DPTD & GSTP
Space19+

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Content

- DPTD – Discovery, Preparation and Technology Development
- TDE – Technology Development Element
- GSTP – General Support Technology Programme
  - GSTP Element 1 Work Plan / Frameworks
  - GSTP Element 2 AO
  - GSTP Element 3
  - GSTP Road to Space19+
- Dissemination and promotion of technology results
Discovery, Preparation and Technology Development

Discovery and Preparation

Disruptive Ideas
- High risk
- Low budget
- Fast and Open
- Interactive
- Internal/external
- Challenge based

Future Missions
- Solid baselines
- Smart Customer
- Across all domains
- System integrator focus

Technology
- Low TRL
- Generic
- Enabling
- SME focus

TDE

Disruptive Ideas, Preparation and Technology Development
Discovery themes with Belgium

- Cyber Security
- Operations
- SSA
- Space Transportation
- Robotic Exploration

EO-Payloads
- Radio Occultation
- Technology
- Cubesats
- Additive Manufacturing

Space Applications
- Surface elevation monitoring
- Climate Change

Strategy
- GNSS market
- Socio-economic impact

Missions
- HERACLES
- DEADALUS
- SMILE
- Missions
- ISRU
- SKIM

Analogues
- Human Spaceflight
- Radiation

Human Spaceflight
- Radiation

Additive Manufacturing

Radiation

SMILE

Science
- ISRU

ISRU

SMILE

Analogues
- Human Spaceflight
- Radiation

Cyber Security

Operations
- SSA
- Space Transportation
- Robotic Exploration

EO-Payloads
- Radio Occultation
- Technology
- Cubesats
- Additive Manufacturing

Human Spaceflight

Additive Manufacturing

SMILE

Technology
- Radioclimatology

Surface elevation monitoring
OSIP - Opening ESA’s Innovation Pipeline

http://ideas.esa.int

- Radically reduced space innovation entrance barriers
- Prepares future with best ideas coming from anybody
- OSIP inverted the logic: No need to know ESA programmes
- ONE simple interface for ideas – ESA to channel to implementation
- OSIP makes the heavy lifting, you concentrate on the ideas

Simple
No need to know ESA programmes

Fast
Continuous feedback & evaluation

Transparent
Open, Fair, visible, online, flexible

OSIP
OPEN SPACE INNOVATION PLATFORM

http://ideas.esa.int
OSIP – ESA’s Open Space Innovation Platform

**Discovery Element Calls**
- Studies
- Early Technology Demos
- Research co-sponsorships

**ESA Internal Calls**
- Facility Management
- OPS internal CFI
- etc

**ESA External Calls**
- GSTP
- Downstream Gateway
- Techno Transfer HQ building

**OSIP**
OPEN SPACE INNOVATION PLATFORM
OSIP Impact

9 Campaigns + 2 Channels

- 6 Months since launch
- Covering all domains
- >500 Ideas
- >1400 active Users
- >13,000 User sessions
- >100,000 page views

56 ideas selected
OSIP Campaign – remote sensing of plastic marine litter

High activity during all Campaign Phases

OSIP used as **platform** for academia, industry & institutions to meet and exchange

59 ideas, 124 comments, 271 participants

Turtle in ghost net, Mediterranean Sea
Source: Jordi Chias

Thank you for your interest in the campaign "Remote Sensing of Plastic Marine Litter". My name is Paolo, I am an ESA engineer and campaign manager of this OSIP campaign. You can ask us questions in the discussion section below your idea or in the general Q&A Channel accessible from the Help Pages. We will do our best to respond to your questions and help you with the submission of your idea.

Very Active Committed User Community
Technology Development Element

TDE enables blue-sky thinking innovation in-line with ESA's objectives

- **Mandatory** for all member states as one of the elements of the Discovery, Preparation and Technology Development programme
- only ESA technology programme supporting all of ESA’s fields of activity across the **entire spectrum** of technical disciplines and applications
- **Based on 2 years WP. Average annual commitment** (industrial contracts) ~ **€55 million**
Technology Development Element
New WorkPlan (2019-2020)

- Volume: €94 million
- Plan presented at the November 2018 IPC
- WP 2019 approved by IPC on the 25th of February 2019
- WP 2020 to be presented to IPC in October 2019
- Invitations to tender for each activity are published throughout the year: see emits.esa.int

Applications
- Navigation
- Telecomm
- Earth Observation

Science Exploration
- Exploration
- Science

Enabling
- Space Transportation
- Generic Technologies & Techniques for all programmes & operations

$6 + 6 + 12 = 24\text{M€}$
$12 + 12 = 24\text{M€}$
$6 + 40 = 46\text{M€}$
Belgium TDE Committed Contracts (M€)

Between 2014 and 2019, 16M€ of contracts were committed with Belgian Entities in TDE

By Entity
- SME 7.44M€
- R&D Institute 3.17M€
- Other Firm 5.49M€

By Application
- EXP-Exploration 28.73%
- EO-Earth Observation 4.49%
- SCI-Space Science 4.07%
- TEL-Telecommunications 1.60%
- Others 12.73%
- GEN-Generic Technologies 40.25%
Budget Evolution

Depending on Space19+

- 20% increase for Basic Activities together with Science Programme
- DPTD part of the Objective 1 of the DG Proposal for LoR (CWG Document 101)
- Proposed increase from CM16 average of 98M€ to 103M€ in 2020 for DPTD
  - increase of **Discovery element from 12M€ to 16M€ in 2020** (including OSIP campaigns for universities and research centres)
  - Stable Preparation element at 20M€
  - Slight increase of **Technology Development element from 66M€ to 67M€ in 2020**
- **DPTD 2021-2022 increase of 8M€/year**
- OSIP campaigns to be funded via Discovery element (including former NPI and ITI)
General Support Technology Programme

GSTP ensures the right technology with the right maturity is available at the right time

- Part of ESA’s Optional Programmes
- Covering all technology disciplines and applications except Telecommunications
- GSTP subscription since 2013 1,100M€ million
- Average annual commitment (industrial contracts) ~ €100 million
- Work plans, with yearly updates, and multiyear activities / frameworks (e.g. de-risk) / Announcement of Opportunity
GSTP - Subscriptions

GSTP Subscription (2012-2019) (not including PROBA3)

Belgium is a key Participating State

24 Participating States

GSTP Period 1,2 & 3, 4, 5 are closed
## GSTP Element Structure

<table>
<thead>
<tr>
<th>ELEMENT 1</th>
<th>ELEMENT 2</th>
<th>ELEMENT 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Develop</strong></td>
<td><strong>Make</strong></td>
<td><strong>Fly (Small Missions)</strong></td>
</tr>
<tr>
<td>Development of technologies and products from low TRL to qualification Platform, Payload, Ground Segment and Engineering tools</td>
<td>Market driven, industry initiated, co-funded direct negotiation activities for technology maturation leading to products</td>
<td>Envelope which hosts projects such as satellites (for technology demonstration), ISS payloads, technology flight opportunities</td>
</tr>
<tr>
<td>Workplans / frameworks</td>
<td>Permanently Open call AO9834</td>
<td></td>
</tr>
</tbody>
</table>

**Component**

Proba 3
The GSTP E1 Develop Compendium is a **compilation of activity proposals that are considered top priority for ESA.**

Activity proposals and selection of activities made by representatives of the technical and application domains and internally coordinated.

It covers all application domains (with the exception of Telecommunication) and specific areas.

The **objective** of the Compendium is to **trigger discussions among industry and Delegations** of the GSTP Participating States with the aim that the activities are supported and implemented within the GSTP WP.

*The GSTP E1 “Develop” Compendium of Potential Activities 2017 (ref. ESA-GSTP-TECT-PL-005452), issued in June 2017 includes 143 Activities (~140M€).*
Development of technologies and products from low TRL to qualification Platform, Payload, Ground Segment and Engineering tools.

Activities to develop of technologies and products that are ESA driven and/or to develop industrial capabilities in ESA Member States.

- Programmatic: TRLs, Application, Consistency of scope/deliverables/TRLs,
- Continuation of previous activities (TRP, GSTP...)
- Innovation? Competitiveness? Enabling mission?
- Industrial sustainability / Capacity Building
- Interest from Delegations + Funds Availability

Roughly 10-25 activities approved in GSTP work plan 5 x per year.
GSTP Element 1 Develop: **Frameworks**

- Roughly 10-25 activities approved in GSTP work plan 5 x per year (including activities from the Compendia and ad-hoc proposals).

- **Frameworks introduced to implement specific types of activities faster**

- **Frameworks in operation:**
  - G617-241TA, Assessments to prepare and de-risk technology developments
  - GT17-137TI, Preparation of enabling space technologies/capabilities
  - G61A-036QT, Assessing the use of Advanced Manufacturing to improve and expand space hardware capabilities
  - GT17-136TI, Activities to bridge national technology developments
GSTP Element 1 Develop: **Frameworks**

**G617-241TA, Assessments to prepare and de-risk technology developments**

Approved by IPC in November 2016 with a budget of 1.8 M€ “...to allow for assessments that will help prepare and de-risk potential development activities”.

Aim: evaluate added value, address critical issues, orient follow-on activities

- Activities include at least one of the following tasks:
  - Analysis of specifications, development actions, schedule and cost
  - Assessment of the benefits and disadvantages of the solution with respect to the state-of-the-art
  - Assessment of critical issues related to using a given technology for a specific application, using analysis/simulation and/or breadboarding

- **Based on pre-proposal template**
  - <200 K€ (<80 K€ for studies) / Duration maximum 9 months
  - 100 activities initiated so far for more than 18 M€ in 15 countries (**14 activities with Belgium Entities**)

Target ESA procurement time: **4 months**
GSTP Element 1 Develop: **Frameworks**

**GT17-137TI, Preparation of enabling space technologies/capabilities**

Approved by IPC in April 2018 with a budget of 8 M€ “...to prepare and to develop enabling capabilities and the associated building blocks for space related systems and the associated sub-systems.”

Aim: targeted and coordinated development of capabilities in a given ESA Member State or across different Member States:

- **Based on pre-proposal template**
- nominal technology development activities, with typical deliverables
- < €500K per activity
- Support received from 8 Member States.
- 6 contracts and 14 under procurement (**6 activities from Belgium**)
- **Target ESA procurement time: 5 months**
G61A-036QT, Assessing the use of Advanced Manufacturing to improve and expand space hardware capabilities

- Maximum €250K per activity, expected activity duration: 12 months
- It allows entities with a background in space to assess the use of advanced manufacturing to improve their product range and benefit from the expertise and know-how of a recognised applied research organization.
- Tasks:
  - Impact analysis of the use of advanced manufacturing
  - Selection of a few product improvement/expansion opportunities
  - Preliminary design and breadboarding to verify and validate analysis
  - Preparation of a development and qualification plan

15 contracts in 4 Member States: **(6 contracts in BE)**

**ESA procurement time: 4 months**
GSTP Element 2 Make

Objective: offer to industry a mechanism for submitting at any time unsolicited proposals for market-oriented technology activities.

Funding schemes:

<table>
<thead>
<tr>
<th>TRL</th>
<th>SME</th>
<th>Non SME</th>
<th>Research Inst. &amp; Universities</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;= 5</td>
<td>Up to 75%</td>
<td>Up to 75%</td>
<td>Up to 100% (&lt;30% total)</td>
</tr>
<tr>
<td>&gt; 5</td>
<td>Up to 75%</td>
<td>Up to 50%</td>
<td>Up to 100% (&lt;30% total)</td>
</tr>
</tbody>
</table>

100 activities now ongoing cover a broad range of products from component to systems level
GSTP Element 2 Make – **New Approach**

**New Call published in EMITS - AO9834**

<table>
<thead>
<tr>
<th>Segment 1</th>
<th>Segment 2</th>
<th>Segment 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market Oriented Opportunities</td>
<td>Company Strategy Oriented Opportunities</td>
<td>National Priority Opportunities</td>
</tr>
</tbody>
</table>

**Segment 1**: For market oriented activities, entities implement the classical approach and propose product developments targeting commercial market opportunities. They present the nominal business case.

**Segment 2**: Entities propose developments of strategic relevance (i.e. leverage non-space capabilities for space, expand operations in the space domain or maintain strategic know-how).

**Segment 3**: Entities propose activities that address specific priorities of ESA Member States. Countries may wish to maintain and develop capabilities that serve different national space considerations.

<table>
<thead>
<tr>
<th>Economic Operator</th>
<th>Outline Proposal</th>
<th>Full Proposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entry Point 1: Mature (entities with established market/product experience &amp; with financial solidity)</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>Entry Point 2: Intermediate maturity level (with limited experience for the targeted market/product)</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Entry Point 3: Limited maturity (entities just created and/or limited commercial market/product experience)</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>
GSTP Element 3 Fly

- In-orbit Demonstration of technologies and products:
  - Target TRL is **7-8**
  - Essential for products requiring **flight heritage** for customers
  - Does **not** include technology development (Element 1)
- Offer Flight opportunities that are identified with: ESA projects & launchers, with National agencies, and with commercial missions
- Technology Flight Opportunity framework
  - Experiment accommodation (e.g. materials experiments)
  - Sound rocket / launcher service studies
  - In-orbit demonstration related systems (systems, payloads...)
- Cubesat framework
Projects funded by GSTP /Fly- 14 projects, 18 CubeSats

- **QARMAN (3U)** studying atmospheric re-entry
- **GOMX-4B (6U)** demonstrating constellation technologies
- **GOMX-3 (3U)** demonstrating new platform technologies
- **OPS-SAT** Operations experiments
- **SIMBA (3U)** monitoring climate variables
- **GOMX-5 (2x12U)** next generation of constellation technology
- **XFM (2U)** measuring solar X-Ray fluxes
- **PICASSO (3U)** studying the atmospheric ozone
- **PRETTY (3U)** demonstrating GNSS reflectometry
- **RACE (2x6U)** demonstrating rendezvous and docking
- **RadCube (3U)** measuring space radiation and magnetic field
- **M-ARGO (12U)** demonstrating asteroid rendezvous and identifying in-situ resources
- **HERA CUBESATS (2 x 6U)** observing asteroid deflection assessment
- **Lunar CubeSats for Exploration (2 x 12U)** studying Moon’s surface and its environment
- **European Space Agency**
GSTP in 2019
Road to ESA’s Ministerial Conference “Space19+”
Strengthen interactions with industry

Structured exchanges and interaction with Industry to establish a continuous dialogue and awareness on needs and technology challenges. Priority themes:

- Operations Innovation
- Digital Engineering (Design to Produce)
- Cyber-safety/-security
- Artificial Intelligence

Further foster timeliness and reactiveness while reducing risk and building capacity

The established frameworks, such as the Cross-cutting, Building block and De-Risk frameworks to further evolve to:

- Exploit synergies
- Further streamline
- Enabling follow-on
Strategic Objectives (2/2)
GSTP Programme Proposal for Space19+

→ Support competitiveness within the evolving context of the European space sector

Element 2 segmented to become more dynamic and tailored towards different needs

✓ Segment 1 - market oriented activities
✓ Segment 2 - strategic developments
✓ Segment 3 - priorities of ESA Member States

→ Facilitate in-orbit demonstration

Element 3 evolves to enable various types of flight opportunities and responds to the growing interest of Participating States, institutions and industry in CubeSats.

✓ Segment 1 - capitalizing on experience
✓ Segment 2 - building competence
✓ Segment 3 - focus on R&D and Academia
GSTP in 2019 – Operational Summary

GSTP E1 Develop – New GSTP Compendia 2019 – *Planned Q4*
- Generic Technologies and Techniques
- Sectorial key themes: Advance Manufacturing, Operations Innovation, Design to Produce, Artificial Intelligence, Cybersecurity

GSTP E2 Make – Segmentation – *Implemented*
- Segment 1: “Market Oriented Opportunities”
- Segment 2: “Strategic Opportunities”
- Segment 3: Implementation of National Priorities

GSTP E3 Fly – *Under preparation*
- Enabling new flight opportunities for in-orbit demonstration
- Segmentation of the cubesat framework
  - Segment 1 – capitalizing on experience
  - Segment 2 – building competence
  - Segment 3 – focus on R&D and Academia
GSTP in 2019 - New GSTP Compendia

- Implementation in GSTP E1 WP
- Compendia intended to be published in EMITS NEWS in Q4 2019

**ESA Driven:**

- **Generic Technologies and Techniques** - Activity proposals and selection of activities made by representatives of the technical and application domains and internally coordinated. ~100 activities
- **Advance Manufacturing** – Build-up on achievements from 2015 AM compendium/ESA expertise/dialogue with Industry. ~30 activities

**Industry Driven - Open Calls for European Industry for submission of ideas/topics of interest:** Issued through targeted calls to identified themes: ~50 activities

- **Operations Innovation**
- **Digital Engineering/Design to Produce**
- **Cybersecurity**
- **Artificial Intelligence**

ESA UNCLASSIFIED - For Official Use
GSTP in 2019 – OSIP Campaigns

http://ideas.esa.int

Indicative timeline:

Debrief to IPC

End Feb

Publication of the open call for industry ideas

April

Collection of ideas/evaluation

Mid April – End June

Pre-selection/discussions

July-August

Publication of the Compendium/implementation of activities

Oct/Nov

Space19+

Central Gateway for ideas for GSTP: Independent campaigns for the specific themes

Revision/Evaluation of the ideas.

Channeling of the activity proposals through the different GSTP Mechanisms: Sectorial area compendium, E1 frameworks, E2.
DTDP & GSTP for Space19+ Summary

DTDP:
- Budget increase of 5 M€ in 2020 year – Basically to Discovery
- DPTD 2021-2022 increase of 8M€/year
- New platform for collecting the ideas/iteration with industry - OSIP

GSTP:
- Element 1:
  - New GSTP Compendia 2019 (~170 activities) - Generic technology, AM, Operations Innovation, AI, Digital Engineering and Cybersecurity
  - Frameworks implementation (de-risk, Building Blocks, AM)
- Element 2 – New Segmentation
- Element 3 – Enabling new flight opportunities for in-orbit demonstration/Segmentation of the cubesat framework
Access to Discovery and Preparation Information

http://www.esa.int/Our_Activities/Preparing_for_the_Future/Discovery_and_Preparation
https://nebula.esa.int
TDE & GSTP: Technology results

Web site: Shaping the future

Events: SET-FPDs, working days on specific technology areas.

Reports:

- General information on TDE & GSTP
- Main achievements within technology programmes
- Contacts with the Team

http://www.esa.int/Our_Activities/Space_Engineering_Technology/Shaping_the_Future
Thank you for your attention

Point of Contact:
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GSTP.Management@esa.int

Visit the ESA Web side on "Shaping the Future":
http://www.esa.int/Our_Activities/Space_Engineering_Technology/Shaping_the_Future