• **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
• Part of ESA’s Optional Programmes.
• Voluntary participation of all Member States (including Canada as associate Member State)
• Covering all technology disciplines and applications except Telecommunications (covered by the ARTES programmes).
• Five-year Work Plans, with yearly updates, and multiyear activities.
• Budget envelop five years ~ 350 Meuro

The GSTP ensures the right technology with the right maturity are available at the right time
General Technology activities. Includes Announcement of Opportunities (AOs)

Bringing individual components and related BBs to products.

Technologies for systems with security applications. Includes Space Situational Awareness (SSA)

Demonstrate new technologies and techniques
Technology Activity Examples:

- Mechanically steerable data downlink Antenna
- Second Generation APS for AOCS prototype
- Small Spacecraft X Band payload telemetry transmitter
- Highly efficient Stand-Alone LHP-based radiator system
- Next Generation Radiation Monitor (NGRM)
Examples:

**AIS (Automated identification System)**

The aim is to demonstrate space-based ship monitoring techniques which can then serve as the basis of operational services via satellite constellations. The experiment was fitted on the ESA’s Columbus module of the International Space Station.

**PROBA 2 PRoject for OnBoard Autonomy**

It is the second mission of the ESA’s In-Orbit Technology Demonstration Programme, dedicated to the demonstration of innovative technologies. Small, low-cost missions allow small companies access to space and provide them with the experience that is essential for European industries to be competitive and innovative.

10 European countries and Canada / 31 participating institutions / 17 new technology demonstration payloads / and 4 scientific experiments.
GSTP – DRAFT NEW STRUCTURE FOR PERIOD 6

Element 6.1 Support Technology for Projects & Industry
- Development of technologies and products for projects and industry, from low TRL to qualification
- Platform, Payload, Ground Segment and Engineering tools
- Spin-in, joint R&D with other sectors
- Preparatory activities for small technology breakthrough missions in 6.N

Element 6.2 Competitiveness
- Announcement of Opportunity (AOs)
- Revised co-funding (50%, 75%, 100%)
- Thematic AO reminders (GaN, REACH)

Element 6.3 Technology Flight Opportunities
- Flight opportunities for new technologies in commercial and institutional missions
- Database of technology needs and flight opportunities

Element 6.N
- Phase CDE of IOD-N mission
- Element 6.4: Ph. CDE Proba-3
- Element 6.4 sub-element: Small Missions Initiative (SMI)
• Development of technologies and products for projects and industry, from low TRL to qualification
• Target TRL shall be 4-6
• Development of engineering and test tools and methodologies (e.g. TD8)
• Covers technologies for space Platform, Payload, Ground Segment, and Engineering tools
• Support to Generic Technologies shall be strengthened
• Open to accommodate specific area work plans or pilot projects, like e.g. technology spin-in and joint R&T
• Preparatory activities for future technology breakthrough missions that will eventually be implemented in a separate ad-hoc GSTP Element
Evolution of the Announcement of Opportunity (AO5720)
Objective: offer to industry a mechanism for submitting at any time unsolicited proposals for market-oriented technology activities
Issue of special thematic reminders (GaN, REACH, ...)
Proposal to revise the funding schemes:

<table>
<thead>
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<th>TRL</th>
<th>Research Inst. &amp; Universities</th>
<th>SME</th>
<th>Non SME</th>
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<td>&gt; 5</td>
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GSTP-6 E3 – Technology Flight Opportunities

- Demonstration in-orbit of technology and products
- Target TRL is 7-8
- Essential for technologies spun-in from non-space sectors and for products requiring flight heritage for commercial customers
- Development and consolidation of capabilities in Member States
- Flight opportunities will be identified with ESA projects and launches, with National partners, and with primes
- Special relation will be established with National programmes with demonstration objectives
- The utilization of the ISS will be also considered
- Needs will be identified systematically as part of technology roadmaps
Precise Formation Flying Demonstration:
  - Implementation of PROBA-3 mission phases CDE.

Small Mission Initiative Sub-element:
  - Studies, analysis and workshops
  - Preparation of the future self-standing programme devoted to small missions
PROBA 3 will open the door to a new type of space missions, paving the way for future Formation Flying missions which need maintained large structures (large aperture antennas, long baseline telescope, interferometers, very long gradiometer etc.) as identified a few years ago, Darwin, XEUS, etc. and recalled at every call for mission proposals.

When implementing a sun coronagraph, AO issued by ESA Space Science, Proba-3 produces the perfect eclipse, observing the sun limb to the lowest tangent point improving significantly the performance of previous missions (e.g. LASCO on SOHO).
Mission architecture

- Occulter, 190 kg, 120 Mb/orbit, 50 m/s
- Two satellites in HEO, 600x60000
  - With inter-satellite links
  - relative NAV sensors, metrology
  - Two years lifetime
- Formation flying:
  - Distance, resizing: 25 – 250 m
  - Position Precision < 1 mm
- Payload:
  - coronagraph, breadboard
  - Startiger
- Coronagraph, 330 kg,
  - 280 W, 9 Gb/orbit,
  - 125 m/s
- Dissemination to users experiment providers
  - Verification benches
- S-band
- Launch by PSLV, Q1 2017 in stacked configuration
- Autonomous operation
  - Data collection
Preparation of the Workplan for GSTP-6 Element 1 – SD 7 Generic Technologies:

- A compendium of some 100-150 activities will be presented to Participating States in January IPC for information
- 1st GSTP-6 E1 workplan will be presented to May IPC, including activities in a specific area workplan for the clean space cross cutting initiative
- Activities related to the other three cross cutting initiatives: Space and Energy, Technologies for exploration and future instruments technologies will be integrated as part of the corresponding technologies roadmaps

Preparation of the Workplan for GSTP-6 Element 1 – Other service domains will be sincronised with TRP workplan preparation in 2013 and will take into consideration the supported programmes in the C/M12
Non-conventional Matrix/Carbon Nanotubes Reinforced Composite for Applications in Space (NACO)

- Carbon Nanotubes (CNT) present a set of very high properties including stiffness, strength, electrical and thermal conductivities
- Development of carbon nanotube (CNT) composite materials for space applications
- Focus on the creation of CNT-Skeletons, thick non-woven papers or felts, that can be embedded in metal, ceramic and polymeric matrixes.
- Envisaged space applications for such CNT-skeleton composites are for “metals”: e.g. heat sinks and structural materials, for “ceramics”: e.g. optical mirrors and benches and for “polymers”: surfaces, CFRP laminates, adhesive, deployable booms/structures, highly thermal/mechanical loaded sections, highly stable CFRP structures.
- Univ. Minho PIEP and Inegi/in colaboration with companies from AT, DE and GR
• **Non-conventional Matrix/Carbon Nanotubes Reinforced Composite for Applications in Space follow on (NACO2)**

  - Manufacture and characterisation unambiguously the most promising materials identified within NACO. Scale-up the material developments and thereby increase the technology maturity for CNT skeleton based ceramic and polymer composites.
  - Feasibility for processing large CNT buckypapers has been demonstrated while the different composite developers have verified compatibility of their processes with the CNT skeletons. Quality measures have been defined to ensure reliability of manufacturing process and test data.
• **Nonlinear Programming Solver (NLP) for Space Trajectory Optimization**

  • New NLP solver increases capacity and capability of European industry in the area of numerical optimization for applications such as trajectory optimization, launcher design optimization, manoeuvre optimization, material optimization.

  • **University of Coimbra** (Expert in NLP development; responsible for the Interior Point (IP) and filter algorithms) and **Skysoft** (Integration of NLP solver in existing trajectory tools for testing and verification)
GSTP - Portuguese Highlights

- 02-Space System Software
  - GSTP - Qualification of X-luna operating system
- 04 -Spacecraft Environment & Effects
  - GSTP - Integrated Radiation Environment, Effects and Component Degradation Simulation Tool (Experimental Verification)
- 05-Space System Control - GNC Technology
  - GSTP - Non-Linear Programming Solver for Space Trajectory Optimization
- 24 -Materials and Processes:
  - GSTP - matrix/carbon nanotubes reinforced composite
  - GSTP- CTTB In-Flight Component Irradiation Test Data Analysis
GSTP - Portuguese Participation to GSTP: GSTP & Technology Areas 2004-2011

2.4 ME Awarded since Yr 2004

- WP GSTP-4: 69%
- Proba-3: 11%
- 4.- Space Transportation & Re-entry Technologies: 4%
- 6.- Generic Technologies: 85%
- 7.- Pilot Projects: 11%
- AO: 13%
- NewPro: 7%
Portuguese Industrial Participation to GSTP 2004-2011

2.4 ME Awarded since Yr 2004

Deimos Engenharia 30%
Edisoft 12%
LIP 12%
AENL 9%
Univ. Minho PIEP 3%
University Coimbra 5%
HOLOS 5%
GMV Skysoft 7%
EFACEC 1%
INEGI 1%
Critical Software 2%
Uninova 3%
Evoleo 2%
Skysoft 4%
Solscientia 4%
Evoleo 2%
Uninova 3%
Critical Software 2%
Evolco 1%