GENERAL SUPPORT TECHNOLOGY PROGRAMME

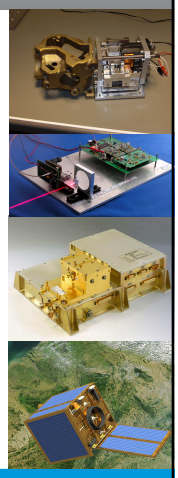
Czech Space Technology Day
TEC-SG
July 2010

European Space Agency
www.esa.int

CONTENTS

GSTP - OVERVIEW

- 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-years Workplans, with yearly updates, and multiyear activities.
- Aims at maturing technology and develop products.
- Budget envelop five year ~ 350 Meuro



The GSTP ensures the right technology at the right maturity are available at the right time

European Space Agency

3

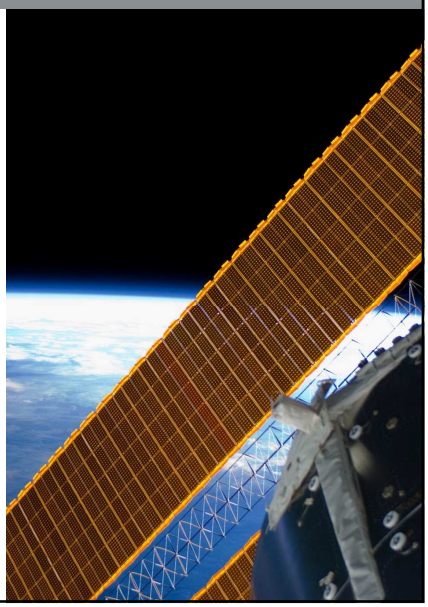
GSTP OBJECTIVES

• Enabling activities of ESA and national programmes by developing technology

•Supporting the **competitiveness** of European industry

• Transferring from outside the space sector to use in the design of new space systems ('**spin-in**').

• Fostering **innovation** and enhance European **technological non-dependence** and the availability of European resources for **critical technologies.**



4

GSTP HISTORY

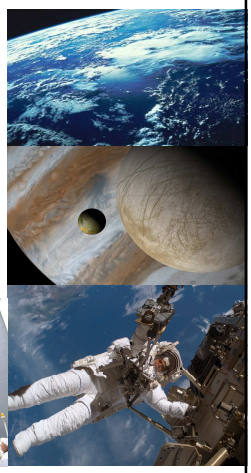
- GSTP Programme was initiated in 1993, following Resolution ESA/C-M/XCVII/RES.1, with the objective to ensure the necessary continuity in the development of identified technologies.
- Initially was established in 3 years periods:
  - GSTP1 – 1993-1995
  - GSTP2 – 1996-1999
  - GSTP3 – 2000-2003 (extended 1 year)
  - GSTP4 – 2004-2010 (extended 3 years)
- Some changes were introduced to the programme in the fifth period, GSTP5:
  - 5 years period (2009-2013)
  - The creation of 4 elements
- The Declaration (ESA/IPC/CXXIX/Dec.1, rev19), and implementing rules (ESA/C(2008)141) are subscribed by all ESA Participating States
- As a target, 80% of the Participant State Contribution shall fund industrial activities.

GSTP IMPLEMENTATION

- GSTP is implemented in 5 years periods
- Review will be conducted in the fourth year and proposal prepared for next period: contents, status of industrial return, population of list of products, status of non-dependence
- Work plans are revised yearly.
- Workplans include multi-year actions.
- Initial Work Plans for GSTP period 5 have been approved in 2009 and 2010.
- Structured in 4 elements.
- Contribution funds allocated by Participating States are not used until committed
- Flexibility to transfer funds among the elements
- Participating States might increase their contribution or transfer the funds at any time

GSTP – SERVICE DOMAINS

- Earth Observation
- Science & Robotic Exploration
- Human Spaceflight and Exploration Preparation
- Space Transportation and Planetary Entry
- Navigation
- Security for Citizens
- Generic Technologies and Techniques

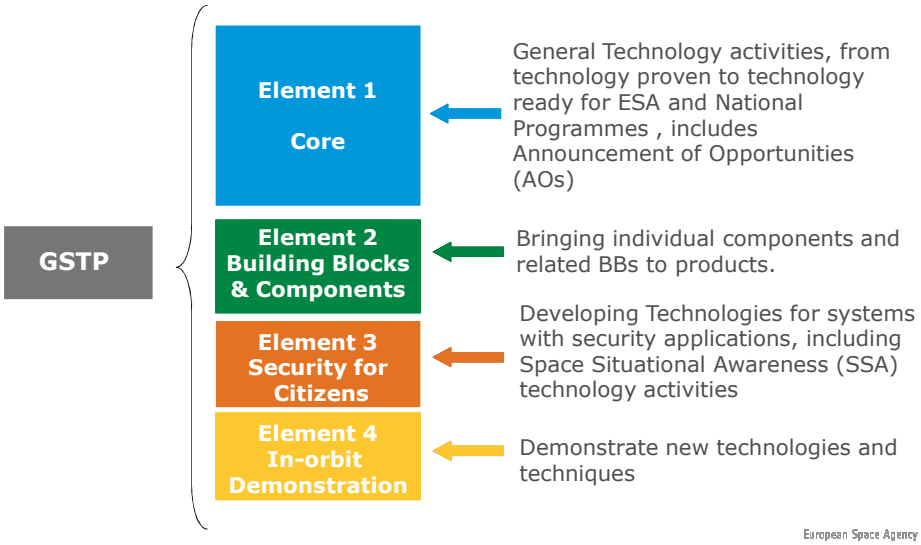


GSTP – PROCUREMENT POLICY

- C Open Competitive Tender
- C(1) Activities in open competition limited to the non-Large-System Integrators (LSI)
- C(2) Activities in open competition, where a significant participation of non-LSI is requested.
- C(3) Activity restricted to SMEs & R&D organisations, preferably in cooperation.
- C(4) Activities in open competition, subject to SME subcontracting clause
- C(R) Competition is restricted to a few companies, indicated in the "Remarks'' column;

- DN/C Direct Negotiation/Continuation; the contract will be awarded in direct negotiation being the immediate continuation of a previous activity with the same contractor
- DN/S Direct Negotiation/Specialisation; the contract will be awarded by direct negotiation in implementation of a defined industrial policy or resulting from a sole supplier situation;

GSTP – OVERALL STRUCTURE



GSTP E1 – CORE ACTIVITIES

Programmatics:

- All service domains except Telecommunications
- TRL from 4-6. From demonstration of the technology to breadboard or prototype demonstrated in relevant environment
- Work Plans/ Procurement Plans presented to Participating States and IPC for approval.
- Workplan updated every IPC.
- Participants Delegations have two months to declare support to the activities.
- Allows special work areas, e.g. for multi-domain breakthrough innovation such as µ-systems
- ITT to Bidders in Participating States having confirmed their support to the activity

European Space Agency

GSTP E1 – CORE ACTIVITIES

Technology Activities Examples:

Earth observation:

- X/Ka band data transmission antenna qualification model
- Light weight, very stable rotating reflector antenna

Navigation:

- GNSS- POD (Precise orbit Determination Unit)

Generic Technologies:

- Non-conventional Matrix/Carbon Nanotubes Reinforced Composite for Applications in Space (NACO)

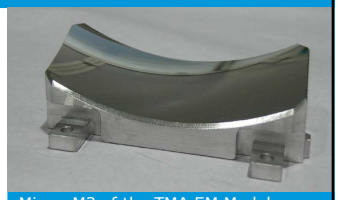
PROBA V:

- Development of the TMA Telescope of a Compact Wide Field-of-View Reflective Multispectral Imager
- Large Format SWIR Focal Plane Array

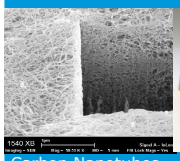
PROBA 3

- Design, Development and Test of a Mini Ion Engine System

11

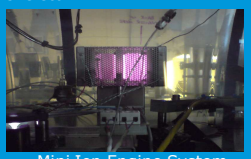


Mirror M3 of the TMA EM Model



Carbon Nanotubes skeleton

GNSS- POD



Mini Ion Engine System

European Space Agency

GSTP E1 – ANOUNCEMENT OF OPPORTUNITIES

Programmatics:

- Permanently open, based on unsolicited proposals
- 50 % co-funding, max ESA 1 M€,
- Conditions:
  - Outline proposals (~ 9-10 pages)
  - Need support by Delegation
  - Market oriented activities – A realistic business plan to be included – customer well identified (not only ESA projects)
  - Full proposal after positive evaluation of ESA Technical Experts
  - Evaluation according to ESA criteria

12

European Space Agency

European Space Agency

GSTP E1 – ANOUNCEMENT OF OPORTUNITIES

Technology Examples:

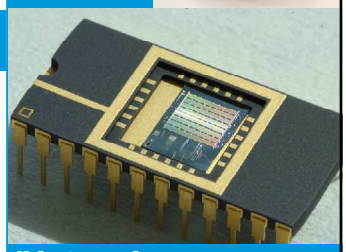
Qualification of Low Mass Configurable SADM

Complete the design (selected to fit the requirements of the future Sentinel 1, 2 and 3 satellites), build and qualify a low cost, low mass, low volume, high reliability and configurable Solar Array Drive Mechanism (SADM), focusing on European components

ROSETTA SADM, base of the new low mass, configurable, new generation SADMs

Novel Sensor for IR Spectroscopy based on Configurable Diffractive Optical Elements

Design, fabrication and test of a fully functional sensor demonstrator for methane (CH4) gas concentration measurement. The novelty relies in the silicon device: the CDOE (Controllable Difractive Optical Element) is a micro-opto-electro-mechanical system (MOEMS), that serves as a two-state spectral filter in the infrared.



IR Spectroscopy Sensor

13

European Space Agency

GSTP E2 – BUILDING BLOCKS & COMPONENTS

Building Block:

- Hardware or Software with a well defined function
- Developed for a reasonable envelope of performance and environment
- With clear interfaces for higher integration
- Allowing re-use without major non-recurrent systems adaptations

Why?

- Improve connection of ESA Technology developments and user projects
- Technology delivery on time -> Europe non-dependence on foreign sources.
- Low projects cost and risk, as the technology is ready at the right maturity level
- Eliminate the Death Valley syndrome identified in the product development cycle

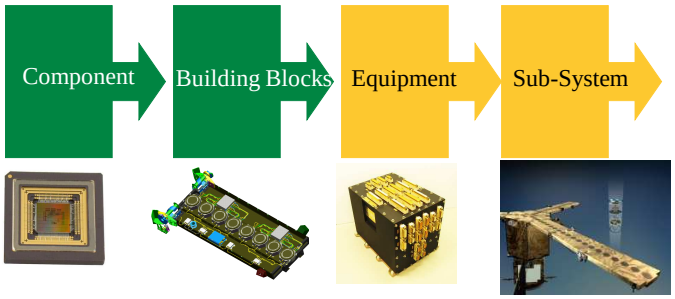
14

European Space Agency

European Space Agency

GSTP E2 – BUILDING BLOCKS & COMPONENTS

Approach: Have technology ready at right TRL and stimulate reuse
From component to equipment, i.e. building blocks



GSTP5 Element 2 aims at facilitating the development of building blocks to be made available to projects at right TRL
Reuse and adaptation: make – buy plans

European Space Agency

GSTP E2 – BUILDING BLOCKS & COMPONENTS

Programatics:

- Development BB&C to TRL6
- Participation to be declared by contributing to the Element
- Voting rights restricted to Element Participating States
- Work Plans/ Procurement Plans presented to Participating States and IPC for approval.
- Participants Delegations have to indicate their support to the activities previous presentation to IPC
- Workplan updated yearly
- Work plans to be approved by Element Participants
  -> Declare interest by approval of the work plan
- ITT to Bidders in Participating States having expressing interest

European Space Agency

GSTP E2 – BUILDING BLOCKS & COMPONENTS

Technology Areas

Building Blocks:

- S/C Avionics
- TT&C and Datadownlink
- Guidance Navigation & Control
- Power conditioning and distribution
- Chemical propulsion
- Electric propulsion
- Actuator technologies
- Thermal control
- Passive instruments (.Sub-mm Wave, detectors)
- Active instruments (LIDAR)

Material and Processes

Components

European Space Agency

GSTP E2 – BUILDING BLOCKS & COMPONENTS

Common Activities

- Define coordinated packages of technologies which shall be further developed as "Development Activities"
- Derive user requirements from customer needs, define utilization and target price for Building Blocks, etc.
- Include technology specification studies, standard architectures definition, spin-in preparatory activities, etc.
- Establishment and maintenance of "Catalogue" of Products

Development Activities

- Actual development and qualification of Building Blocks to achieve TRL6
- Building Blocks successfully developed and qualified will become part of the "Catalogue" of Products

European Space Agency

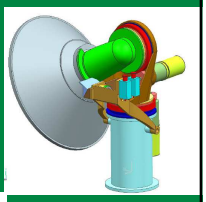
GSTP E2 – BUILDING BLOCKS & COMPONENTS

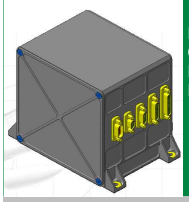
Technology Activity Examples:

- 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)
- DC/DC Converters

19

Mechanically steerable data downlink Antenna





Next Generation Radiation Monitor

Small Spacecraft X Band payload telemetry transmitter

European Space Agency

GSTP E3 – SECURITY FOR CITIZENS

- Building Blocks, same concept than for Element 2 but covering development of technologies for applications in the domain of Security for Citizens.
- Areas covered:
  - Secure TT&C and DataDownlink
  - Space Situational Awareness (SSA)
    - Space Weather
    - Near Earth Objects (NEOs)
    - Critical Technologies for SSA (telescopes, tracking, imaging, survey technologies)

20

European Space Agency

GSTP E3 – SECURITY FOR CITIZENS

Programatics:

- Development BB&C to TRL6
- Participation to be declared by contributing to the Element
- Voting rights restricted to Element Participating States
- Work Plans/ Procurement Plans presented to Participating States and IPC for approval.
- Workplan updated yearly
- Participants Delegations have to indicate their support to the activities previous presentation to IPC
- Work plans to be approved by Element Participants
  -> Declare interest by approval of the work plan
- ITT to Bidders in Participating States having expressing interest

European Space Agency

GSTP E3 – SECURITY FOR CITIZENS

Common Activities

- Define coordinated packages of technologies which shall be further developed as "Development Activities"
- Derive user requirements from customer needs, define utilization and target price for Building Blocks, etc.
- Include technology specification studies, standard architectures definition, spin-in preparatory activities, etc.
- Establishment and maintenance of list of Products

Development Activities

- Actual development and qualification of Building Blocks to achieve TRL6
- Building Blocks successfully developed and qualified will become part of the "Catalogue" of Products

European Space Agency

GSTP E3 – SECURITY FOR CITIZENS

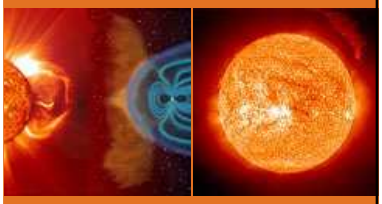
Technology Activity Examples:

Secure TT&C and Datadownlink:

- Highly Secure and High Data Rate Telemetry Encoder Building Block
- Space link security - Cryptographic processor

Space Weather:

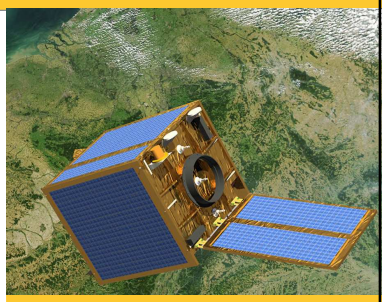
- Service oriented spacecraft magnetometer set
- Next Generation Space Environment Information System
- Virtual Space Weather Modelling Centre



23

GSTP E4 – IN-ORBIT DEMONSTRATION

- Demonstration of innovative technologies especially when flight heritage is needed.
- Demonstration of techniques and tools for research.
- Demonstration of operational monitoring techniques.
- Demonstration of spacecraft operations techniques.
- Techniques and tools for system development, AIV.
- Space and spacecraft characterisation – essential for technology
- Offering opportunities to guest payloads



PROBA V

24

GSTP E4 – IN-ORBIT DEMONSTRATION

Examples:

SMOS Soil Moisture and Ocean Salinity

ESA's SMOS mission is the first one designed to observe soil moisture over the Earth's landmasses and salinity over the oceans. SMOS carries a novel instrument called the Microwave Imaging Radiometer using Aperture Synthesis (MIRAS), captures images of emitted microwave radiation around the frequency of 1.4 GHz (L-band). MIRAS is the first polar-orbiting, spaceborne, 2D interferometric radiometer.

PROBA 2 PRoject for OnBoard Autonomy

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 countries1 and Canada / 31 participating institutions/ 17 new technology demonstration payloads/ and 4 scientific experiments.

25

European Space Agency

GSTP E4 – IN-ORBIT DEMONSTRATION

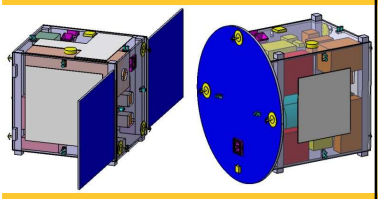
Examples:

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 3 PRoject for OnBoard Autonomy

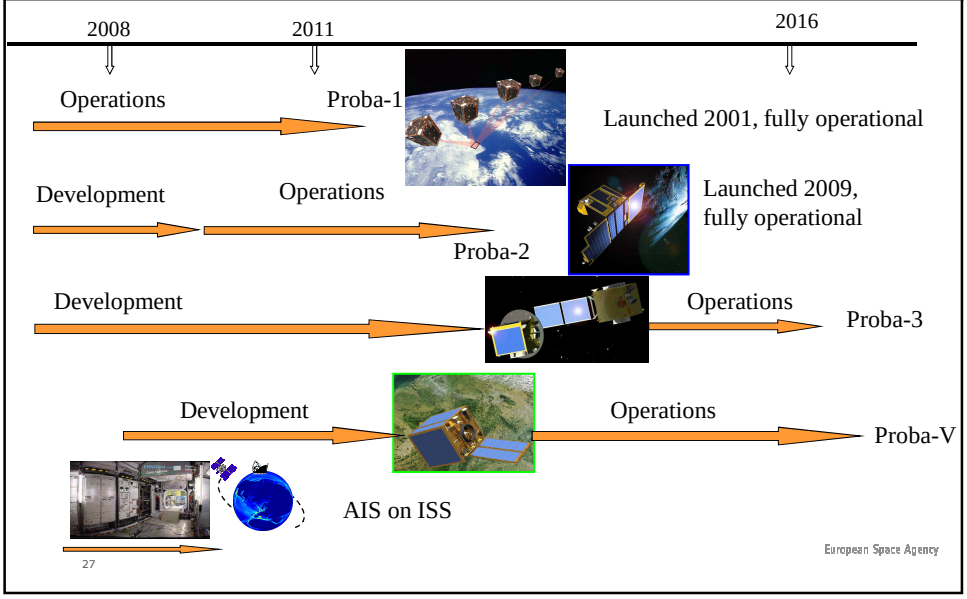
is the third mission of the ESA's In-Orbit Technology Demonstration Programme, dedicated to the demonstration of innovative technologies . Proba-3 will demonstrate the technologies required for formation flying of multiple spacecraft. An instrument to observe the solar corona will complement the demonstration.



26

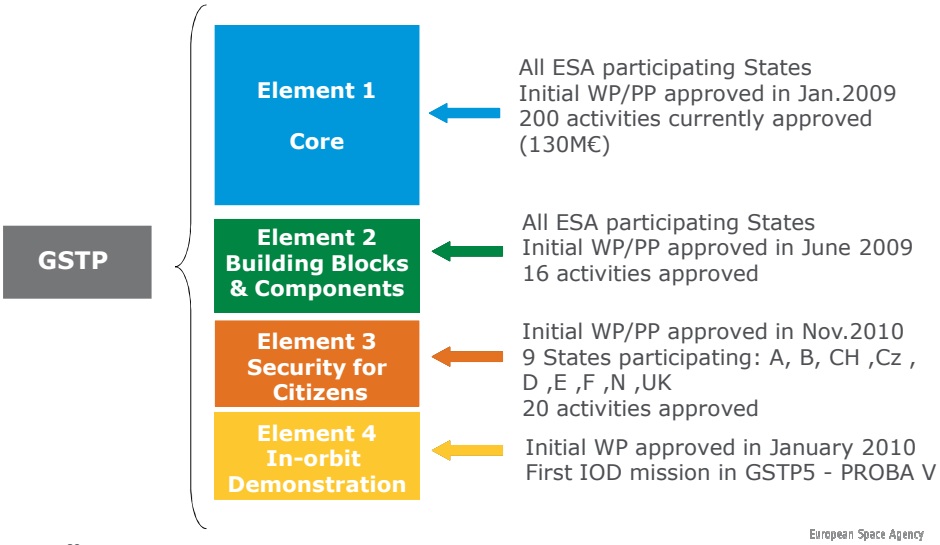
European Space Agency

IN-ORBIT DEMONSTRATION



European Space Agency

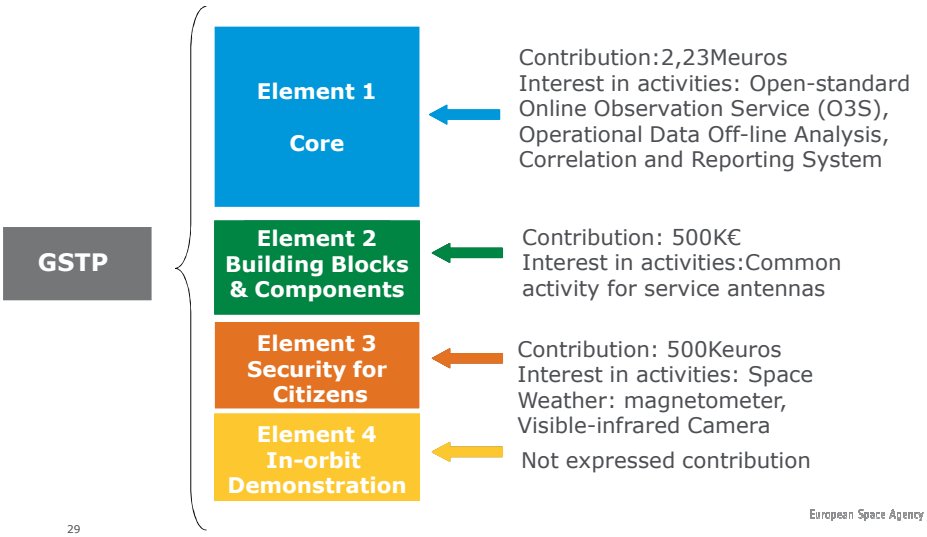
GSTP – STATUS JUNE 2010



European Space Agency

GSTP – STATUS JUNE 2010– CZECH REPUBLIC

Overall Contribution to GSTP Period 5 = 3.23 Meuros



29

European Space Agency