262 PROJECTS have been supported by FP7
EU funding 662 MC

Further information available in
Example of a fact sheet

2 - Research activities in EEE space components

**Horizon 2020**

**HORIZON 2020 BUDGET (in current prices)**

€ 79 billion from 2014 to 2020

- **Industrial Leadership**
  - EUR 17.0 billion
- **Societal Challenges**
  - EUR 29.7 billion
- **Excellent Science**
  - EUR 24.4 billion
- **European Institute of Innovation and Technology**
  - EUR 2.7 billion
- **Euratom (2014-2018)**
  - EUR 1.6 billion
- **Other**
  - EUR 3.2 billion

2013 figures

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**Space Programmes**

**Multiannual Financial Framework 2014-2020**

- **Copernicus**
  - ~ 12.000 M€
- **GALILEO**
  - ~ 3.800 M€
- **EGNOS**
  - ~ 6.300 M€
- **HORIZON 2020**
  - ~ 1.400 M€
The Space Theme in Horizon 2020

Industrial Leadership

- Information and Communication Technologies (ICT)
- Nanotechnologies
- Biotechnology
- Advanced manufacturing and Processing

LEIT - Leadership in enabling and industrial technologies

Key Enabling Technologies

Space Theme

Excellent Science

Beneficiary

Societal Challenges

There is a place for SPACE everywhere

Frontier research European Research Council (ERC)
Future and Emerging Technologies (FET)
Marie Curie actions on skills, training and career development
Research Infrastructures

Innov. SMEs
Access Risk Finance

Space in H2020

Health...
Food-Agriculture-Marine...
Energy...
Transport...
Environment...
Inclusive societies...
Security...
Four objectives Specific Programme proposal

- **Enhance competitiveness, non-dependence, and innovation of EU space sector**
  
  The objective is to maintain a globally leading role in space by safeguarding and developing a competitive space industry and research community and by fostering space-based innovation

- **Enable advances in space technologies**
  
  The objective is to ensure the capability to access space and to operate space systems to the benefit of European society in the next decades

- **Increase exploitation of space data**
  
  The objective is to ensure more extensive utilisation of space data from existing and future European missions in the scientific, public and commercial domain

- **Enable participation in international space partnerships**
  
  The objective is to support the European research and innovation contribution to long term international space partnerships

+ relevant space applications under Societal Challenges

  - Transport, Climate, Security,.....


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CSTs in the H2020 Space building blocks

- **Satellite Navigation** (Galileo and EGNOS)
- **Earth Observation** (Copernicus)
- **Competitiveness of the European Space sector**
- **Protection of the European Space Assets**

<table>
<thead>
<tr>
<th>Applications</th>
<th>EGNSS evolution</th>
<th>Earth Observation (Copernicus)</th>
<th>Applications</th>
<th>Technologies for European non-dependence and competitiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data</td>
<td>Copernicus evolution</td>
<td>Competitiveness of the European Space sector</td>
<td>Independent access to space</td>
<td>Space Surveillance and Tracking</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Space Science and Exploration</td>
<td>Space Weather, Space Debris, Near Earth objects</td>
</tr>
</tbody>
</table>

Bottom-up engagement of SMEs in space R&D (SME Instrument) / Fast Track to Innovation pilot
**H2020 Space Work Programmes**

**2014-2015** work programme published in 10 December 2013
- 2014 call: call closed, grants signed, projects launched in January 2015
- 2015 call: call closed, projects in the phase of 'grant preparation'

**2016-2017**
Work programme pre-published (14 October 2015)
Opening date: 10 November 2015
- **2016 call** deadline 3 March 2016
- **2017 call** deadline 1 March 2017

**Work Programme 2014-2015**

**Competitiveness of the European Space Sector**

*Non-dependence & technology development*
Horizon 2020 Space in the Participant Portal

Horizon 2020 Participants Portal:

**H2020 Space Work Programme**

**Calls for proposals**

**Types of actions and Funding rates**

- **Research and innovation actions (Funding rate: 100%)**: Projects aiming to establish new knowledge, new or improved technology by possibly including basic and applied research, technology development, testing and validation on a small-scale prototype.

- **Innovation actions (Funding rate: 70% - exception: 100% for non-profit legal entities)**: Projects aiming to produce plans, arrangements or designs for a new or improved product, design, process or service by possibly including large-scale product validation and market replication.

- **Coordination and support actions (Funding rate: 100%)**: Projects consisting of accompanying/complementary measures (standardisation, awareness-raising, communication, policy dialogues, networking, studies, etc.)
COMPET-1: Technologies for European non-dependence and competitiveness

2014
U1 - Space qualification of low shock non-explosive actuators
U2 - Advanced thermal control systems
U5 - Alternative to Hydrazine in Europe
U11 - Application Specific Integrated Circuits (ASICS) for Mixed Signal Processing
U17 - High density (up to 1000 pins and beyond) assemblies on PCBs

2015
U4 - Advanced materials and material technology for combustion chambers
U6 - Fibre Optic Gyro (FOG) based Inertial Measurement Unit - IMU
U7 - Power amplification: Travelling Wave Tube (TWT) materials
U12 - High Capacity Field-Programmable Gate Array (FPGA)

<table>
<thead>
<tr>
<th>Topic Project Title</th>
<th>EU contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEGASUS Flight Qualification of Deployable Radiator using Two Phase Technology</td>
<td>3.534.174 €</td>
</tr>
<tr>
<td>REACT ReSettable Hold-Down and Release ACTuator</td>
<td>2.731.451 €</td>
</tr>
<tr>
<td>Rheform Replacement of Hydrazine for orbital and launcher propulsion systems</td>
<td>3.787.554 €</td>
</tr>
<tr>
<td>SEPHY SPACE ETHERNET PHYSICAL LAYER TRANSCEIVER</td>
<td>3.115.223 €</td>
</tr>
<tr>
<td>ERFTM Export Restriction Free Travelling wave tubes Materials</td>
<td>3.126.720 €</td>
</tr>
<tr>
<td>VEGAS Validation of European high capacity rad-hard FPGA and software tools</td>
<td>3.976.861 €</td>
</tr>
<tr>
<td>SaShA Si on SiC for the Harsh Environment of Space</td>
<td>997.130 €</td>
</tr>
<tr>
<td>PAMPA Plastic Components for Advanced Microwave Equipment of New Generation SatCom Payloads</td>
<td>1.036.877 €</td>
</tr>
<tr>
<td>PhySIS Sparse Signal Processing Technologies for HyperSpectral Imaging System</td>
<td>1.028.000 €</td>
</tr>
<tr>
<td>R2RAM Radiation Hard Resilient Random-Access Memory</td>
<td>1.039.363 €</td>
</tr>
<tr>
<td>TCLS ARM FOR SPACE Feasibility and Definition of a Triple Core Lockstep ARM System-on-Chip for Space Applications</td>
<td>1.027.338 €</td>
</tr>
</tbody>
</table>

Projects in Low TRL topics WPs 2014-2015

There are other topics available for EEE components

COMPET-6-2014: Bottom-up space technologies at low TRL

- "high-resolution optical and radar observation related technologies (including hyperspectral systems)", "radiation-hardened instrument components", "in-situ sensors/instruments of physical parameters", "technologies for flexible/new generation SatCom payloads" and "advanced inter-satellite and/or downlink communications and tracking techniques (RF or Optical)".

COMPET-3-2015: Bottom-up space technologies at low TRL

- "energy storage", "energy production", "materials and structures", "additive layer manufacturing techniques", "mechanisms", "wireless power transmission", "high performance and reliable electronics to boost on-board power", and "thermal control management systems"
Horizon 2020 Space projects

- H2020 Space Projects at REA webpage

SME Instrument and Fast Track to Innovation

THE FRAMEWORK PROGRAMME FOR RESEARCH AND INNOVATION

HORIZON 2020
Why the SME Instrument?...  
...To get across the Valley of Death...

A Major Hurdle for Innovators
The Valley of Death

New Ideas are “new” - Often they cannot attract support

What’s needed? Capital to Transform Ideas into Innovations

No Capital

Innovation, Product Development and Growth

SME Instrument target
Technology readiness level 6 or above

operation / production phase

TRL1 Basic Technology Research  TRL6 Technology Demonstration  TRL7  TRL8 System Launch & Operation  TRL9
SME Instrument phases

SME Instrument

EEE related projects selected in the SME Instrument / Space

<table>
<thead>
<tr>
<th>Topic</th>
<th>Project</th>
<th>Title</th>
<th>EU contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space-SME-2014-1</td>
<td>ASC</td>
<td>Amorphous Speculative Compression</td>
<td>50,000 €</td>
</tr>
<tr>
<td></td>
<td>SIMPLE</td>
<td>Spacefibre IMPLementation design test Equipment</td>
<td>50,000 €</td>
</tr>
<tr>
<td>Space-SME-2015-1</td>
<td>SPACE-DSP</td>
<td>REPROGRAMMABLE GENERAL PURPOSE INSTRUMENT FOR DIGITAL SI</td>
<td>50,000 €</td>
</tr>
<tr>
<td></td>
<td>SPACEFIT</td>
<td>SPace-Compatible Filters in dielectric waveguide Technology</td>
<td>50,000 €</td>
</tr>
<tr>
<td></td>
<td>Blink</td>
<td>Software, not Hardware: Revolutionising Satellite Data Acquisition</td>
<td>50,000 €</td>
</tr>
<tr>
<td></td>
<td>EO-SLR</td>
<td>Enhanced Satellite Laser Ranging System</td>
<td>50,000 €</td>
</tr>
<tr>
<td></td>
<td>iSIM</td>
<td>Integrated Standard Imager for Earth Observation Microsatellites</td>
<td>50,000 €</td>
</tr>
</tbody>
</table>
Fast Track to Innovation Pilot
THE ULTIMATE BOOST FOR OUTSTANDING BUSINESS INNOVATORS WITH A NEED FOR SPEED...

**Preparation**
- Build a feasibility/intention-compliant consortium (minimum 2 partners, maximum 6 partners)
- Must be based in the EU (or in a Horizon 2020 associated country)

**Develop Your Innovation**
- Receive an EU grant of EUR 1 million to 3 million (70% of funding, 100% of funding for non-profit entities)
- From Mature R&D to Market-Oriented R&D to Market-Mature Innovation
- 6 months time to grant
- 12-24 months for implementation
- At least 36 months from grant to market

**Market**
- Market-ready result (technical product, service, process/TRL 9)

...AND EAGER TO COMPETE ON GLOBAL MARKETS,!

**Activities Supported**
- Systems validation in real working conditions – Testing – Piloting – Business model validation – Standard setting – Pre-normative research – EU quality label

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FTI Pilot – Useful Information

3 - Research activities in EEE space components

Horizon 2020 (2016-2017)

<table>
<thead>
<tr>
<th>Calls</th>
<th>Opening dates</th>
<th>Deadlines</th>
</tr>
</thead>
<tbody>
<tr>
<td>EO-2016 COMPET-2016</td>
<td>10 November 2015</td>
<td>3 March 2016</td>
</tr>
</tbody>
</table>
COMPET-1-2016
Technologies for European non-dependence and competitiveness

Activities shall address technologies identified on the Joint EC-ESA-EDA Task Force list of Actions 2015-17

- U14 - Active discrete power components
- U18 - Enhanced performance and space qualified detectors
- U19 - High speed DAC-ADC based on European technology
- U20 - Very high performance microprocessors
- U22 - ASICS: Deep Sub-Micron (DSM)
- N27 - RF components

The aim of identified actions is to contribute to ensuring European Non-dependence:

- “Independence” would imply that all needed space technologies are developed in Europe.
- “Non-dependence” refers to the possibility for Europe to have free, unrestricted access to any required space technology.
**U14 – Active discrete power components**

<table>
<thead>
<tr>
<th>Description and needed Action</th>
<th>Development and qualification of active components (like diodes) assuring unrestricted availability of space qualified high reliability components in Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>– CMOS MOSFET transistors</td>
</tr>
<tr>
<td></td>
<td>– GaN diodes &amp; transistors</td>
</tr>
<tr>
<td></td>
<td>– Power functions: POL, PWM, ICL, drivers (MOS)</td>
</tr>
</tbody>
</table>

The recommendations from European Space Components Coordination (ESCC) via CTB will be taken into account.

| Target TRL: | 6 |
| Estimated Initial TRL | 4 (usually) |
3 - Research activities in EEE space components

Horizon 2020 (2018-2020)

The 2016 revision of the JTF list of actions

Your participation is expected!!
Main opportunities in WP 2018-2020 will be in

- Bottom-up space technologies at low TRL
- Technologies for European non-dependence and competitiveness
- In-Orbit Demonstration and Validation
- SME instrument
- Fast track to innovation (if continued)

*Your participation is expected!!*
> 200 M€ is the estimated total cost for the grants related to critical space technologies financed in FP7 and H2020.

The COM-ESA-EDA Joint Task Force (JTF) is the main driver in defining the actions on critical space technologies.

H2020 Work Programmes offer a full spectrum of activities for EEE components.

We are in an open consultation for WP 2018-2020.  Participate!

Need to set a coherent framework for ensuring a end-to-end supply chain for technological non-dependence and competitiveness for European industry ranging from development to in-orbit testing and qualification. This will be achieved by continue working in conjunction Member States and ESA, aiming at building up complementarity among different actors.

Register as expert!
• For proposal evaluation
• For project reviews

Where?
At the PARTICIPANT PORTAL: http://ec.europa.eu/research/participants/portal/desktop/en/experts/index.html
Thank you for your attention

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