FP7-Space:
R&D activities in support of European microelectronics enabling technologies

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Enterprise and Industry

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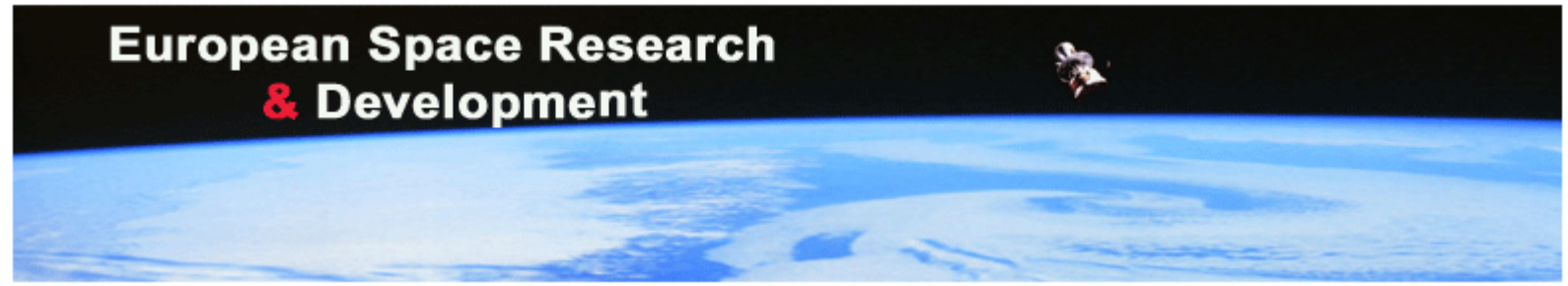
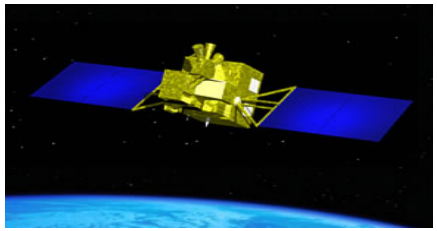
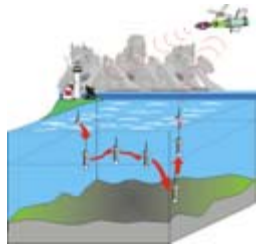


Space research in the Framework Programme, brief history







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“Space” in the EU Research Framework Programmes

Space a **new activity**, first introduced in the 6th Framework Programme under the Aeronautics & Space theme - FP6 (2002-2006):

- About € 230 million over five years.
- Earth observation (GMES), Satcom, Satnav
- Focused on applications and services

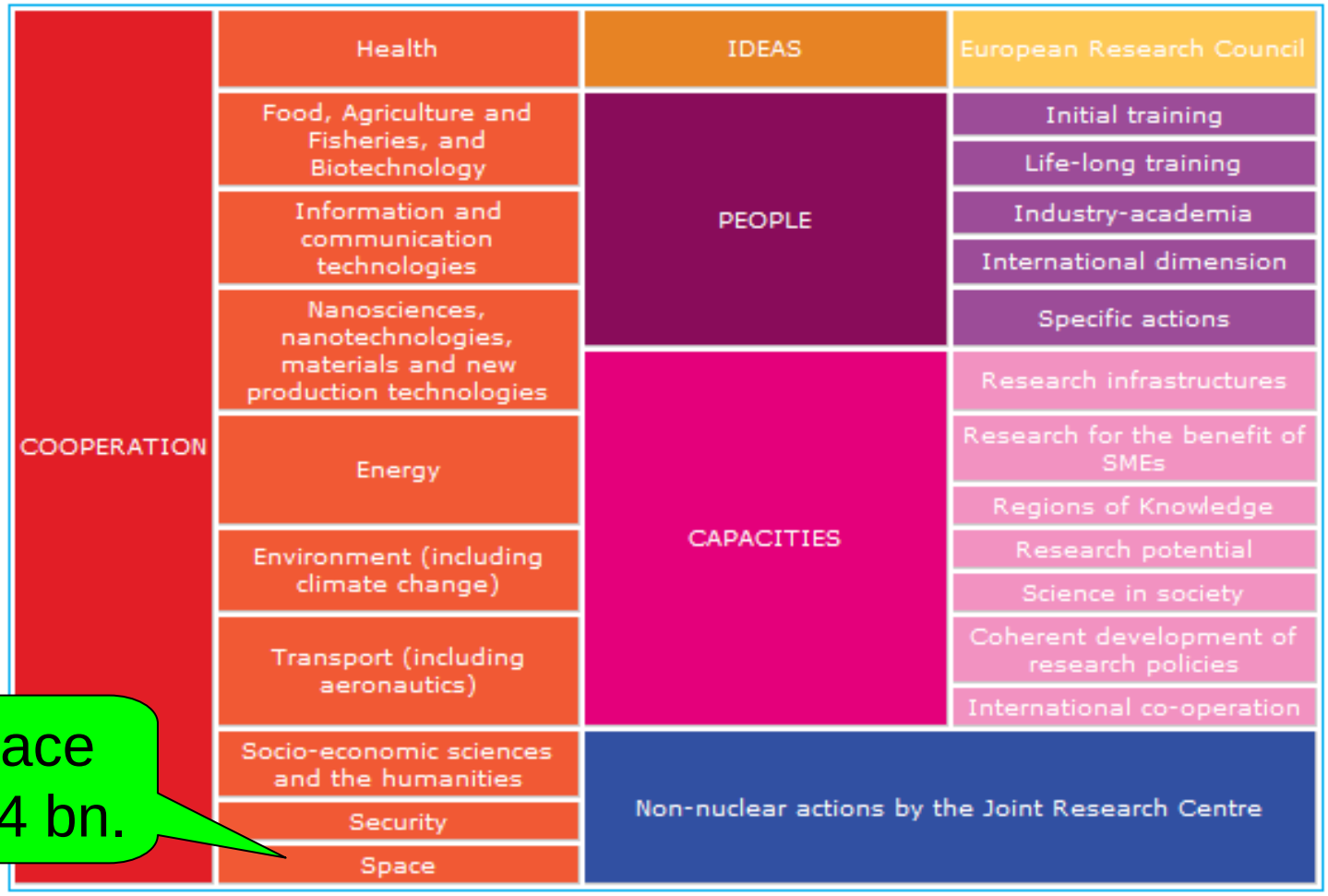
With own **Space** theme in **FP7 (2007 – 2013)**

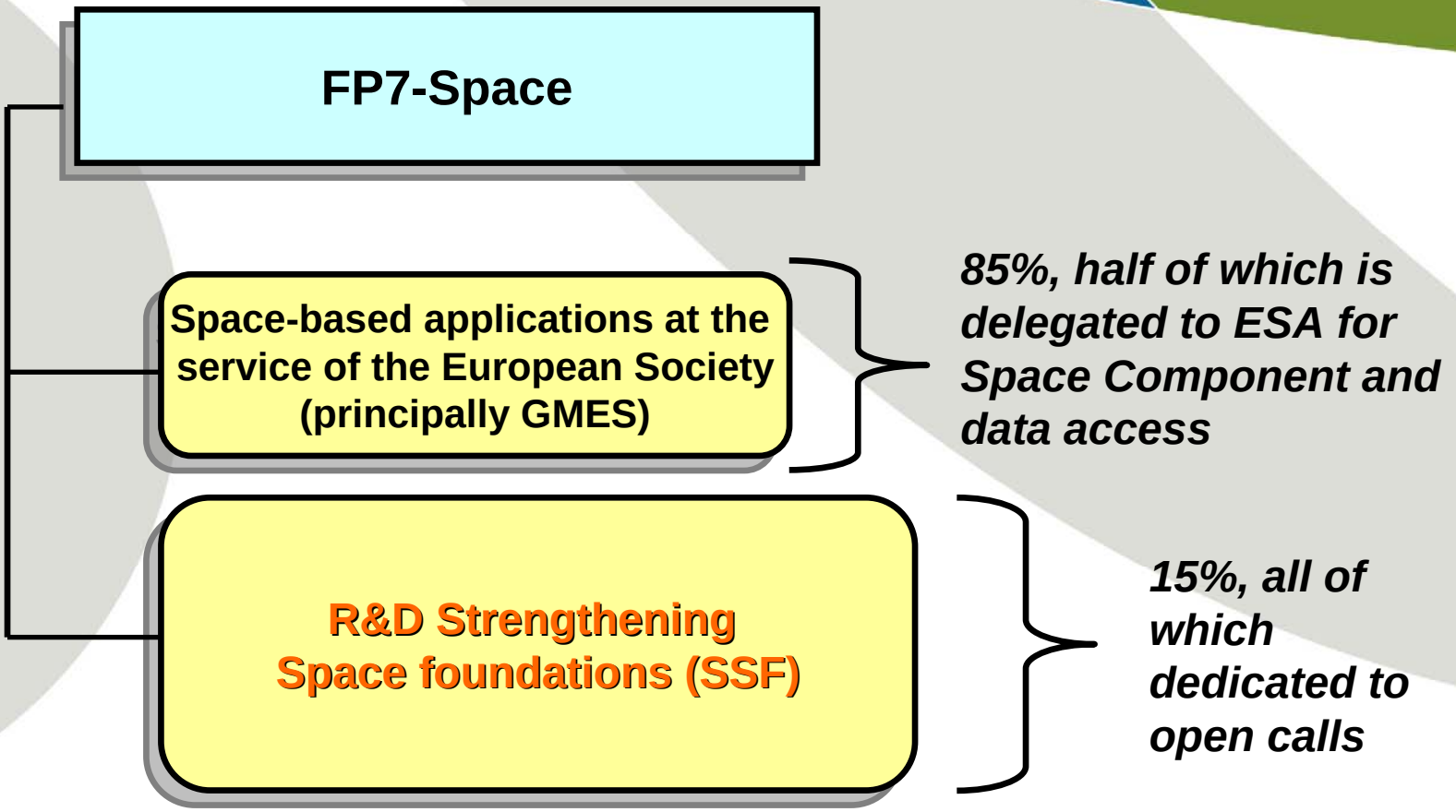
- About € 1.4 billion over 7 years
- GMES + Strengthening Space Foundations
- Services, but also technology development

Post 2013:

- See later…

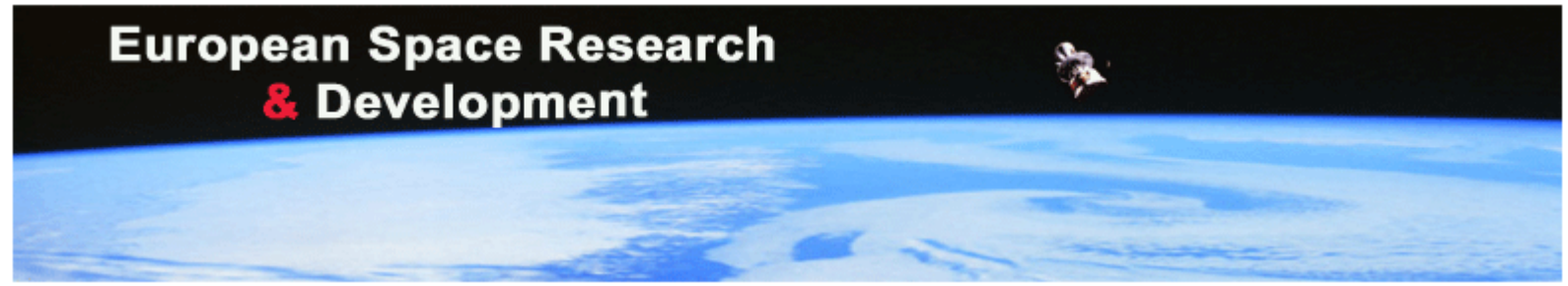
Framework Programme 7




FP7-Space
Space-based applications at the service of the European Society (principally GMES)
85%, half of which is delegated to ESA for Space Component and data access
R&D Strengthening Space foundations (SSF)
15%, all of which dedicated to open calls

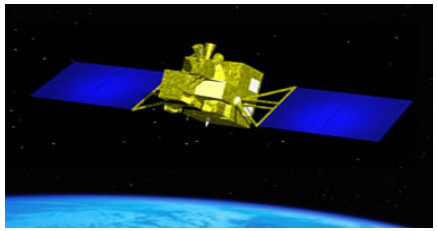
Strengthening Space Foundations (SSF): Main topics addressed

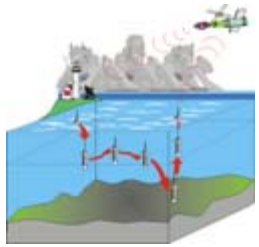
- Space science
  (exploitation of scientific data)
- Space transportation
  (in-space propulsion, launch, entry)
- Planetary exploration
  (robotics, sample return)
- Space situational awareness
  (space debris, space weather, NEOs)
- **Key space technologies, "critical technologies for European non-dependence"
  (electronics…), <u>about € 10 million/year</u>**



Work of the EC-ESA-EDA Joint Task Force on Critical Technologies







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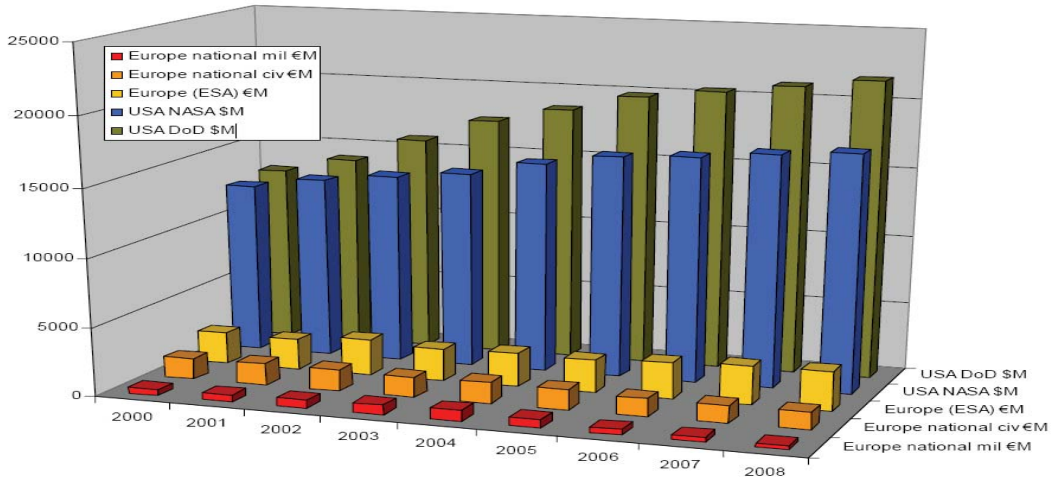
The Issue

Technology Gap

- Europe is 5 years behind in a number of technologies, e.g. in microelectronics
- Our market is too small
- Thus, dependence on imports (associated restrictions)
- Long term availability is not guaranteed

Funding Gap

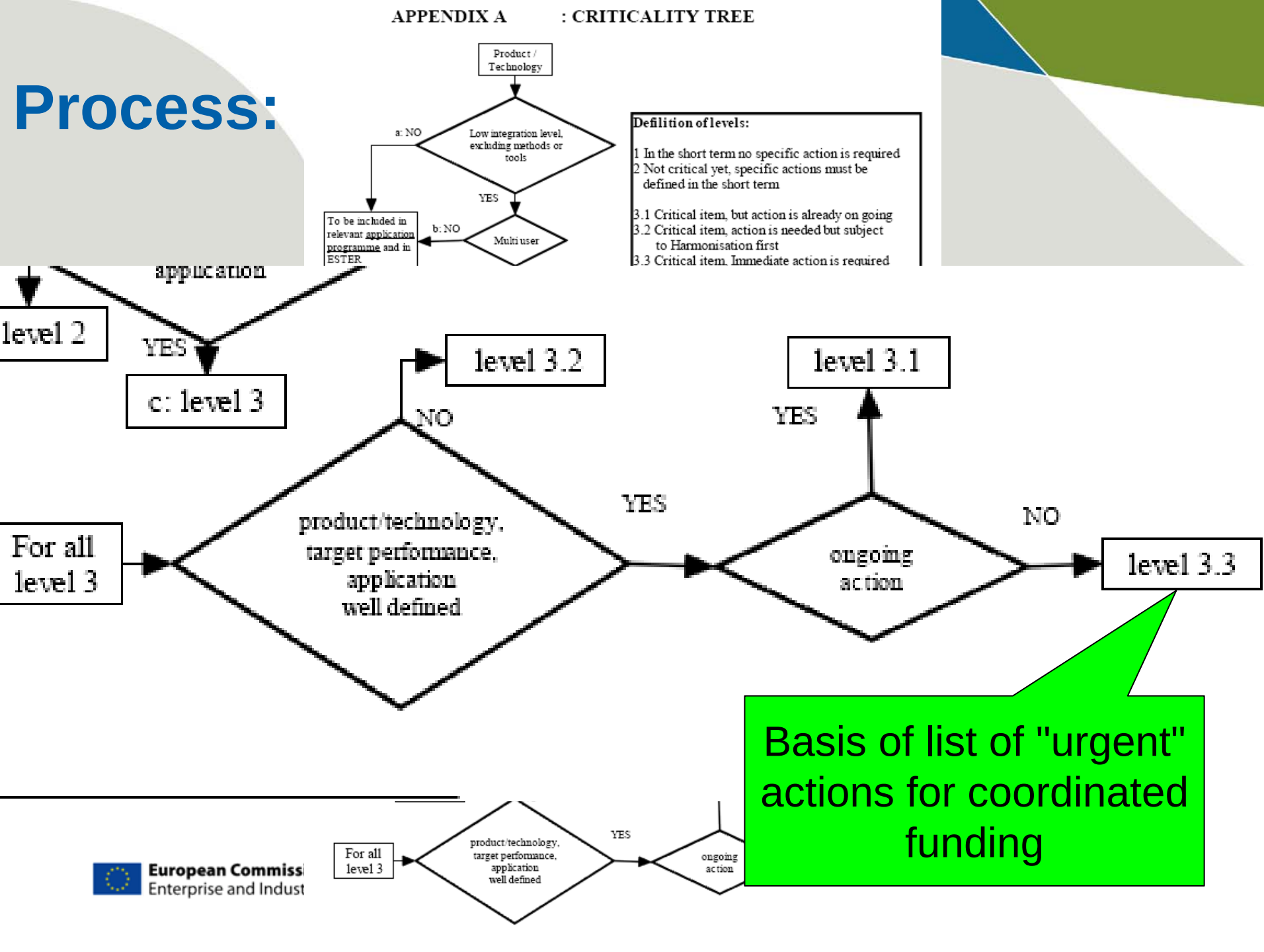


Joint Task Force Mandate/Recommendations

2008 Workshop in Brussels: EC, ESA and EDA decides to join forces to address critical space technology research:

- Raise awareness on this strategic issue for Europe,
- Define an agreed common methodology for a coherent Europe-wide approach, building on the existing and recognised processes, such as the ESA led European Space Technology Harmonisation process (THAG),
- Define a common list of priorities for critical space technologies
- Identify a list of critical items for which immediate action is required (for review every 2 years)

Process:


APPENDIX A : CRITICALITY TREE
Product / Technology
Low integration level, excluding methods or tools
a: NO
YES
Multi user
b: NO
To be included in relevant application programme and in ESTER
Defilition of levels:
1 In the short term no specific action is required
2 Not critical yet, specific actions must be defined in the short term
3.1 Critical item, but action is already on going
3.2 Critical item, action is needed but subject to Harmonisation first
3.3 Critical item. Immediate action is required
application
level 2
YES
c: level 3
level 3.2
level 3.1
NO
YES
For all level 3
product/technology, target performance, application well defined
YES
NO
ongoing action
level 3.3
Basis of list of "urgent" actions for coordinated funding
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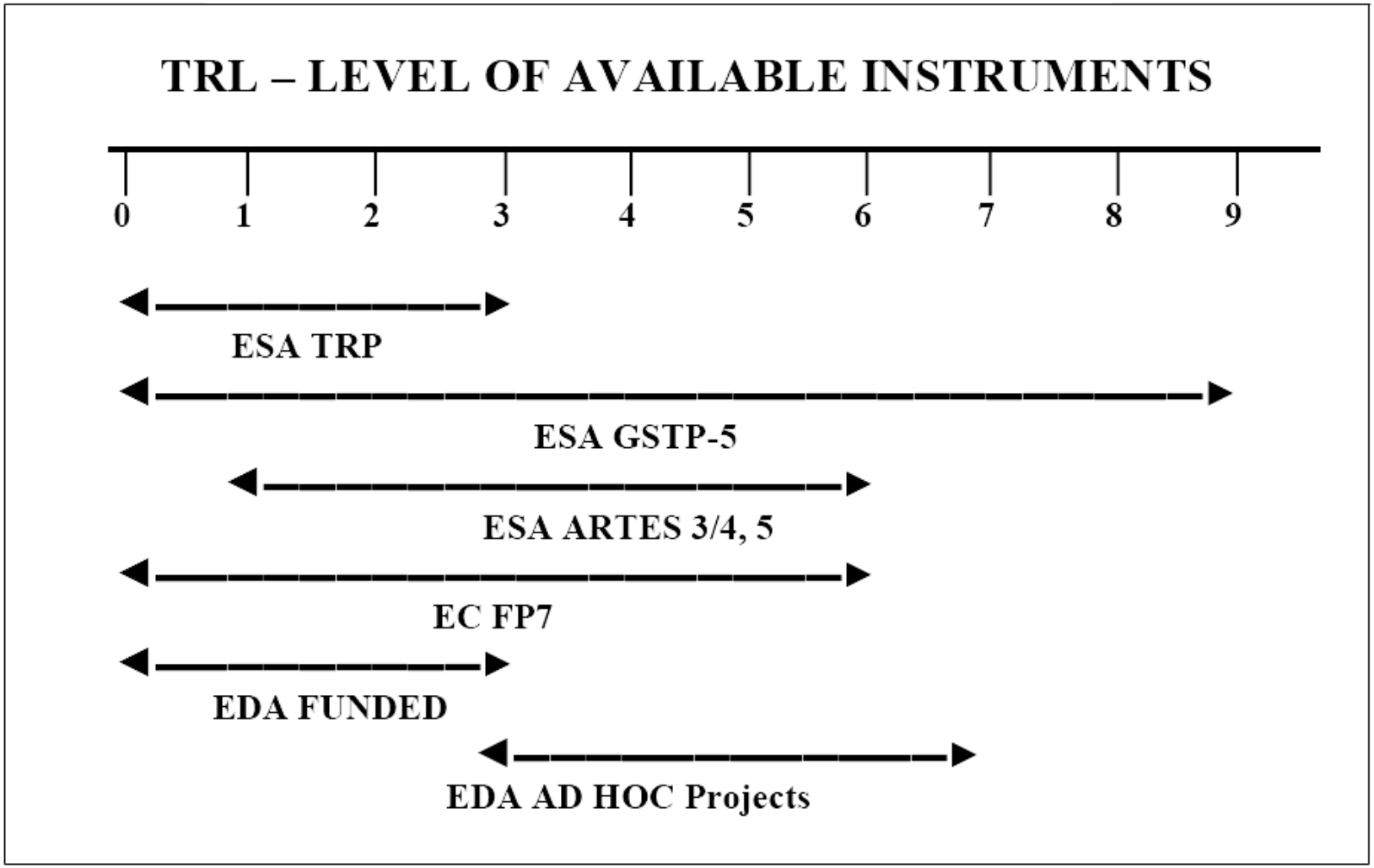


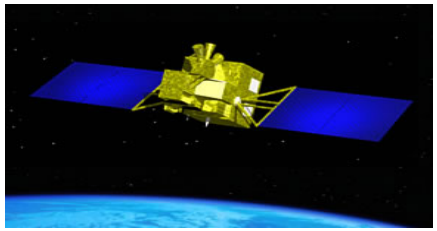
Figure 2 Funding instruments and their TRL-levels

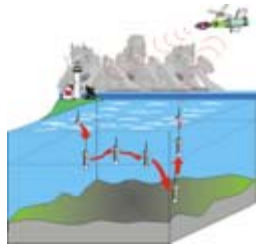
List of 25 « critical items » for which immediate action is required

ID	*Title*
1	Core processors for DSP computers
2	ASICS
3	High speed DAC-ADC based on European Technology
4	Very high speed serial interfaces
5	FPGAs
6	Solid state gyroscope components
7	Power amplification: TWT materials
8	European State of the Art Dielectric Materials
9	Make available Submmw Local Oscillator Sources
10	Space-worthy solid-state laser sources
11	Enhanced performance, space-worthy 1-D + 2-D sensor focal planes operating from X-ray to the Infrared
12	Bladder tanks for bipropellants
13	Propellant flow and distribution components for electric and chemical propulsion
14	Development of Large Deployable structures
15	Development of low shock (NEA-like) initiators
16	Advanced Ablative Systems for high speed re-entry
17	Passive Components
18	Active Components
19	Very High performance microprocessors
20	Advanced microwave components - MMIC
21	Low-cost high-resolution L and X-band SAR components
22	Advanced thermal control systems
23	Advanced thermal control materials
24	High density (up to 1000 pins) assemblies on PCB
25	Space qualified carbon fibre and pre impregnated material sources for satellite subsystems

Initial results for critical technologies in FP7 (especially microelectronics)







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FP7-Space, state of play for SSF topics (after Calls 1, 2 and 3)

- Very significant interest for all SSF topics (3 to 6 fold oversubscription rates)
- Portfolio of some 120 projects
- About 66 projects under SSF topics
- Main topic groupings:
  - Space science data exploitation (9)
  - Human space exploration (2)
  - Robotics for planetary exploration (4)
  - Space transportation technol. (12)
  - International coop. with Russia (6)
  - Space weather/debris (15)
- - **Critical technol. (13)**

FP7 Space: projects funded under critical technologies topic

Call	*Coordinator*	*Acronym*	*Title*
1	ThalesAleniaSpace France	AGAPAC	Advanced GaN Packaging
2	E2V Semiconductors SAS, France	COMETS	Converters broadband low power high performance for telecommunications in space
2	SiCrystal AG, Germany	EuSiC	High Quality European GaN-Wafer on SiC Substrates
2	Science and Technology Facilities Council, UK	MIDAS	Millimetre-wave Integrated Diode and Amplifier Sources
2	Thales Research and Technology, France	SATURNE	Microsystems Based on Wide Band Gap Materials for Future Space Transmitting Ultra Wideband Receiving Systems
2	Chalmers University of Technology, Sweden	TeraComp	Terahertz heterodyne receiver components for future European space missions
3	Commissariat à l'Energie Atomique, France	CESAR	Cryogenic Electronics for Space Applications and Research
3	Caen Arelia Space Srl, Italy	DSPACE	Digital Signal Processor for Space Applications
3	Helsingin Yliopisto, Finland	E-SQUID	Development of SQUID-based multiplexers for large Infrared-to-X-ray imaging detector arrays in astronomical research from space
3	Austrian Institute of Technology	HARMLES	Dry lubricated Harmonic Drives for space applications
3	Universidad Carlos III, Madrid, Spain	MAGDRIVE	Magnetic-Superconductor Cryogenic Non-contact Harmonic Drive
3	Fundacion Insmet, Spain	SMARTEES	Multifunctional components for aggressive environments in space applications
3	Heinrich-Heine-Universitaet, Duesseldorf, Germany	SOC2	Towards Neutral-atom Space Optical Clocks: Development of high-performance transportable and breadboard optical clocks and advanced subsystems
4	-	-	Carbon Fibres and Pre-Impregnated Materials
4	-	-	Re-entry ablative thermal protection
4	-	-	Large Deployable Technologies
4	-	-	Miniaturized Flow Control
4	-	-	CMOS Imagers
4	-	-	Aerogels for Space Applications
4	-	-	Very High Speed Serial Interfaces

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25	Space qualified carbon fibre and pre impregnated material sources for satellite subsystems

Calls 1, 2 and 3

Call 4

GaN-based technologies

GaN has emerged as the technology of choice for the next generation of high-power electronics

- **AGAPAC (Coord.: ThalesAleniaSpace, FR):** Develop a space-compliant power micropackage to dissipate up to 100 W, based on innovative high thermal conductivity diamond or nanocomposites

- **EuSiC (Coord.: SiCrystal AG, DE):** Develop SiC high-quality 3-inch substrate for GaN.

High-frequency Schottky diodes

Terahertz receivers are essential for scientific exploration and Earth observation

- **TeraComp (Coord.: Chalmers University of Technology, SE):**
  Development of a European industrial capability for terahertz receivers based on Schottky diodes (novel Heterostructure Barrier Varactor and mHEMT MMIC)

- **MIDAS (Science and Technology Facilities Council, UK):**
  Development of a demonstrator source delivering enough power at 300 GHz for direct commercial applications (builds on European amplifier technology, Schottky varactor diodes)

Wide bandgap semiconductors

Flexible RF front ends for versatile satellites

- **SATURNE (Thales SA, FR):**
  Realise novel types of microwave functions through Wide Band Gap semiconductors and RF-MEMS switches. Develop re-configurable, highly power-efficient communication payloads with narrow-, multi- or wide-band channel allocation.

Further information available: ec.europa.eu/embrace-space

FP7 "**Let's Embrace Space**" conference, 12-13 May, Budapest, Hungary

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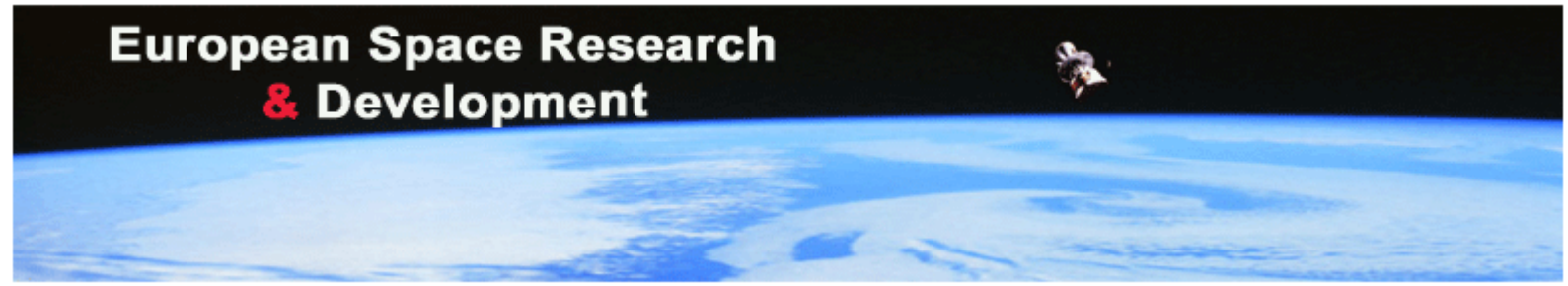
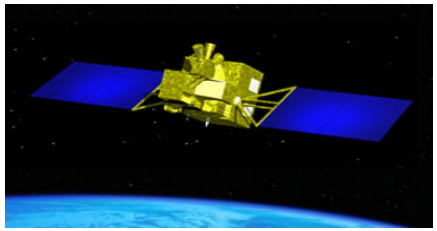
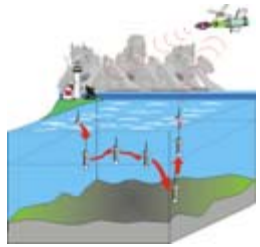


Future work







Next steps

- Take stock of results of the first 4 calls of FP7-Space (topic will not be open in Call 5)
- Review list of urgent actions based on these results

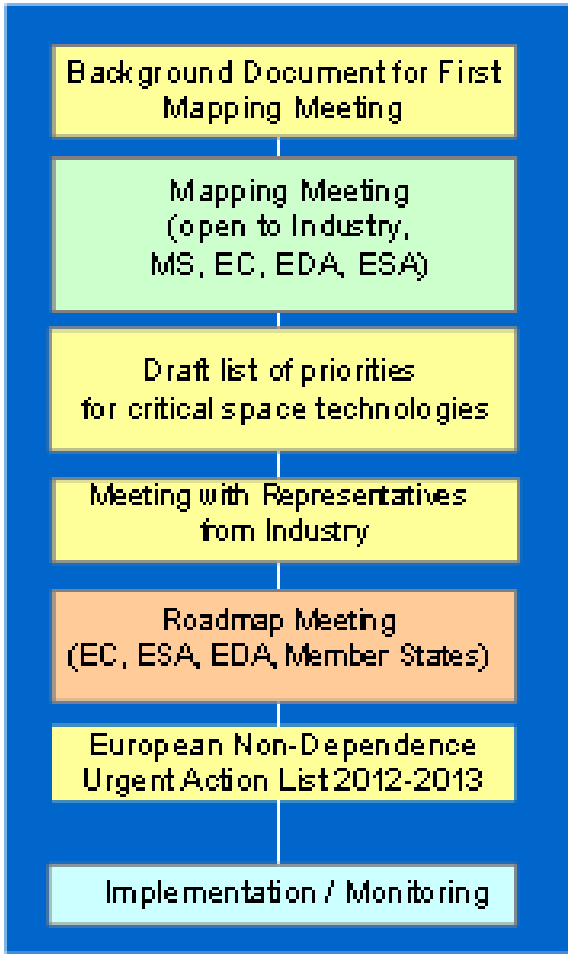


Figure 1 European Non-Dependence Process in 2011

More information: ec.europa.eu/**embrace-space**

Thank you for your attention

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  Space Research and Development Unit

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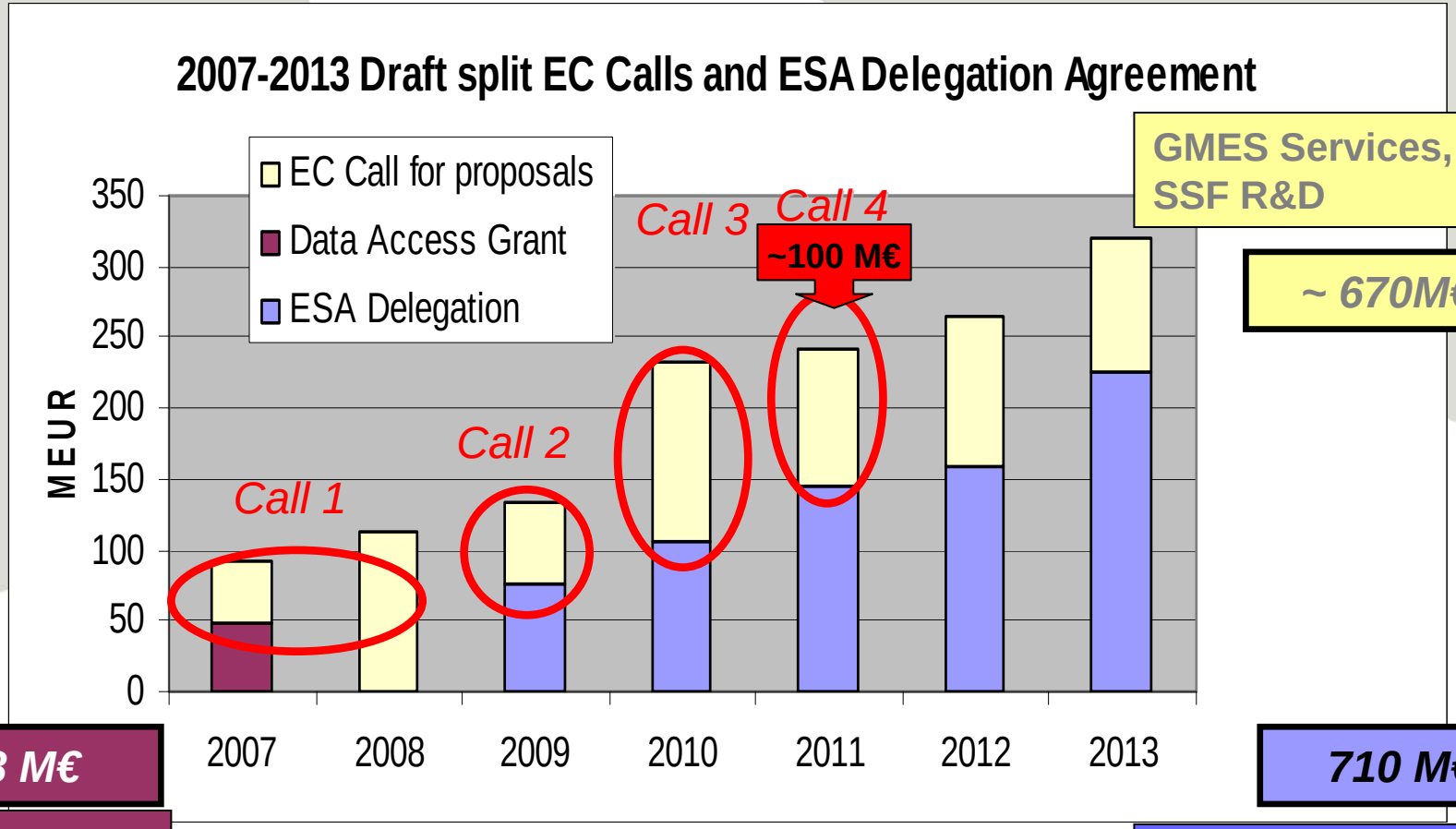
Breakdown of FP7 Space funding



GMES Services, SSF R&D

~ 670M€

48 M€

Space data

710 M€

Space Infrastructure

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Commission Green Paper

- On 9 February 2011, the Commission adopted a Green Paper *'From Challenges to Opportunities: Towards a Common Strategic Framework for EU research and innovation funding'* (COM(2011)48).
- This Green Paper launches a public consultation on the key issues to be taken into account for future EU research and innovation funding programmes.
- The consultation website is available at: http://ec.europa.eu/research/csfri/index_en.cfm. Submissions can be made until 20 May 2011 in form of questionnaire or position papers.

Those topics closed for this call from the "list of urgent actions" are barred

ID	*Title*
1*	~~Core processors for DSP computers~~
2	ASICS
3*	~~High speed DAC ADC based on European Technology~~
4	Very high speed serial interfaces
5*	~~FPGAs~~
6	Solid state gyroscope components
7	Power amplification: TWT materials
8	European State of the Art Dielectric Materials
9*	~~Make available Submmw Local Oscillator Sources~~
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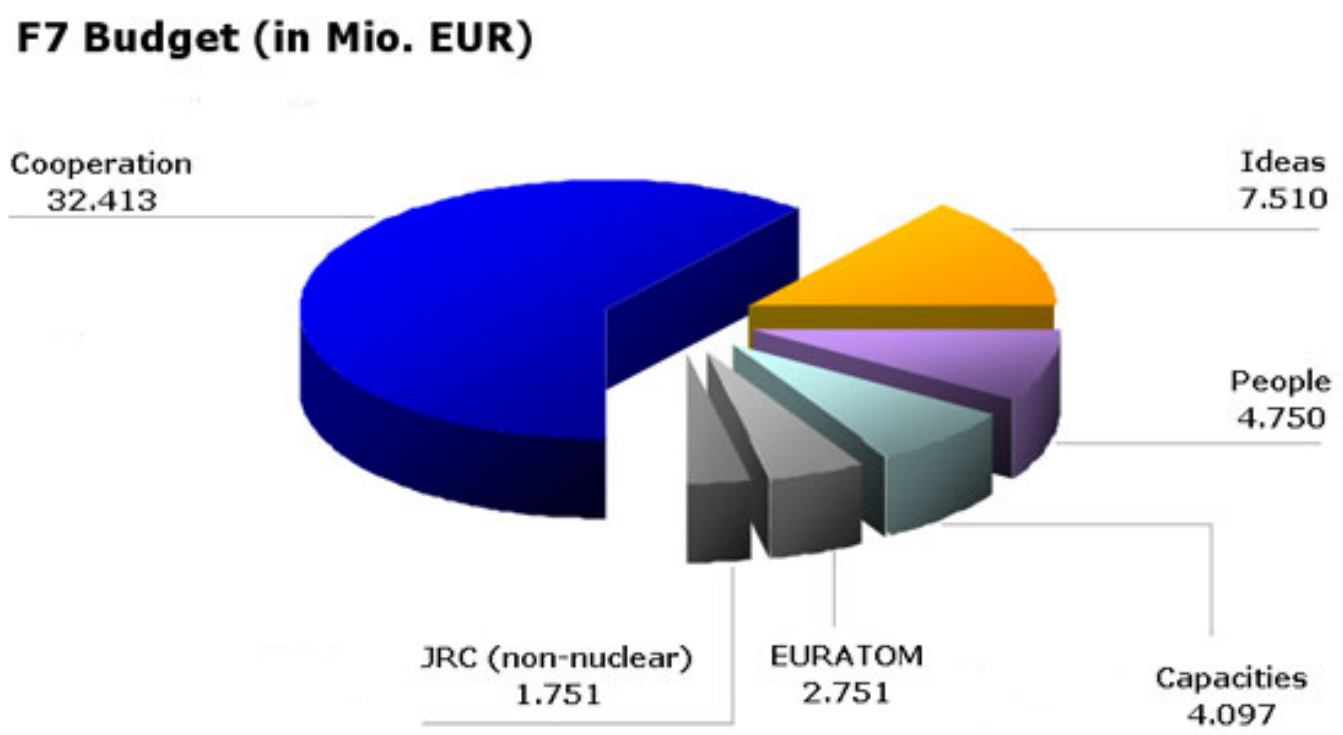
Framework Programme 7



FP7 budget

	Themes	December 2006 (****)
COOPERATION	Health	6100
	Food, Agriculture and Fisheries, and Biotechnology	1935
	Information and Communication Technologies	9050
	Nanosciences, Nanotechnologies, Materials and new Production Technologies	3475
	Energy	2350
	Environment (including Climate Change)	1890
	Transport (including Aeronautics)	4160
	Socio-economic Sciences and the Humanities	623
	Security and Space	Space 1430 Security 1400
Total COOPERATION		32413
IDEAS	European Research Council	7510
PEOPLE	Marie Curie Actions	4750
CAPACITIES	Research Infrastructures	1715
	Research for the benefit of SMEs	1336
	Regions of Knowledge	126
	Research Potential	340
	Science in Society	330
	Coherent development of research policies	70
	Activities of International Co-operation	180
Total CAPACITIES		4097
Non-nuclear actions of the Joint Research Centre		1751
Total EC		50521
Euratom for nuclear research and training activities		2751

Main characteristics of research funding under FP7

General approach:

- Complementary to ESA research programmes (address gaps, target topics for which FP can bring added value, coordination to avoid duplication)
- Bottom-up approach: relatively broad definition of research topics to be addressed
- Competitive selection based on evaluation by external experts (no geo-return constraints)
- Most FP7 research projects are 50% co-funded
- Overall budgets are set from beginning of the FP

Framework Programme (FP)

- European Union's main financial tool to support research and development activities in almost all scientific disciplines
- Initiated in 1984
- 5-year cycles (up to FP6)
- Current incarnation: FP7. Period of seven years (2007 – 2013), to be synchronised with the EC's Multiannual Financial Framework (MFF)
- FPs are proposed by the European Commission and adopted by Council and the European Parliament following a co-decision procedure
- Now starting to prepare for the next MFF and therefore "FP8"…

Beyond FP7 (2 calls remaining)

Working assumptions:

- Lisbon Treaty means that space should remain a priority for the EU and the FP
- Budget should be similar to that of FP7, but GMES to move out of the FP
- Majority of budget therefore for SSF-type topics
- However, financial crisis…

First preparations:

- Commission Green Paper
- FP8 space research hearing, December 2010
- Input from the FP7 Space Advisory Group

JTF Recommendations

For the transitory phase until more focused instruments are in place:

- **to use the first common list of critical technologies for European Strategic Non-Dependence as input for the work programmes of all the three institutions**
- **to launch the European Non-Dependence Process in 2nd semester 2009**
- **to review and update the Non-Dependence List every 2 years and monitor its status on a regular basis**
- **to make adequate and complementary funds available for critical technologies activities (approximately 100-120 M€/year).**
- **for the three Institutions to make best use of the available instruments until more dedicated programmatic instruments are set up**

Proposed Common Methodology

- Build on the existing and recognized European Space Technology Harmonisation process of ESA and
- the Synchronised Programming Approach of EDA
- Expand the Technology Harmonisation Advisory Group (THAG) to EC and EDA
- Proceed to calls on the basis of the joint list

	2011 EUR million[53]	total
Call FP7-SPACE-2011-1 Activity 9.1 Space-based applications at the service of European Society : 1.1 GMES Security: exploring governance options	1	56
5.1 Marine service	28	
5.2 Atmosphere service	19	
5.3 R&D to enhance future GMES applications in the Marine and Atmosphere areas	8	
Call FP7-SPACE-2011-1 Activity 9.2 Strengthening of Space foundations: 1.1 Exploitation of Space Science and exploration data 1.2 Developments for space exploration 2.1 Space Transportation technologies	17	31
Call FP7-SPACE-2011-1 Activity 9.2 Strengthening of Space foundations: 2.2 Space Critical Technologies	10	
Call FP7-SPACE-2011-1 Activity 9.2 Strengthening of Space foundations: 3.1 Prevention of impacts from NEO	4	
Call FP7-SPACE-2011-1 Activity 9.3 Cross- cutting activities/International Cooperation 2.1. Support for "GMES and Africa" Initiative	1	12
2.2. Facilitating access to space for small scale R&D missions	8	
Call FP7-SPACE-2011-1 Activity 9.3 Cross-cutting activities 3.1. Trans-national and international coop. among NCPs 5.1. Studies and Events in support of European Space Policy	3	