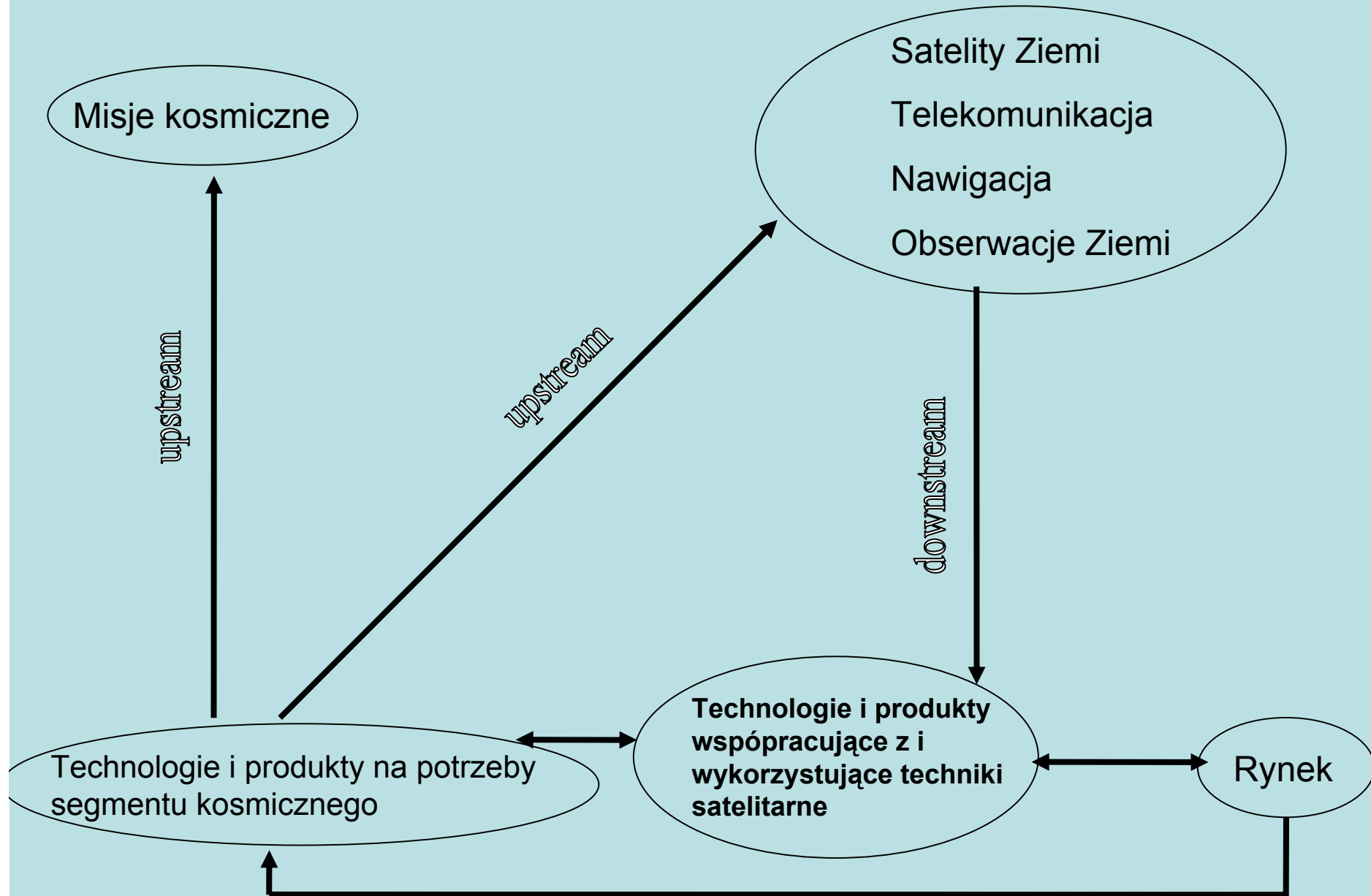


# **Sugerowane dziedziny**

## **Projektów PECS**

Zbigniew Kłós CBK PAN

# Aktywność „space-related”



# Obszary Aktywności Technicznej

## PAYLOADS

Telecom & navigation payloads  
Earth Observation & Science payload  
Manned Spaceflight hardware  
Microgravity hardware  
equipment Satellite Bus Equipment  
network

## Ground-based

Launcher equipment  
EGSE, MGSE simulator  
On-board processors+software  
Sat/LV ground stat. Ground segment

Ground segment

IV&V of on-board softwar

## SYSTEMS

Mission Analysis  
Satellite ground control software  
Administration & Support Services  
Value Added ground system & services  
Value added system user terminals  
Mission centres (data archiving)  
Space related Science and research



# ESA-“HOT SPOTS”

- SPACE MISSIONS
- SATELLITE PROJECTS
- TECHNOLOGY PROGRAMMES

# Space - a challenge

Space project areas for technological demands

- Attitude orbit control - 19%
- Telemetry & Telecommand -17%
- Propulsion - 12%
- Thermal control - 2%
- Mechanism & Tribology-14%
- Power - 7%
- Payloads -23%
- Data Handling -6%

# Space - a challenge

The space missions need new

- Structures and materials
- Fast electronic devices with low consumption
- Sensors
- Devices for energy and fuel storage

Today Nanotechnology is close to bring solutions

# Space Technology in Europe

- Supports future European space missions, example of identified technology needs:

- Advanced materials and processes
- Platform technology
  - Advanced structural concepts, inflatable and deployable structures
  - Composites for low mass structures (solar array, antennas, tanks, bo protection...)
  - Chemical and electric propulsion
  - Solar generators, power management and energy storage
  - Heat-pipes, capillary driven loops, fluid-loops, cryo-coolers
  - High efficiency radiators and MLI (Multi layer insulation)



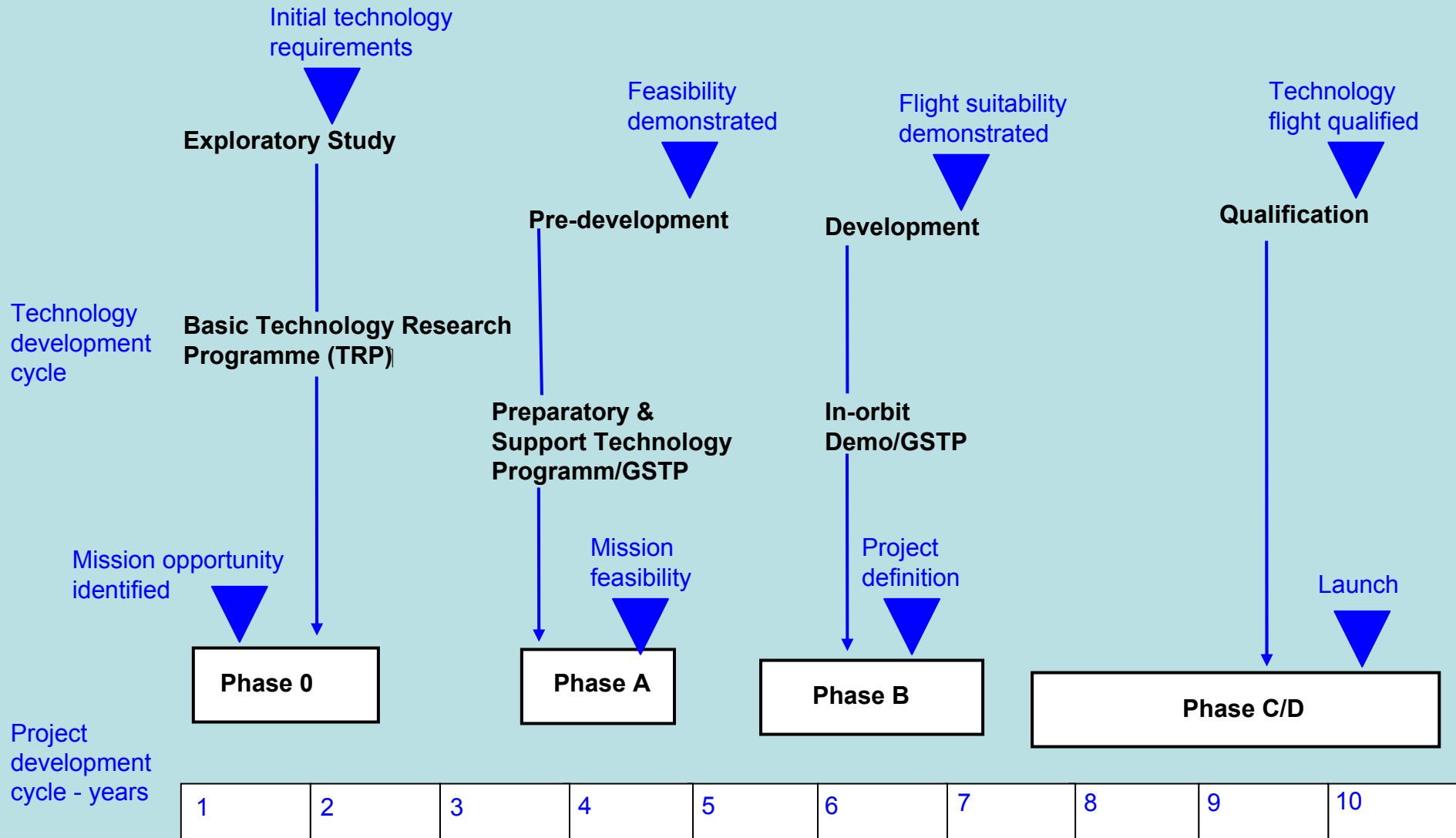
# ESA Technology Programmes

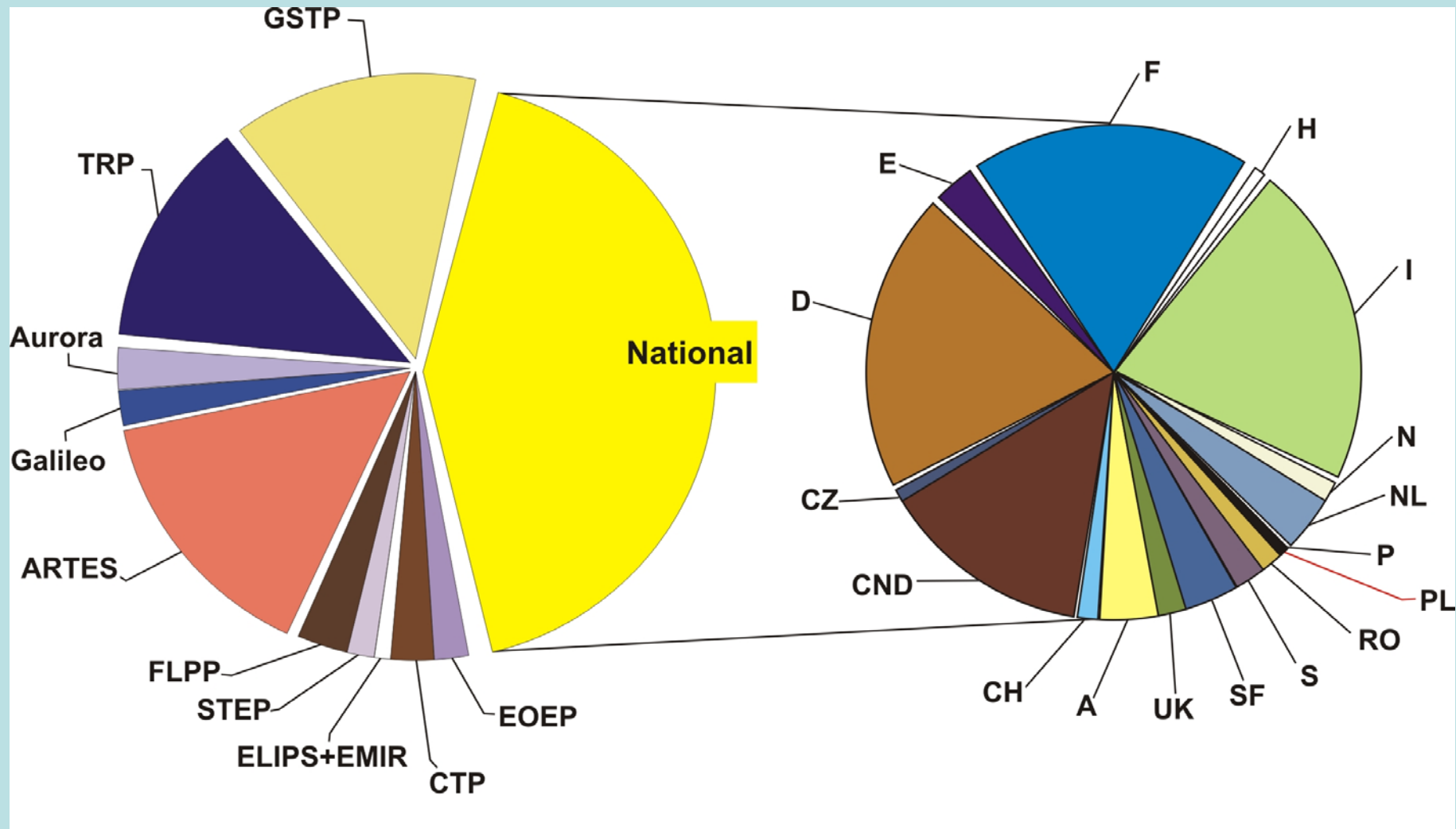
- GSTP – General Support and Technology Programme
- FLPP – Future Launcher Preparatory Programme
- STEP – Standard Exchange of Product
- ELIPS – ESA for Life and Physical Sciences
- EMIR – ESA Microgravity Programme
- CTP – ESA Core Technology Programme
- EOEP – Earth Observation Envelope Programme
- TRP – Technology Research Programme

# Space technology in Europe

- ESA General Support and Technology Programme (GSTP) – for 2005
  - Earth Observation actions 44
  - Science & Robotics Exploration actions 26
  - Human Spaceflight & Robotic Exploration 33 actions
  - Space transportation 25 actions
  - Generic technology 147 actions
  - Pilot Projects 3 actions
  - TOTAL 278 actions
  - TOTAL FOUNDING 132 MEuro

# ESA Technology Development Cycle

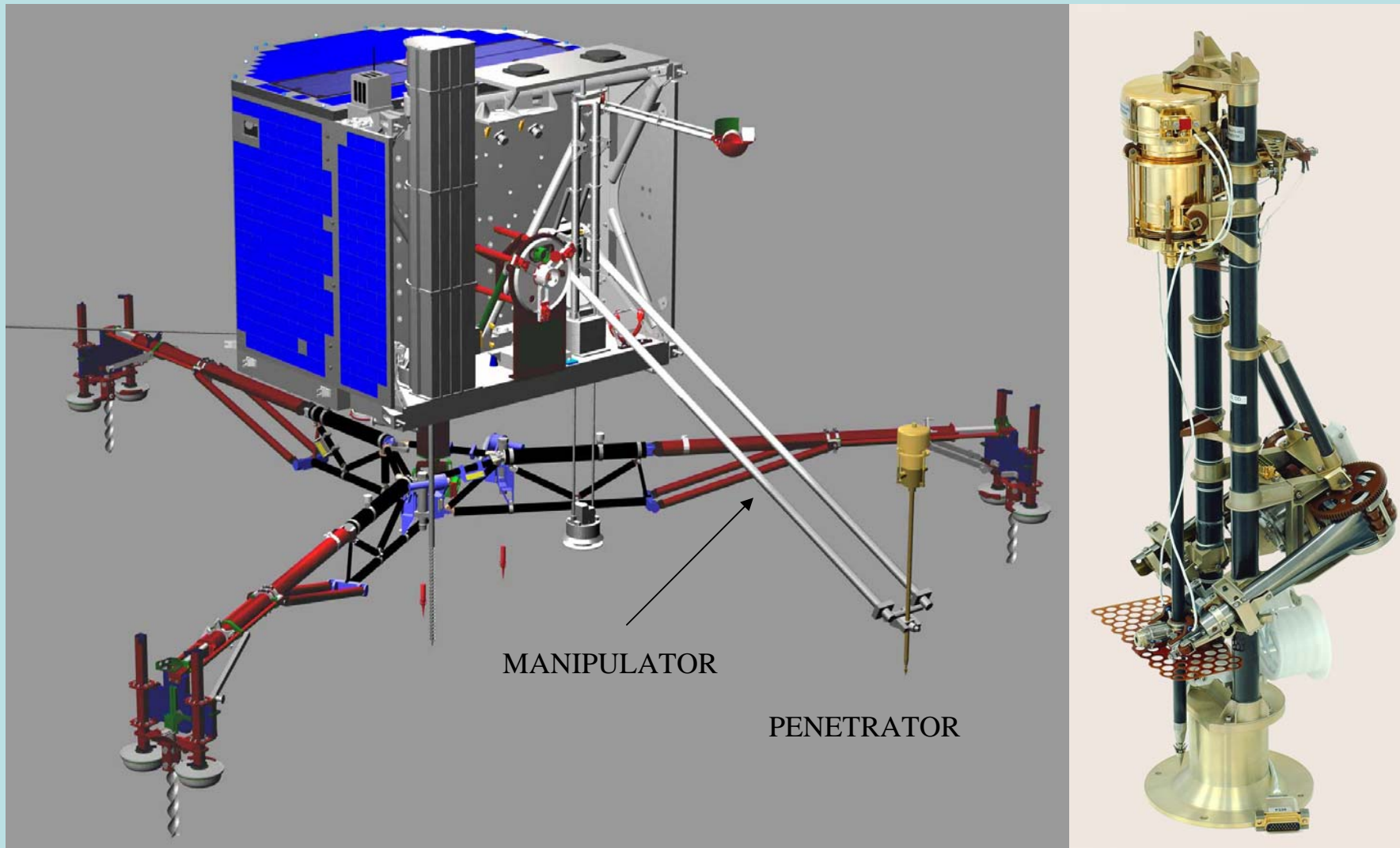




European space technology R&D: Average yearly budget as of 2005 ( 380million € )

# MUPUS-TP onboard PHILAE (ESA-DLR lander)

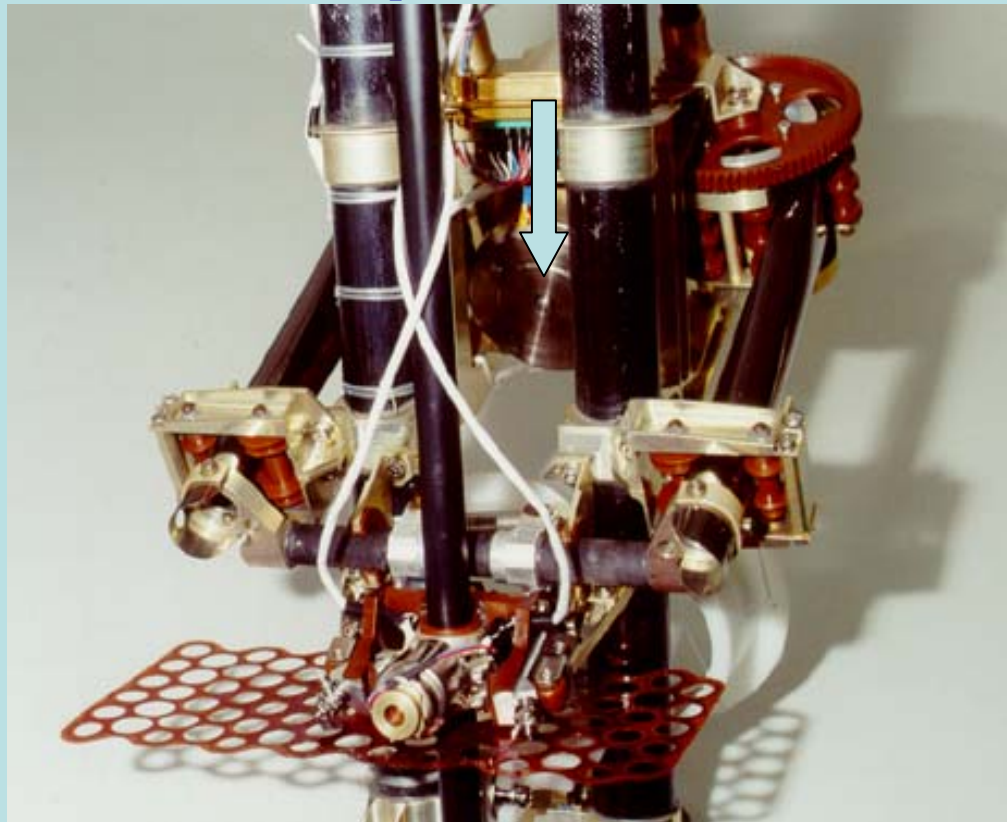
POLISH  
ACADEMY  
OF SCIENCES  
SPACE  
RESEARCH  
CENTRE



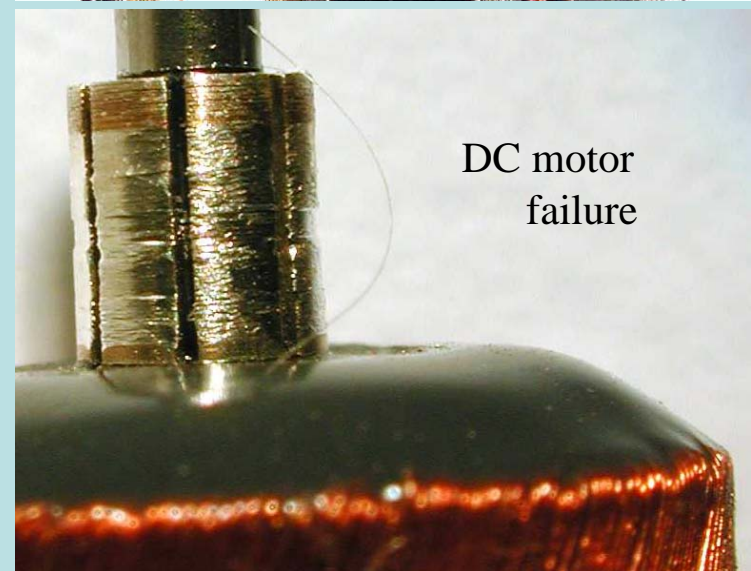
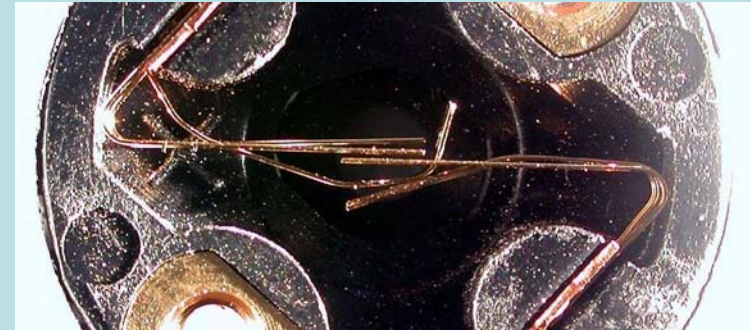
## Challenge (1) DC motors brushes and commutators materials

Increased wear resulting from the process of sliding combined with the passage of high currents and arcing

Improved stepper motor  
Escape P430



Extension & Retracting Mechanism



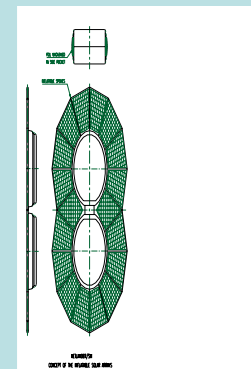
# Space Programs: a challenge for material engineering



- (1) DC motors brushes and commutators materials
- (2) Tribo-components materials
- (3) Semiconductors which can operate below  $-55^{\circ}\text{C}$
- (4) Flexible cable isolation at low temperature
- (5) Solar Cells on a foil (not susceptible to cracking)

presented by: **Jerzy Grygorczuk**

**E-MRS-2006, Warsaw, Sept. 06**



# Spacecraft Engineering

- PROBA (satelita)
- Space Mechanical System (design, analyse and manufacture)
- Mechatronics
- Mechanism
- Electrical propulsion
- Electrical power and conversion
- Electromagnetic and space environment
- Paled System
- EGSE
- MGSE



# Navigation & Spacecraft System

- EGNOS,
- GALILEO

# Telecommunication

- ARTES-4 – user segment, technology

# Earth Observation

- SMOS – groundbased verification
- EarthCare – radiometer ,lidar

# Science Mission

- Bepi Colombo (Mercury)
- LISA
- EXO-MARS

# WORK Description

- Project title:
- Overall Objective (mission):
- Role of the Institute  
(Principal/Co-Investigator for ...):
- Project term (to be) covered by the  
implementation Contract (dates of beginning  
and end of contract):
- Brief description of Main Tasks:
- Project output at the end of the term  
specified in the Implementation Contract in  
terms of :
  - hardware:
  - software:
  - documents:
  - Major Milestones (if any):