# The Basic Technology Research Programme

# European Space Agency

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Estonia,

24th September 2014

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- ESA's Technology Programmes
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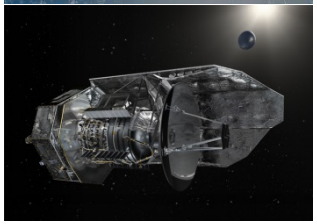
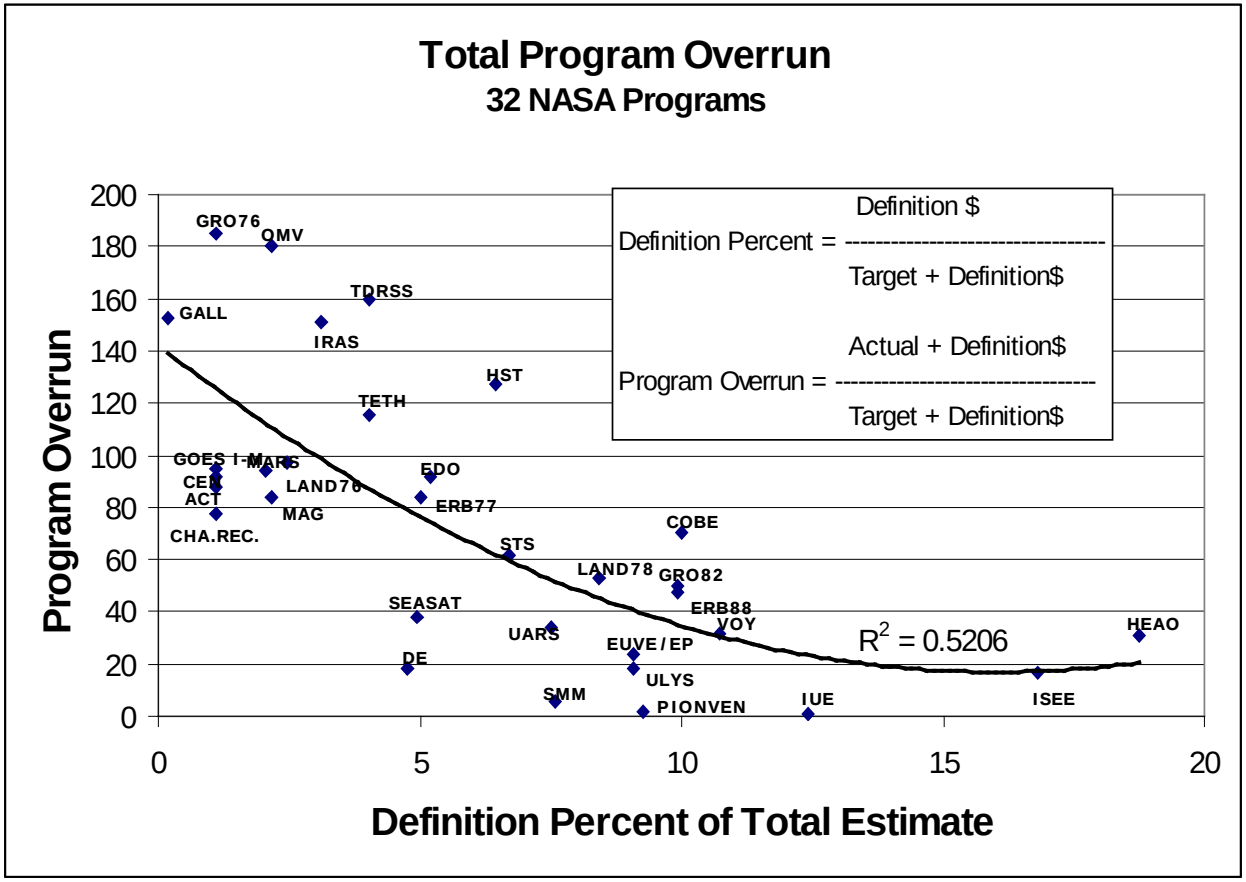


# What Technology is setting out to achieve

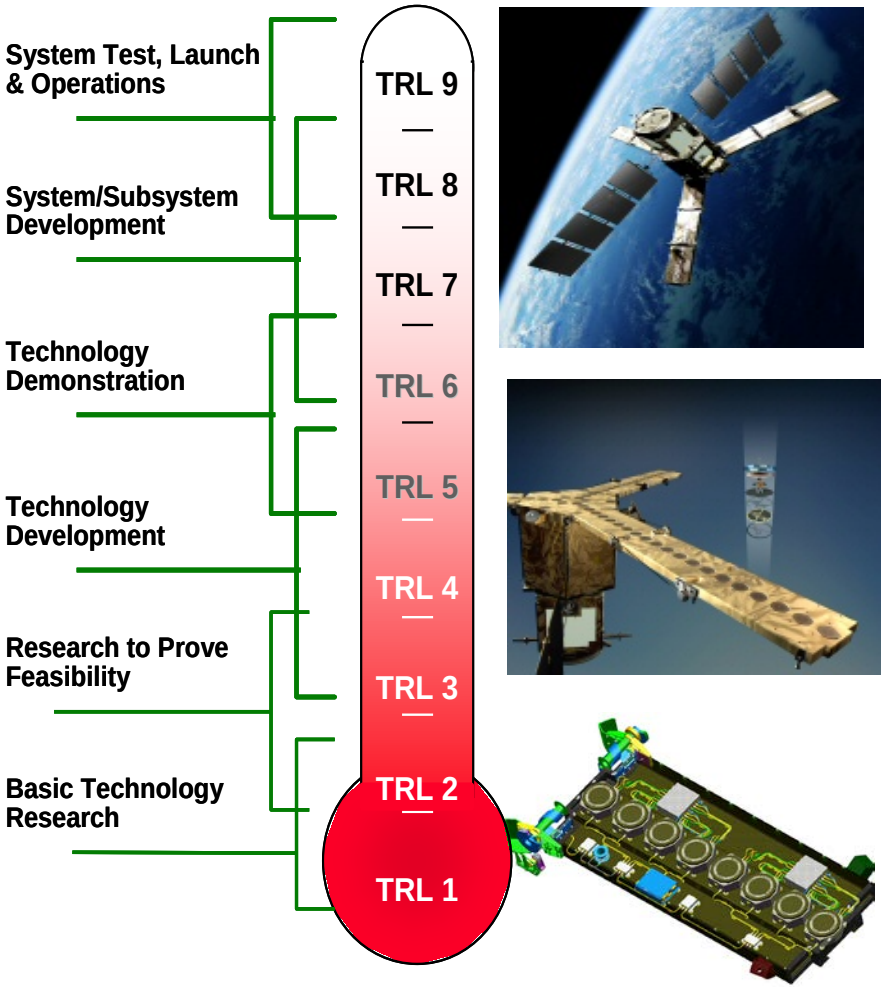
# Technology ready or cost overruns




Projects with less efforts for technology preparation have a higher likelihood of cost overruns. Technology should be made available at the right maturity

# How to measure technological progress ?

## Technology Readiness Level





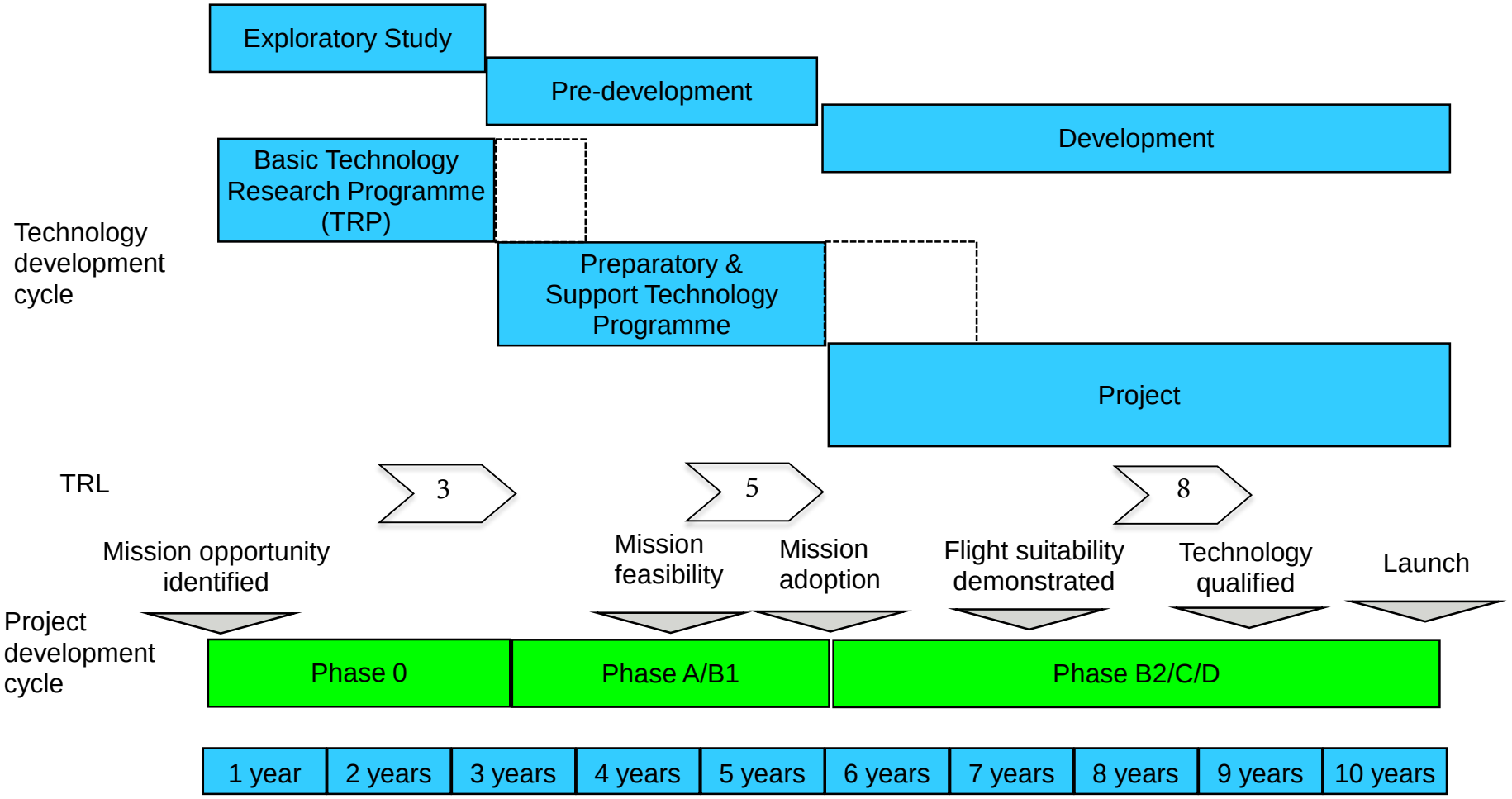





9) Actual system "flight proven" through successful mission operations
8) Actual system completed and "flight qualified" through test and demonstration (Ground or Flight)
7) System prototype demonstration in a space environment
6) System/subsystem model or prototype demonstration in a relevant environment (Ground or Space)
5) Component and/or breadboard validation in relevant environment
4) Component and/or breadboard validation in laboratory environment
3) Analytical and experimental critical function and/or characteristic proof-of-concept
2) Technology concept and/or application formulated

1) Basic principles observed and reported

# How to prepare future missions ?



# ESA TECHNOLOGY PROGRAMMES

# How ESA works: PROGRAMMES

All Member States participate (on a GNP basis) in activities related to space science and a common set of programmes (**Mandatory** programmes).

**Mandatory**

- General Budget: Future studies, technological research, education, common investments (facilities, laboratories, basic infrastructure)
- Science: Solar System science, astronomy and fundamental physics

In addition, Member States choose their level of participation in **Optional** programmes.

**Optional**

- Human Spaceflight
- Telecommunications & Integrated Applications
- Earth Observation
- Launchers
- Navigation
- Robotic Exploration
- Space Situational Awareness

# TECHNOLOGY PROGRAMMES: Results oriented

**Mandatory Programmes**

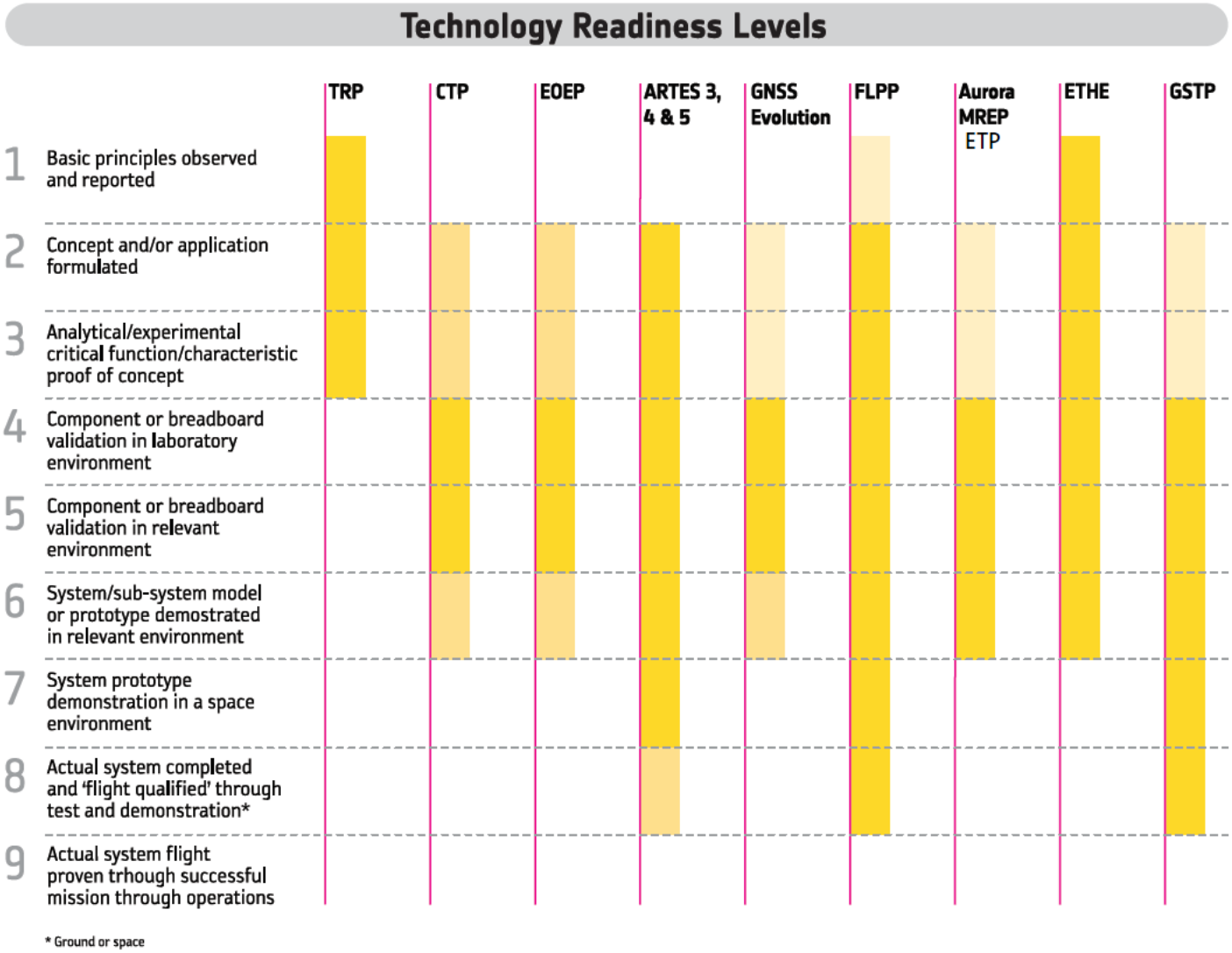
- Science Core Technology Programme (CTP),
- **Basic Technology Research Programme (TRP)**
- **European Components Initiative (ECI)**

  - **Generic**
  - **Application specific**

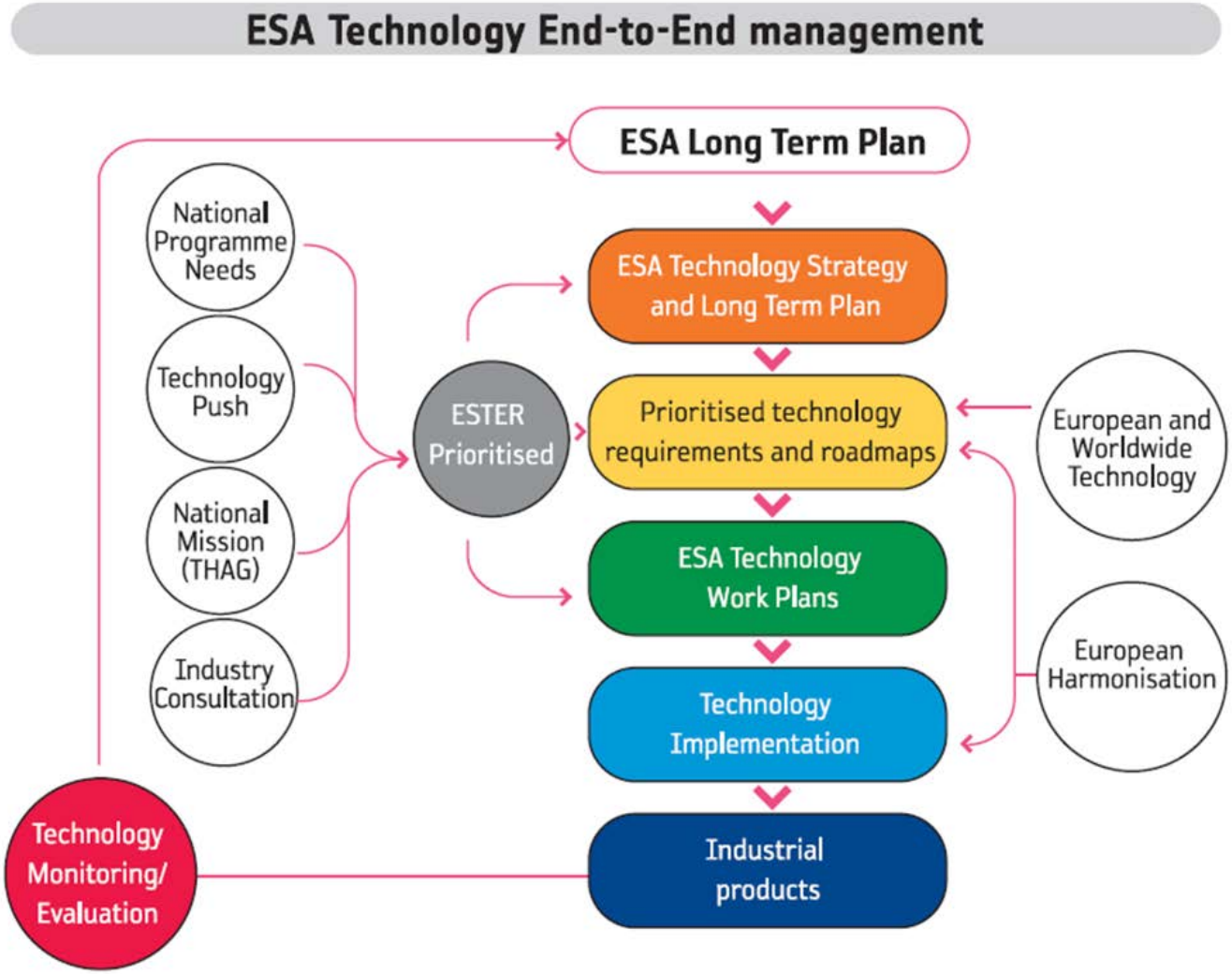
**Optional Programmes**

- **General Support Technology Programme (GSTP)**
- Earth Observation Envelope Programme (EOEP)
- Advanced Research in Telecommunication Systems (ARTES 3-4, 5)
- European GNSS Evolution Programme (EGEP)
- Future Launchers Preparatory Programme (FLPP)
- Mars Robotic Exploration (MREP)

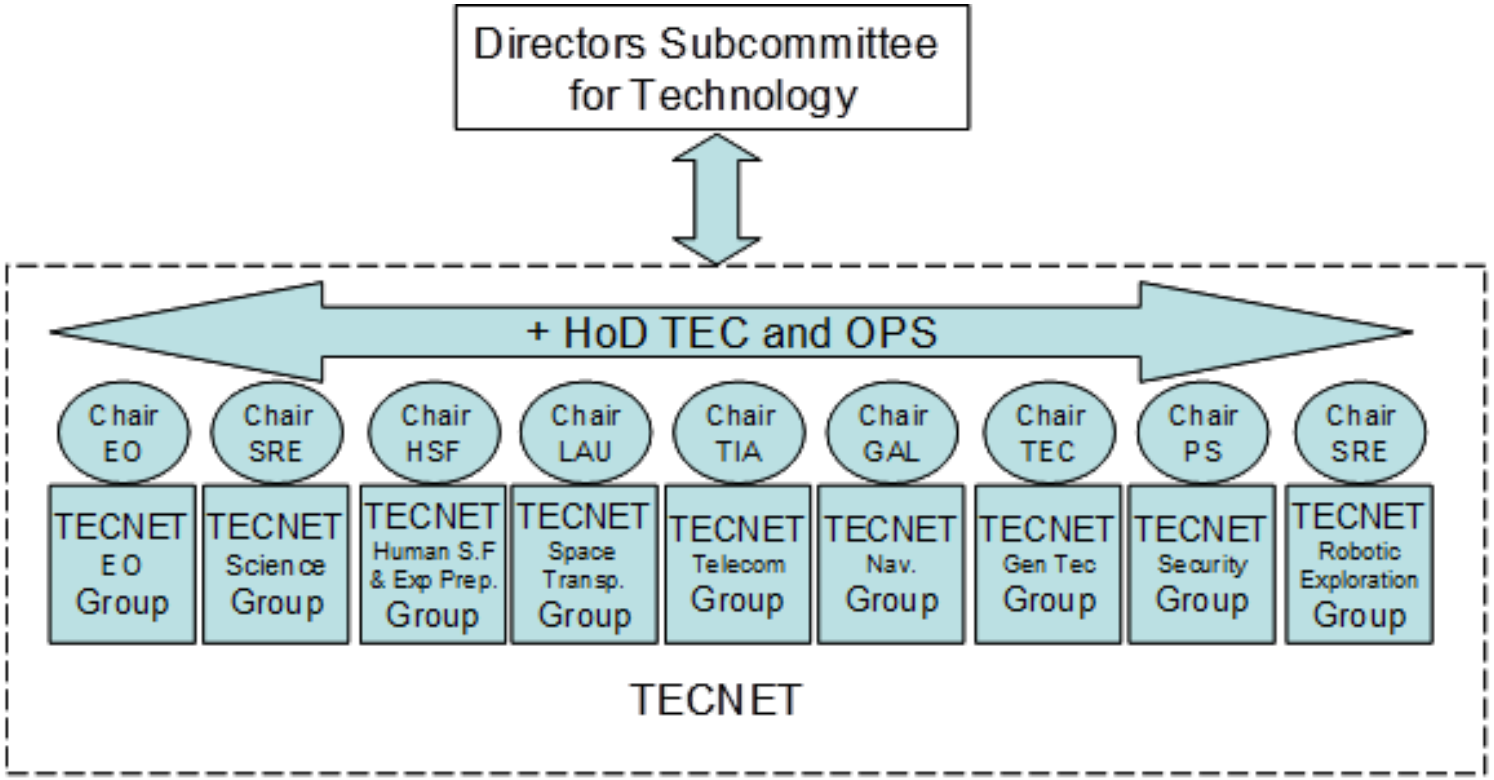
# TECHNOLOGY PROGRAMMES: TRL based



# END-TO-END ESA TECHNOLOGY MANAGEMENT PROCESS



# TECNET backbone of the E2E Process

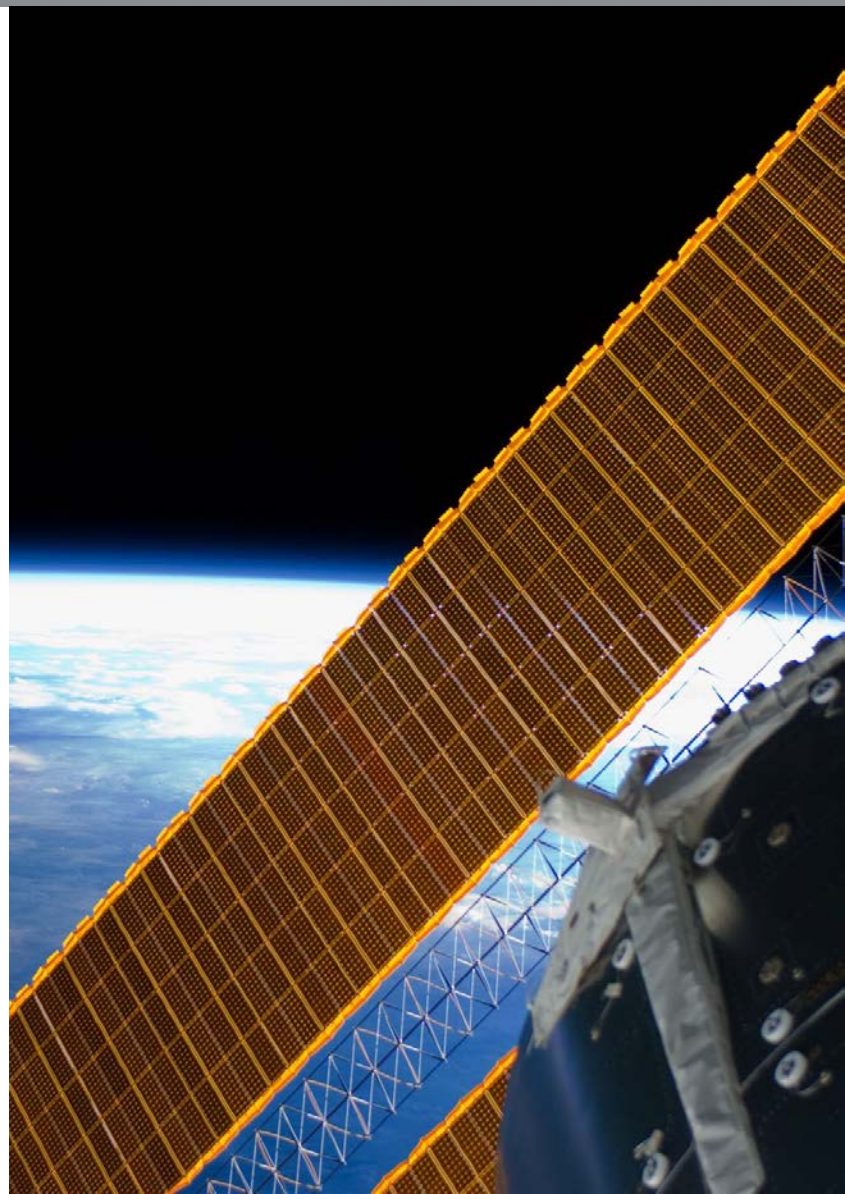



TECNET is aligned with the ESA matrix structure

# Basic Technology Research Programme - Basics

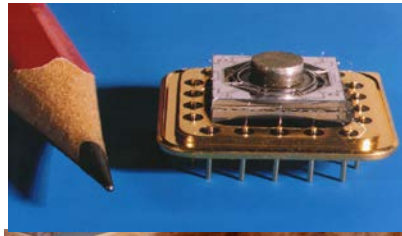
# TECHNOLOGY PROGRAMMES: OBJECTIVES

- **Enabling** missions of ESA and national programmes by developing technology
- Fostering **innovation** by creating new products
- Supporting the **competitiveness** of European industry
- Improve European **technological non-dependence** and the availability of European sources for **critical technologies.**
- Facilitate **spin-in** from outside the space sector



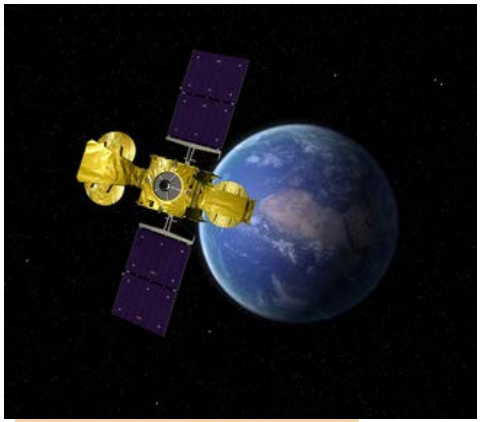
# TRP - OVERVIEW

- Part of ESA's Mandatory Basic Activities
- All technology disciplines & applications
- Based on two year Workplans, with yearly updates
- About 50 M€ in industrial contracts per Year
- About 150 contracts per year
- One of the main contributors to scientific & engineering excellence
- One of the main sources of new ideas



**The TRP is the backbone of ESA's innovation effort covering up to proof-of-concept TRL 3**

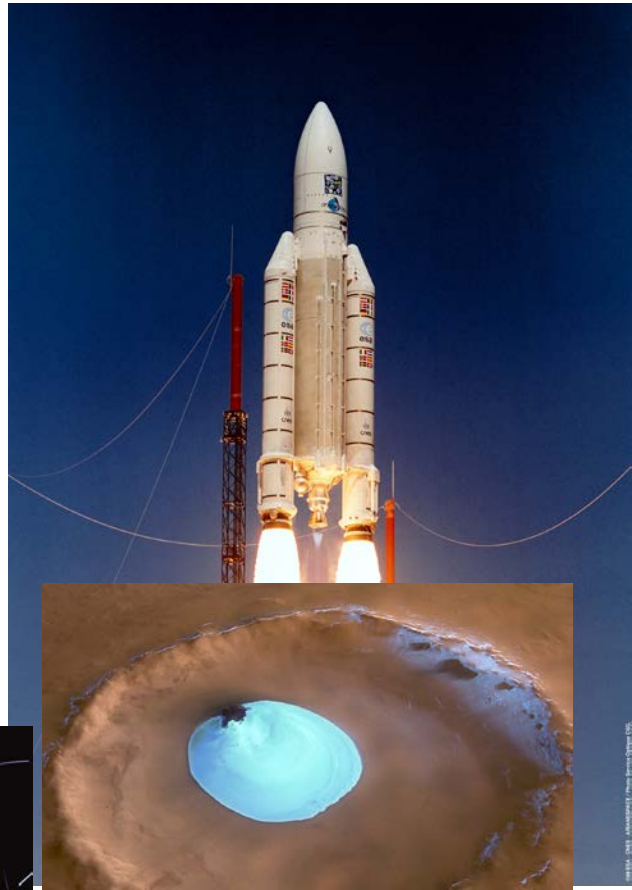
# A wide spectrum of applications …

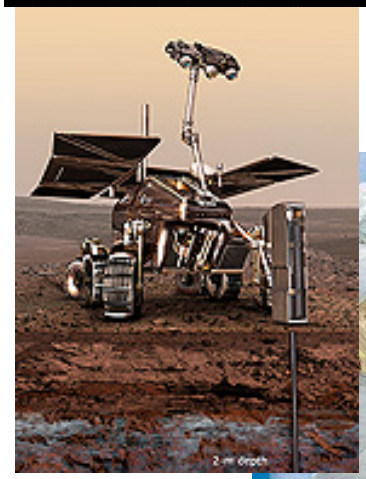


**Inpirational Activities:**
- Space Science
- Earth Science
- Microgravity Science
- Human Exploration

**Enabling Activities:**
- Access to space
- Competitive technologies

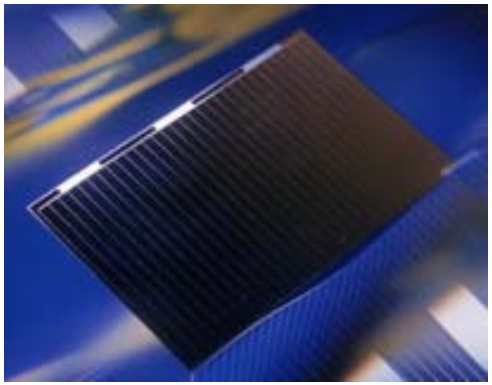
**Utilitarian Activities:**
- Earth Observation
- Meteorology
- Telecommunications
- Navigation

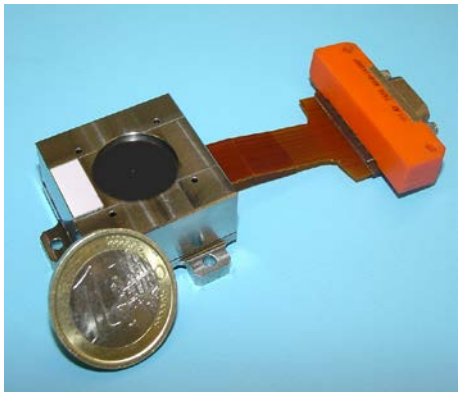


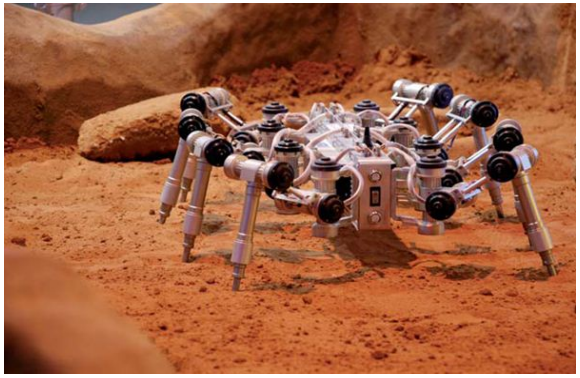


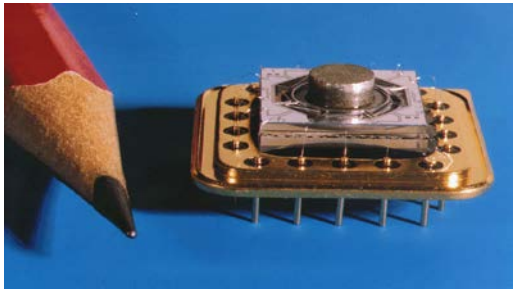


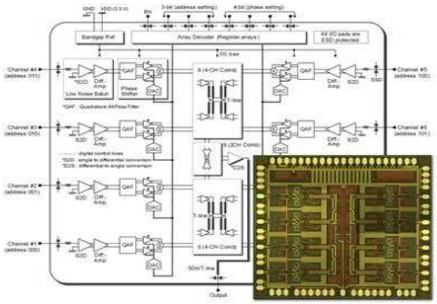
# A wide spectrum of technologies …

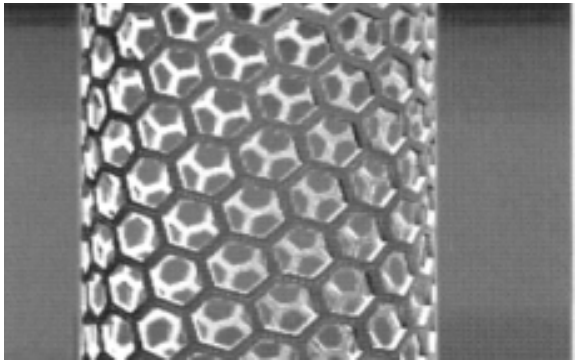












**Technologies needed for space cover a spectrum ranging from basic materials up to very complex systems**

# Going to extremes….

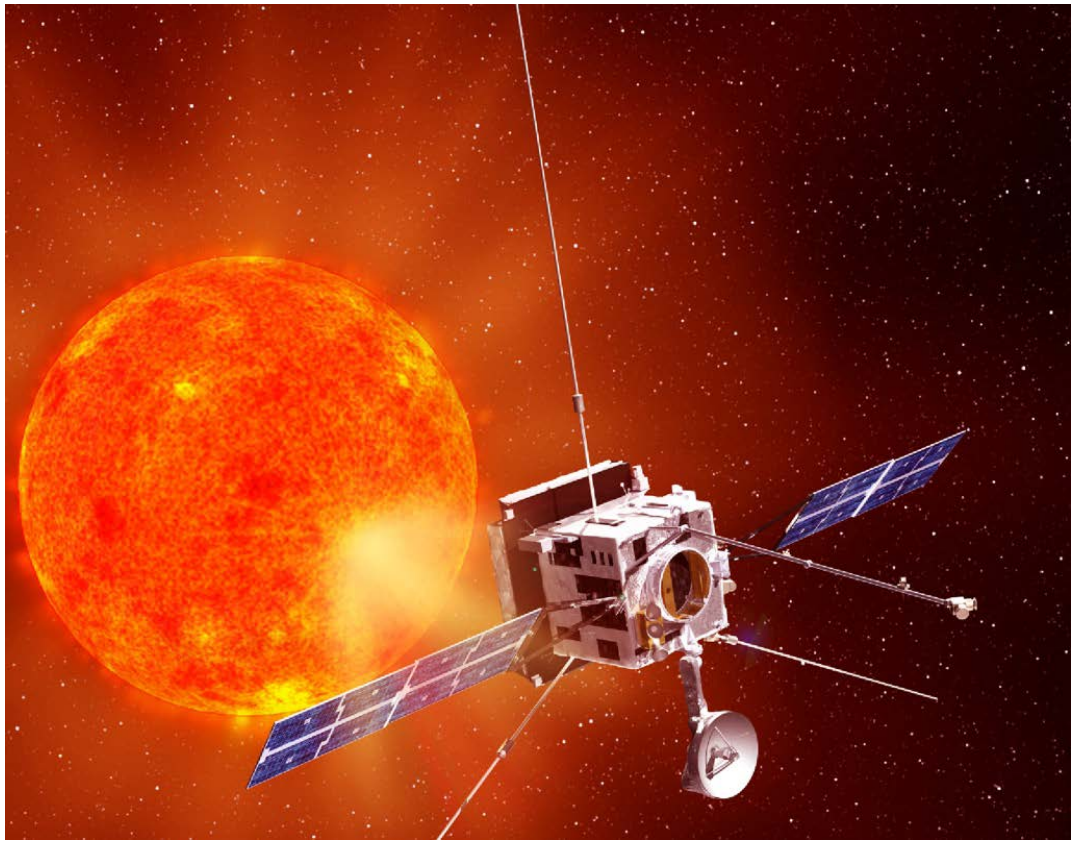
## Solar Orbiter

- Objective: match the Sun's rotation to study solar regions from the same viewpoints for several days
- Launch date 2017
- Distance: 60 solar radii,

  or 0.28 AU

  - Solar Flux 17.3 KW/$m^2$

    Earth 1.4 KW/$m^2$



# ...Relentless drive for miniaturization....

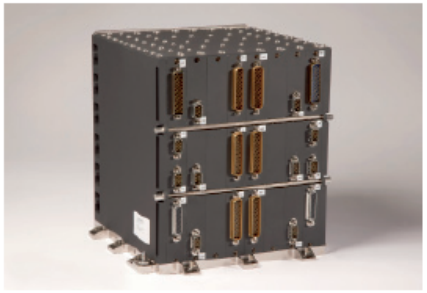
Reduction of power consumption, mass and dimensions achievable with silicon evolution and introduction of the SoC technology are significant:

GOCE (2009) CDMU
TAS-I *ERC32*

Power consumption = < **90 W** average (excluding external loads)

Mass = 21kg

Dimensions = 470(L)x272(H)x332(D) mm

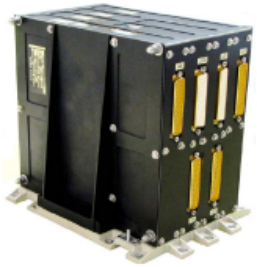


GAIA (2013) CDMU
RUAG-S *AT697F*

Power consumption = < **40W** average (excluding external loads)

Mass = 16kg

Dimensions = 420(L)x270(H)x(276(D) mm



SEOSAT (2014) OBC
ASTRIUM-E *SCOC3*

Power consumption = **15W** peak (excluding external loads)

Mass = 5.2kg

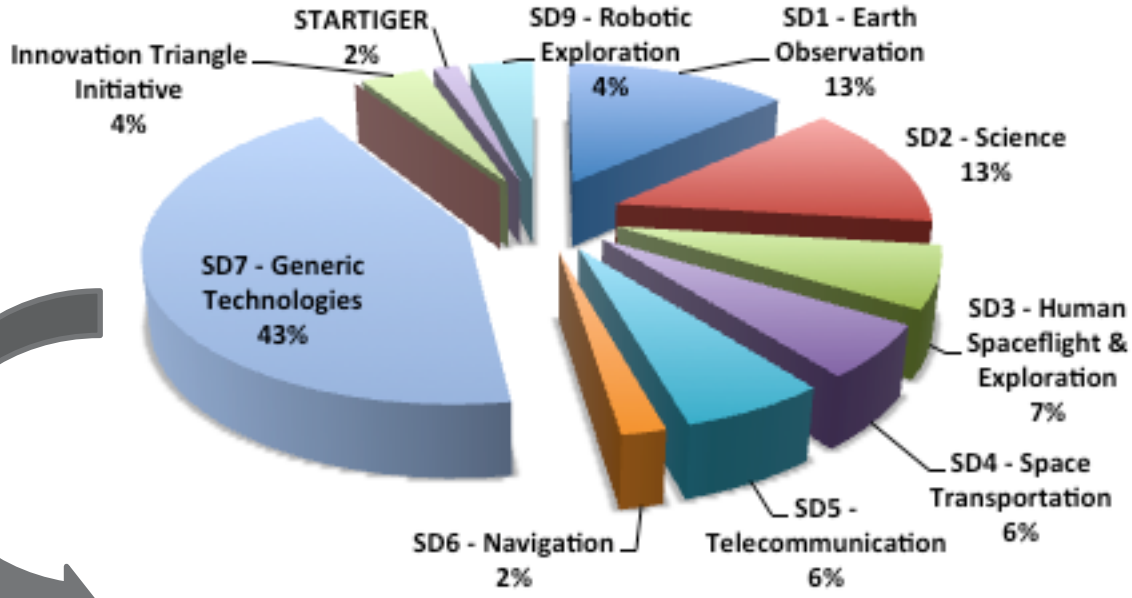
Dimensions = 250(L)x150(H)x216(D) mm

# Basic Technology Research Programme 2014-2015

European Space Agency

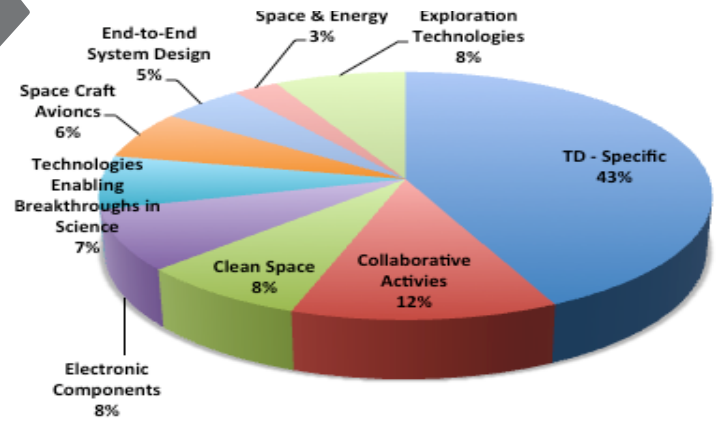
# TRP Budget dedications 2014-2015

## 2014-2015 Budget Perspective




| | M\€ |
|---|---|
| SD1 - Earth Observation | 14 |
| SD2 - Science | 14 |
| SD3 - Human Spaceflight & Exploration | 7 |
| SD4 - Space Transportation | 7 |
| SD5 - Telecommunication | 6.5 |
| SD6 - Navigation | 2 |
| SD7 - Generic Technologies | 44 |
| SD8 - Space Surveilance | 0 |
| SD9 - Robotic Exploration | 5 |
| STARTIGER | 1.6 |
| Innovation Triangle Initiative | 4 |

## 2014-2015 Generic Budget Breakdown



# How to communicate ?

ESA Unclassified
For official use

ESA/IPC(2013)107
Paris, 19 Sept 2013
(English only)

EUROPEAN SPACE AGENCY

INDUSTRIAL POLICY COMMITTEE

Information Note

BASIC TECHNOLOGY RESEARCH PROGRAMME

Preliminary Selection of Activities for the TRP 2014-2015 Work Plan

SUMMARY

The purpose of this document is to:

- present the preliminary selection of TRP 2014-2015 activities in compliance with programmatic needs
- support bilateral meetings with Delegations
- summarise the process and logic which have led to the selection

REQUIRED ACTION

IPC delegations are invited to take note.

NEXT STEPS

Following the presentation of this preliminary selection at the September 2013 IPC, bilateral contacts will be established with Delegations. The procurement plan for the activities to be initiated in 2014 will be presented to the November 2013 IPC.

ESA unclassified - For official use

ESA/IPC(2014)3,add.2
Att.: Annexes
Paris, 10th April 2014
(English only)

**EUROPEAN SPACE AGENCY**

**INDUSTRIAL POLICY COMMITTEE**

**BASIC TECHNOLOGY RESEARCH PROGRAMME**

**Update of the TRP 2014 Work Plan**

**The IPC is invited to approve the TRP Work Plan 2014 Update by simple majority of the Member States.**
**AT+BE+CH+CZ+DE+DK+ES+FR+FI+GR+IT+IE+LU+NO+NL+PL+PT+RO+SE+UK**

**SUMMARY**

This document is an update of the TRP Work and Procurement Plan for 2014.

**REQUIRED ACTION**

1.- Member States are invited to approve the attached TRP Work Plan 2014 Update.

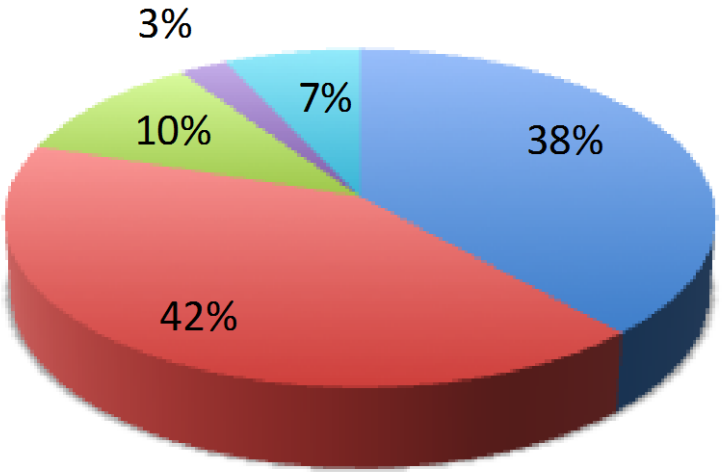
2.- The Industrial Policy Committee is invited to approve the procurement plan associated to the attached Work Plan Update (Activities in Annex I identified with the label IPC), based on the descriptions and justifications provided in Annex II.

Multi-year plan

Updates as required

Every single action in TRP is presented to the IPC and contractual status reported at every IPC

# How to procure ?




- C - Open Competition
- C(1) - Competition restricted to non-prime contractors
- C(2) - Competition, where a significant participation of non-primes is requested
- C(3) Competition restricted to SMEs & R&D Entities.
- DN - Direct Negotiation

> 80% are in competition

# Crosscutting Initiative - Example: Clean Space Initiative

*Guaranteeing the future of space activities by protecting the environment.*

# Crosscutting Initiative - Example: Clean Space Initiative

**Environmental concerns** lead to:

- New legislations (REACH, RoHS, LOS)
- Competitive advantage due to green technologies
- Pressure on the space industry (risk of supply chain disruptions; requests from customers, operator clients, employees)

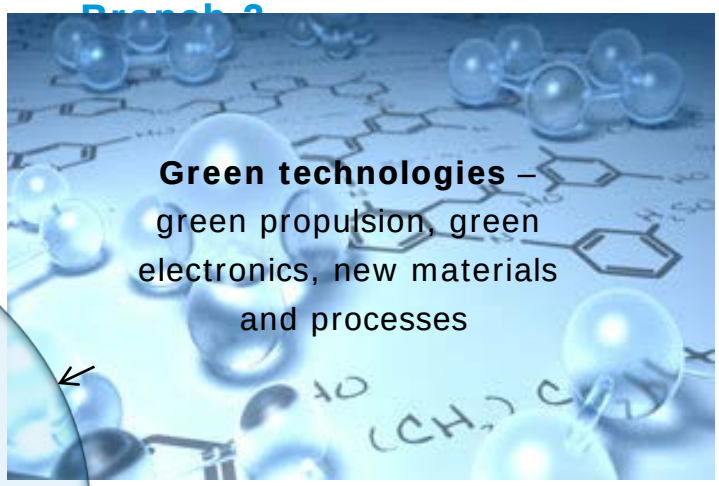
Concerns on the sustainability of the **exploitation of space**:

- Risk due to space debris
- News headlines worldwide (impact on the image of the space sector as a whole)

ESA, with the Clean Space initiative, will give a pro-active answer to the environmental challenges both on ground and in space, including its own operations as well as operations performed by European space industry in the frame of ESA programmes

**ACTION IS NECESSARY TO TRANSFORM THREATS INTO OPPORTUNITIES**

# Crosscutting Initiative - Example: Clean Space Initiative

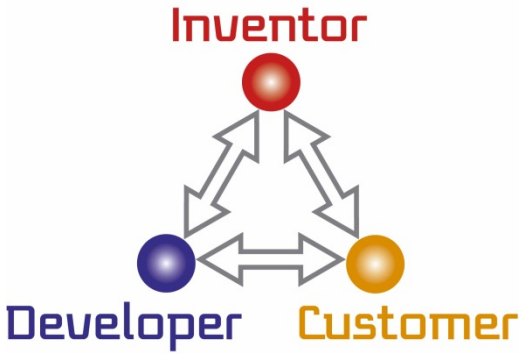




Green technologies

**Clean technologies**

Space Debris


# TRP: Innovation Triangle Initiative




**ITI is based on the "Innovation Triangle" concept requiring the collaboration of 3 different entities: an INVENTOR, a DEVELOPER and a CUSTOMER.**

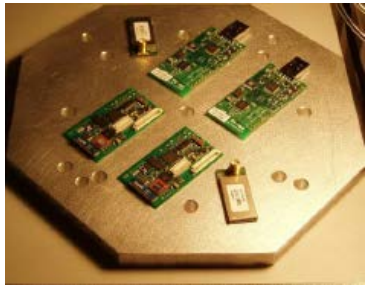
Three types of activities aimed at the different elements of the triangle:

(A) Proof of Concept (for INVENTORS): fast validation of new ideas

(B) Demonstration of Feasibility and Use (for DEVELOPERS): component and/or breadboard development up to validation in the laboratory

(C) Technology Adoption (for CUSTOMERS): development up to validation in a relevant environment,

**Pressure sensor, Oxensis**



**Wireless sensors, SSTL**

# TRP: STARTIGER

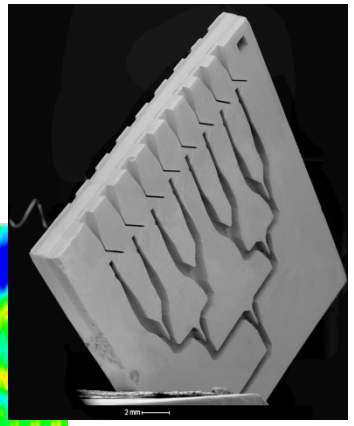
**Objective:** Achieve a leap in technology in a short period of time

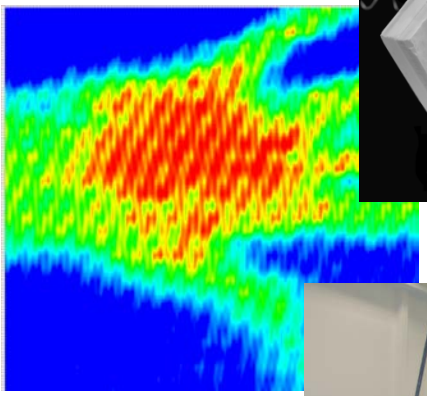
**Mechanism** (Skunk Work Approach):
- Intensive period of research, Focused to a specific technical goal
- Small cross disciplined team
- Co-located in a distraction free, resource rich environment
- Enthusiastic approach to problem solving
- Priority technical support

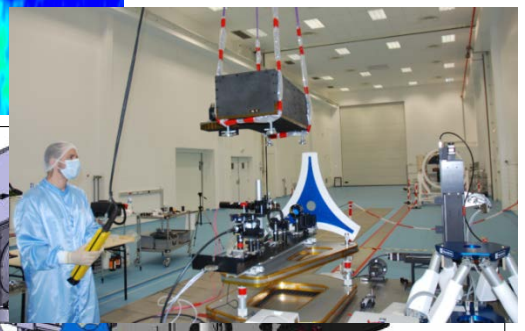
**Spin-offs:**
Breeding ground for innovative thinking

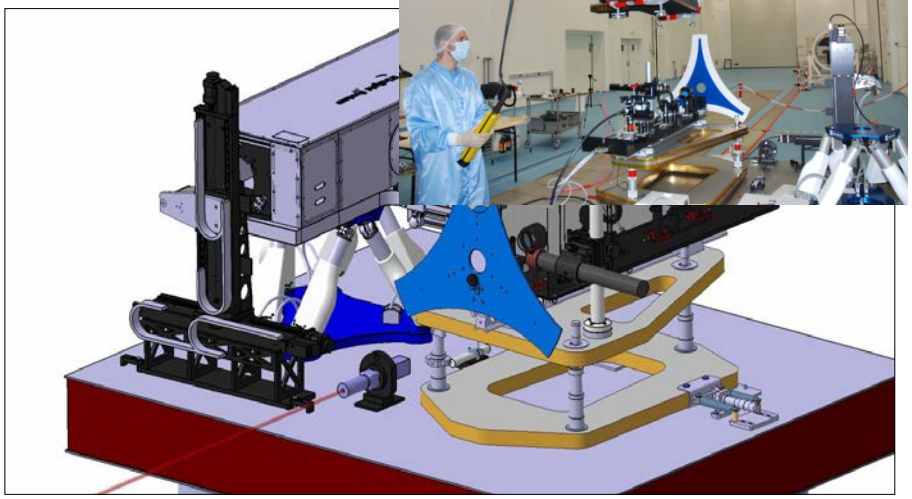
**Previous Testcases:**
- STARTIGER Pilot Activity at RAL (UK) in 2002
- Formation Flying Coronograph at LAM (F) in 2009

**Status:**
- Regular feature of the programme 2X per year










Thanks you for your attention !
European Space Agency