

DPTD & GSTP Space19+

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ESA

Brussels,
30th September 2019

- 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 and Preparation

TDE

Disruptive Ideas

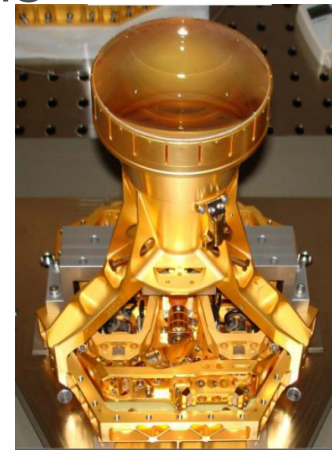
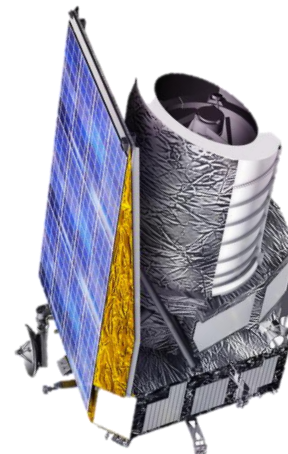
Future Missions

Technology

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

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

- Low TRL
- Generic
- Enabling
- SME focus



Discovery themes with Belgium



Cyber Security
Operations
Space Transportation
Robotic Exploration

SSA

GNSS-R
Climate Change
Space Applications
Surface elevation monitoring

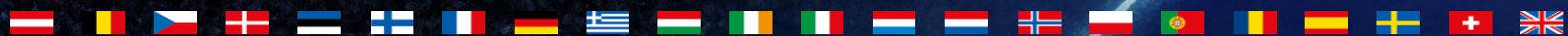
GNSS market
Strategy
Socio-economic impact



EO-Payloads
Radio Occultation
Technology
Cubesats
Additive Manufacturing

Analogues
Human Spaceflight
Radiation

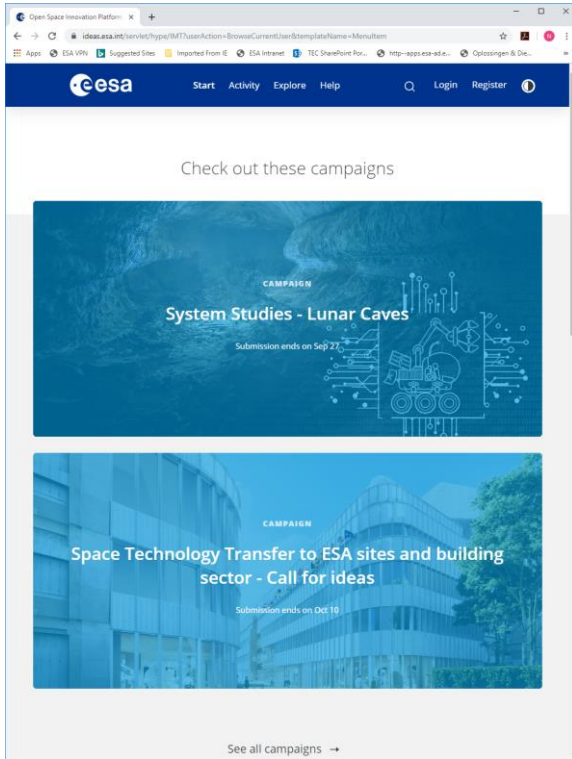
HERACLES
SMILE
ISRU
DEADALUS
Missions
SKIM



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

ESA UNCL

/09/2019| Slide 5



European Space Agency

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

9 Campaigns + 2 Channels

- Internal Call for Ideas on Space Safety
- Digital Design-to-Produce
- Cyber-Safety/Security
- Artificial Intelligence for Space
- Operations Innovation - Call for Ideas 2019
- Remote Sensing of Plastic Marine Litter
- Enabling Harbour to Harbour Autonomous Shipping
- System Studies - Lunar Caves
- Space Technology Transfer to ESA sites and building sector ideas
- Novel research co-sponsorship Ideas
- Space for Urban Innovation - Smart Cities



- ◆ 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

59 ideas,
124 comments,
271 participants

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

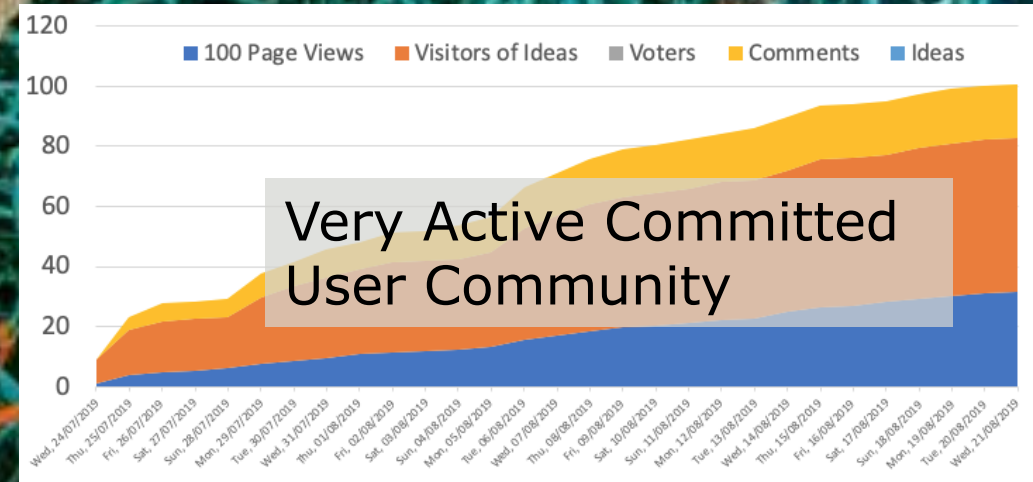
Do you need help?



Campaign Manager - Paolo Corradi, SYSTEM ENGINEER

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.

High activity during
all Campaign Phases

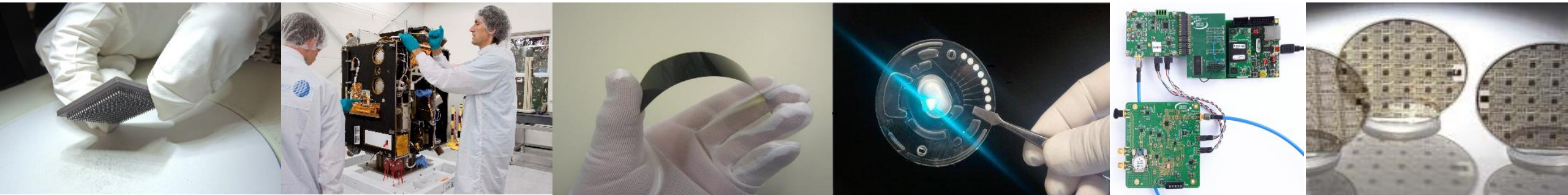
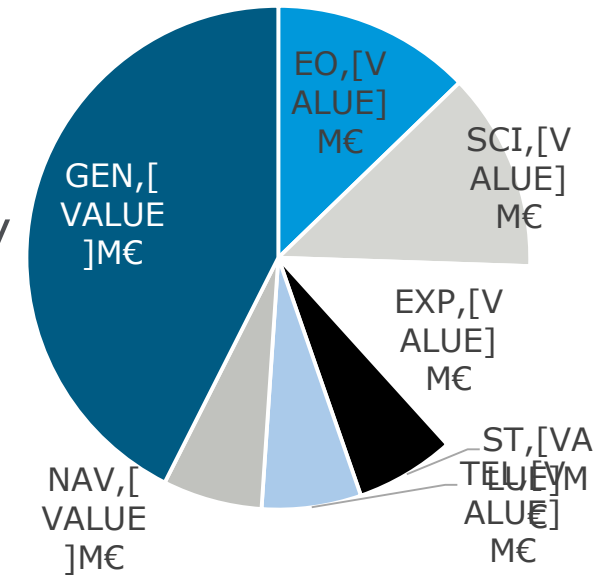


Turtle in ghost net, Mediterranean Sea
Source: Jordi Chias



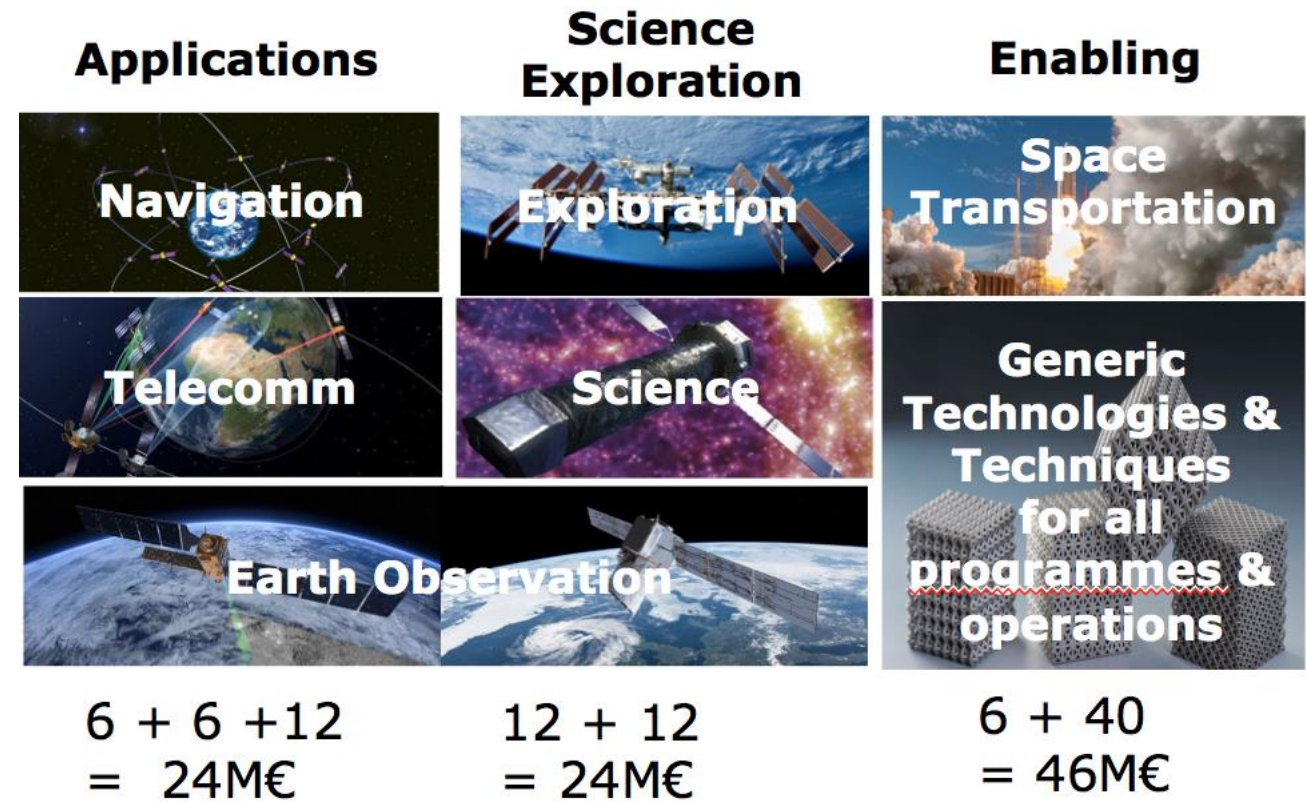
TDE enables blue-sky thinking innovation in-line with ESA's objectives

- **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**

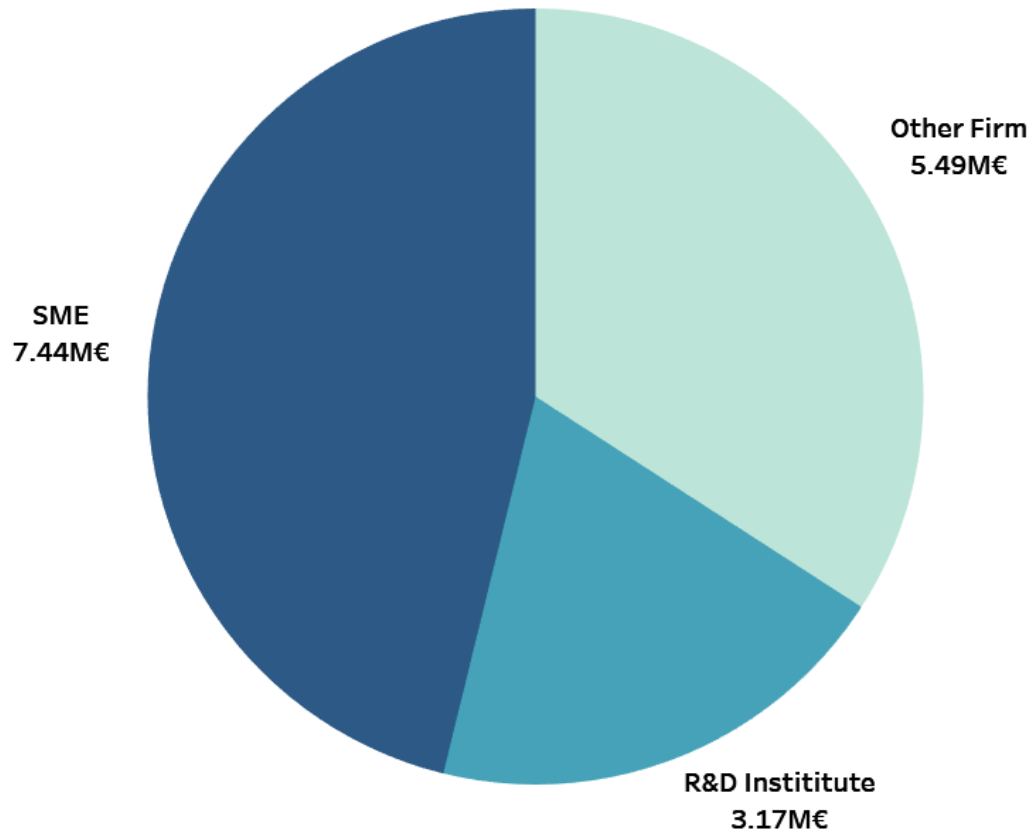


Belgium TDE Committed Contracts (M€)

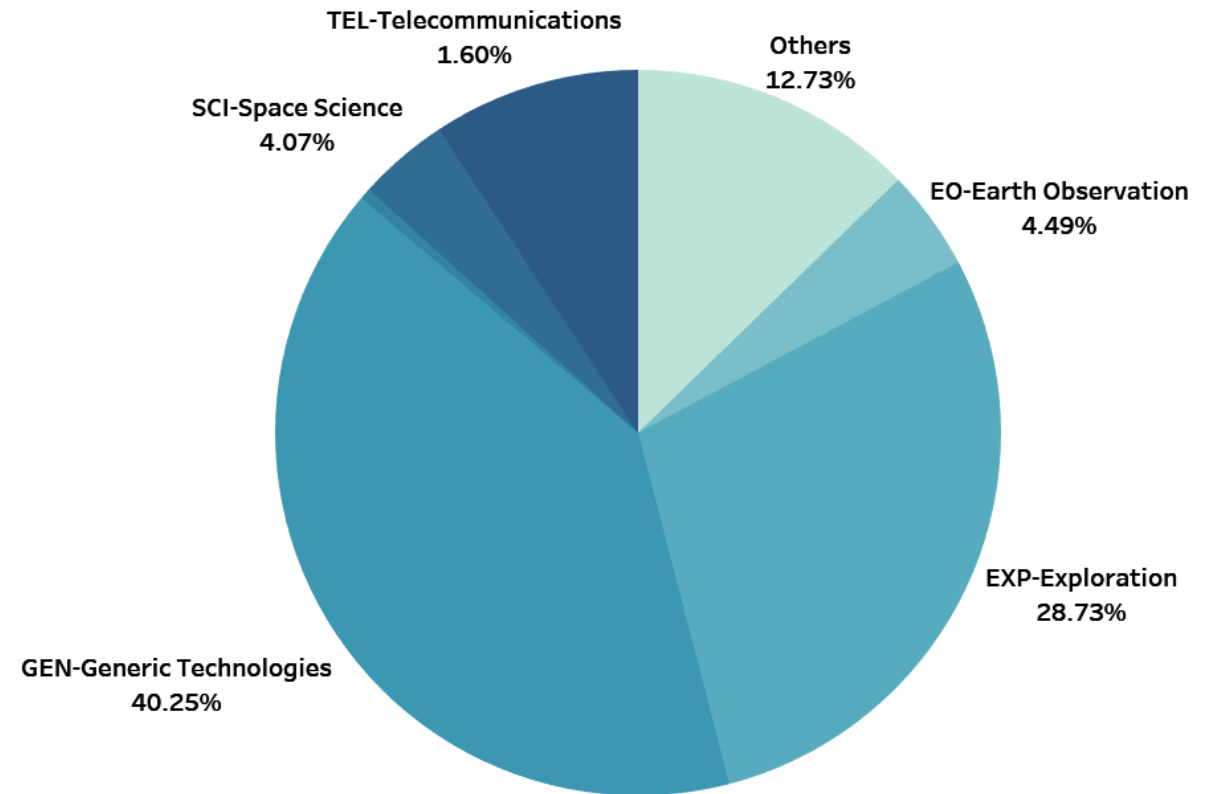


Between 2014 and 2019, 16M€ of contracts were committed with Belgian Entities in TDE

By Entity



By Application



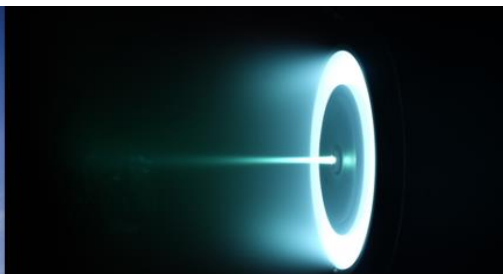
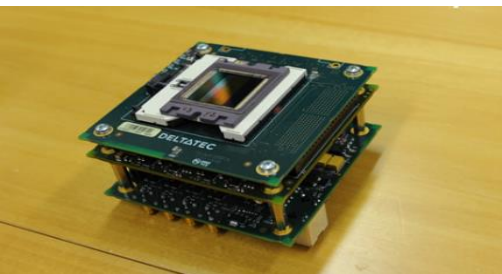
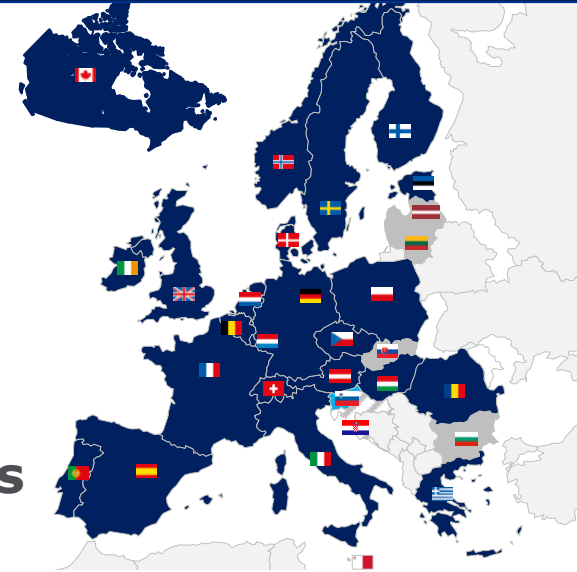
Depending on Space19+

- **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

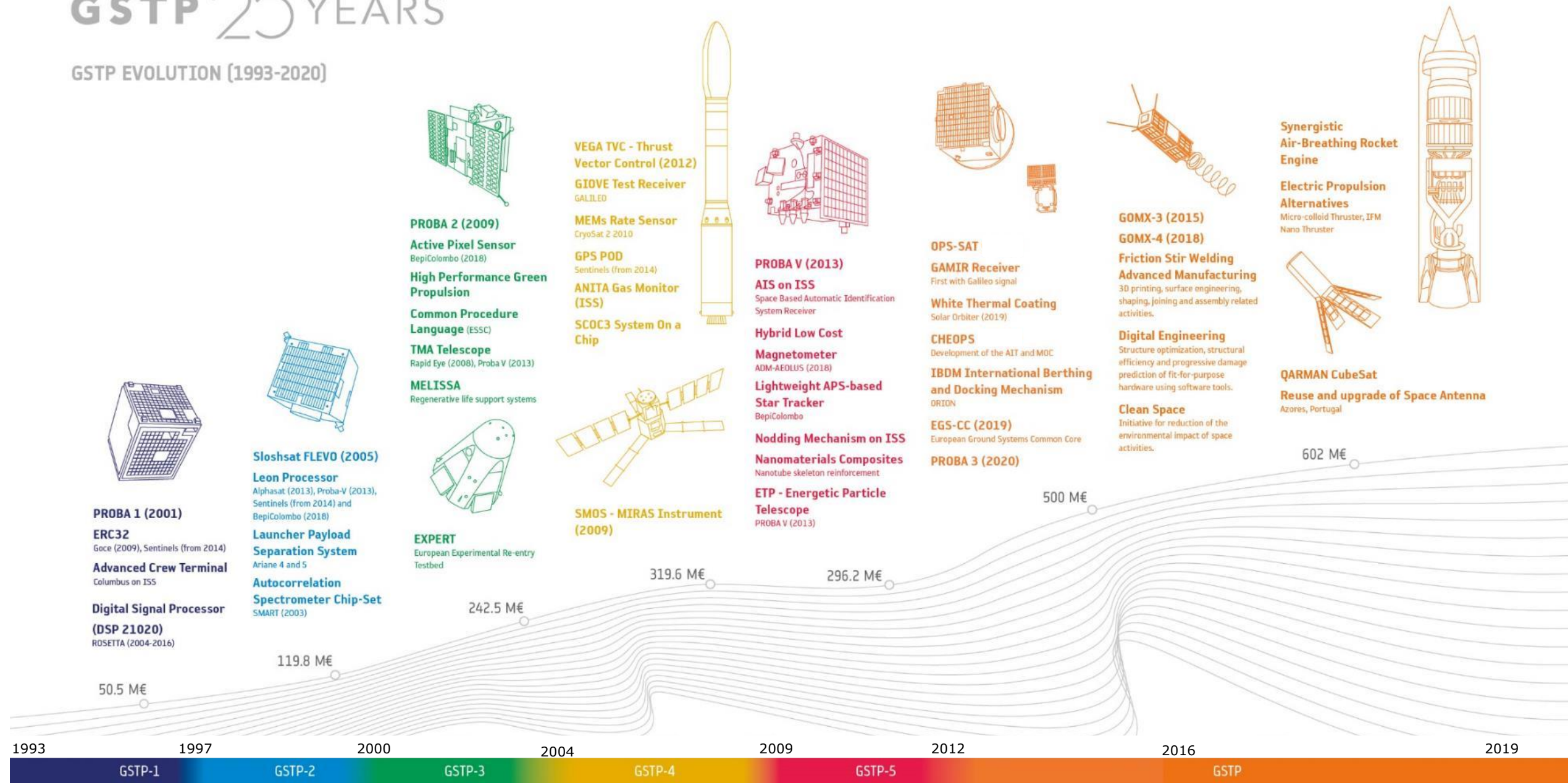
GSTP ensures the right technology with the right maturity is available at the right time

- 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**

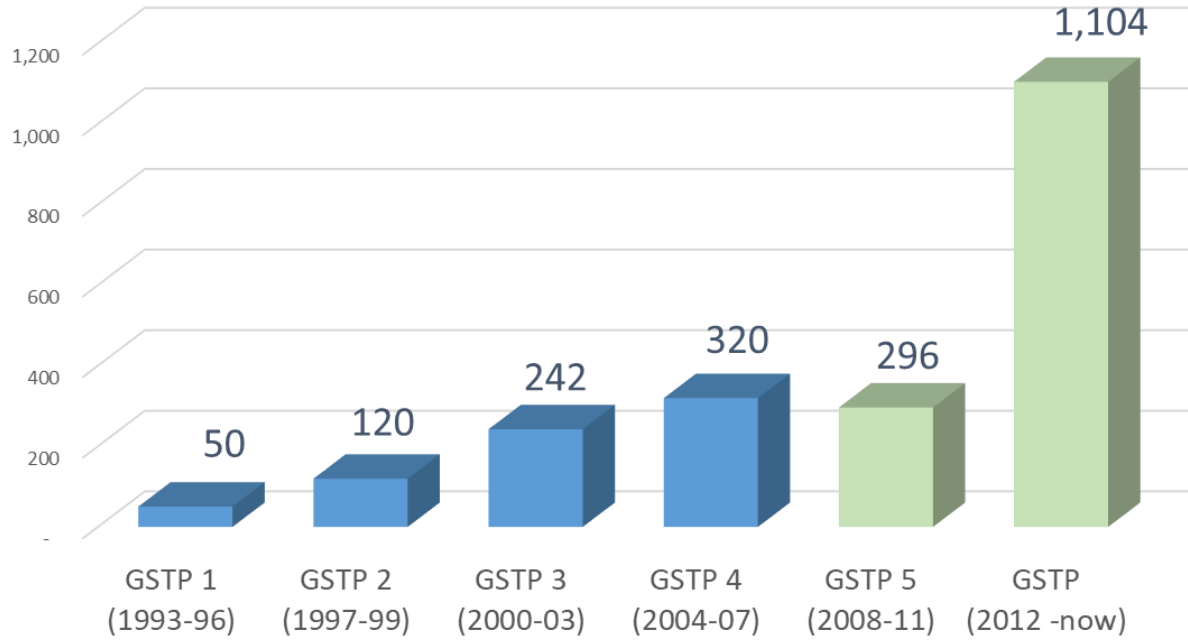


GSTP 25 YEARS

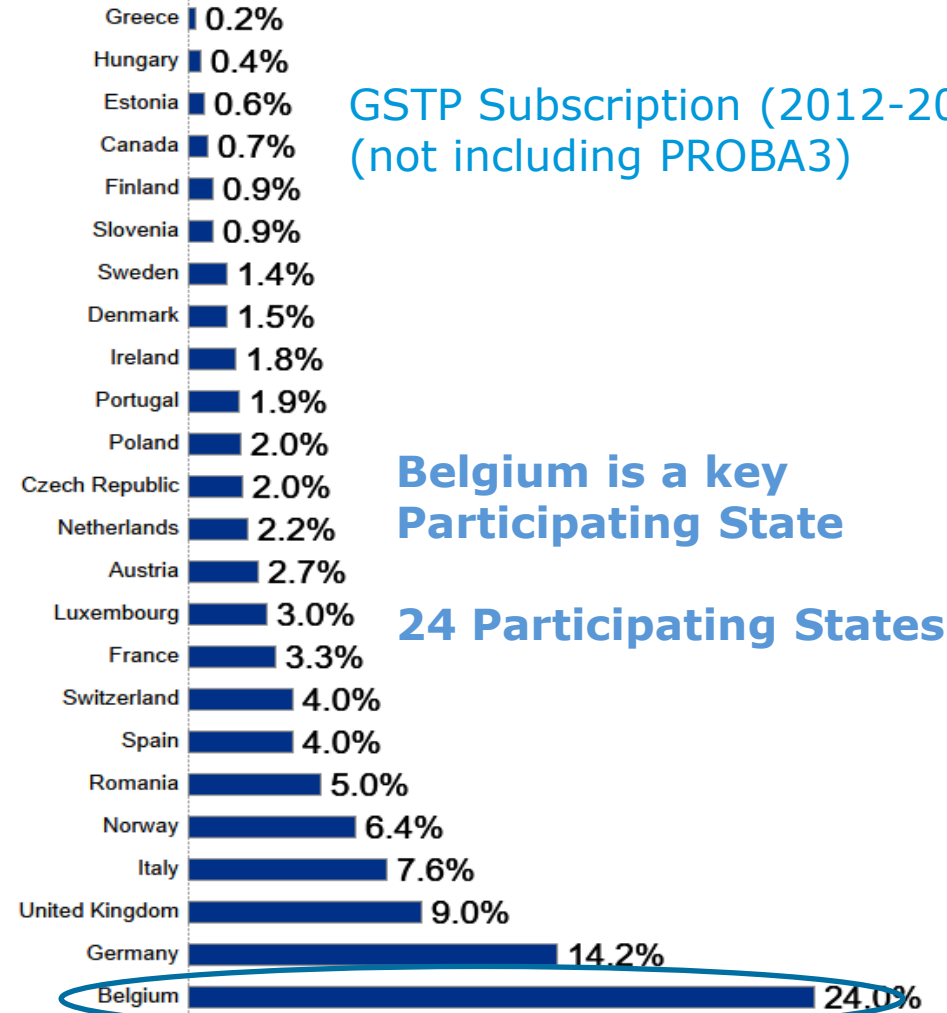
GSTP EVOLUTION (1993-2020)



GSTP - Subscriptions



GSTP Period 1,2 & 3, 4, 5 are closed



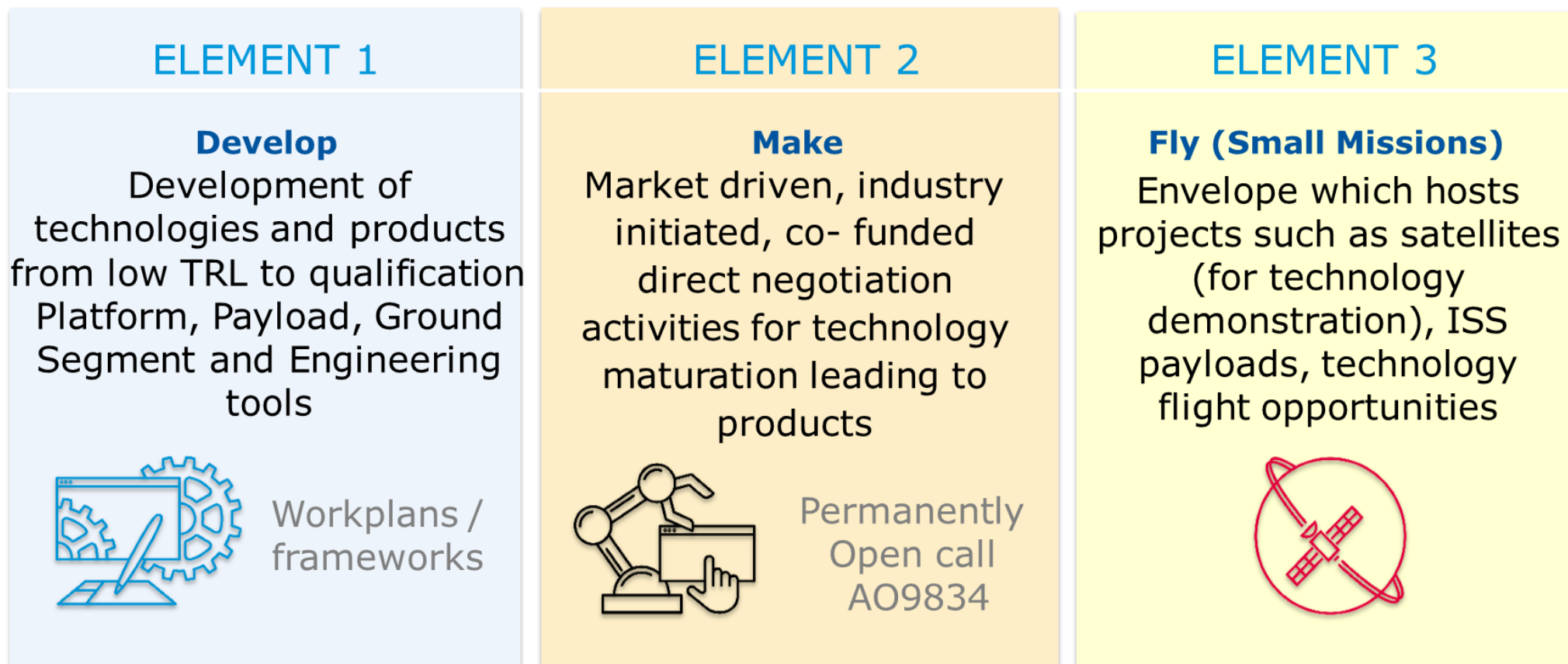
GSTP Subscription (2012-2019)
(not including PROBA3)

Belgium is a key
Participating State

24 Participating States



GSTP Element Structure



Component
Proba 3



GSTP Element 1 Develop: **Compendia**

- 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€).



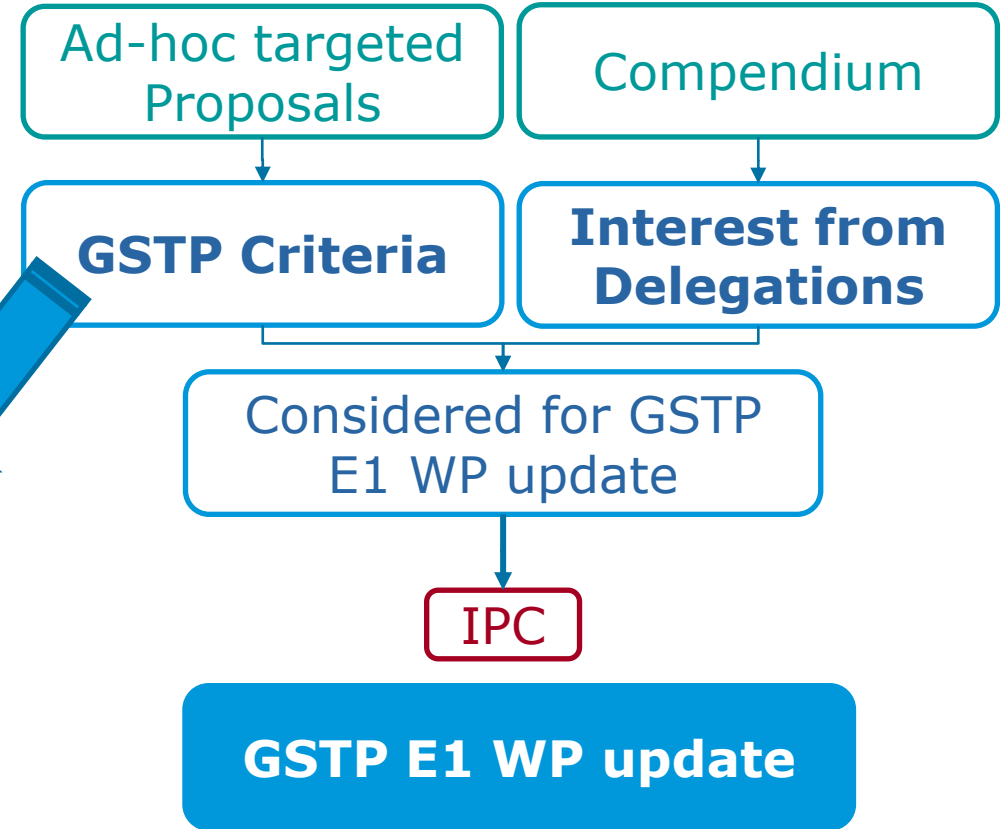
GSTP Element 1 Develop: Work Plan (WP)



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

Proposal GSTP E1 WP update



Roughly 10-25 activities approved in GSTP work plan 5 x per year





GSTP Element 1 Develop: **Frameworks**

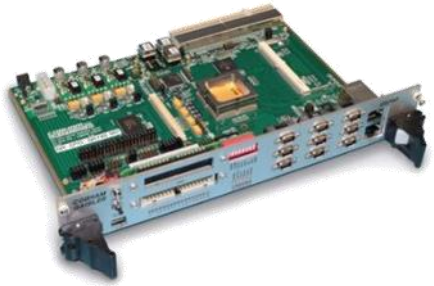
- Roughly 10-25 activities approved in GSTP work plan 5 x per year (including activities from the Compendia and ad-hoc proposals).
- **Frameworks introduced to implement specific types of activities faster**
- Frameworks in operation:
 - G617-241TA, Assessments to prepare and de-risk technology developments
 - 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**

Pre-proposal



Assessment



Full proposal





GSTP Element 1 - Develop: Frameworks



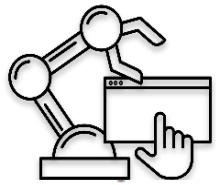
G61A-036QT, Assessing the use of Advanced Manufacturing to improve and expand space hardware capabilities



- 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

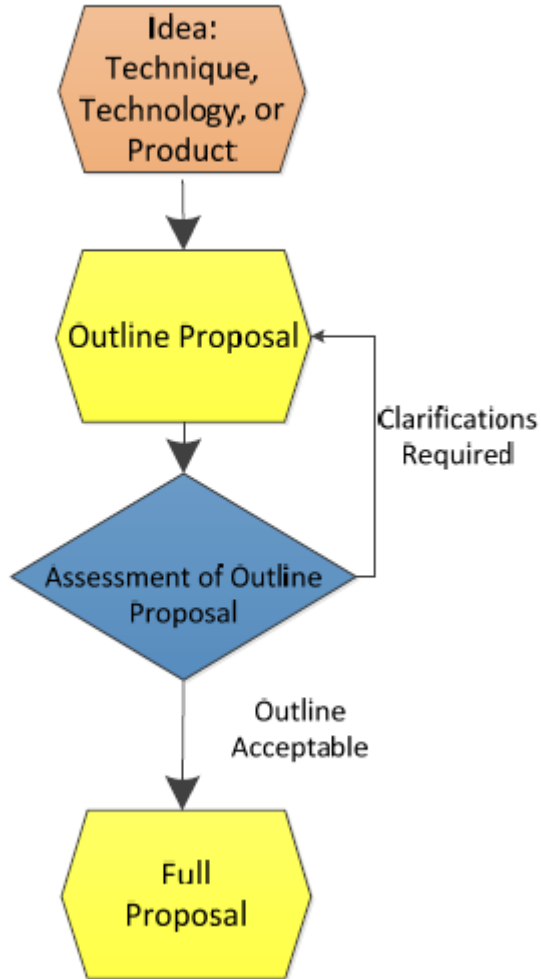


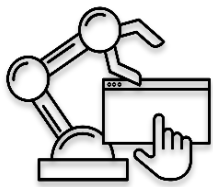
Objective: offer to industry a mechanism for submitting at any time **unsolicited proposals** for market-oriented technology activities.

Funding schemes:

| | SME | Non SME | Research Inst. & Universities |
|--------------|-----------|-----------|-------------------------------|
| TRL \leq 5 | Up to 75% | Up to 75% | Up to 100% (<30% total) |
| TRL $>$ 5 | Up to 75% | Up to 50% | Up to 100% (<30% total) |

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 - A09834

**Segment 1
Market Oriented
Opportunities**

**Segment 2
Company Strategy
Oriented Opportunities**

**Segment 3
National Priority
Opportunities**

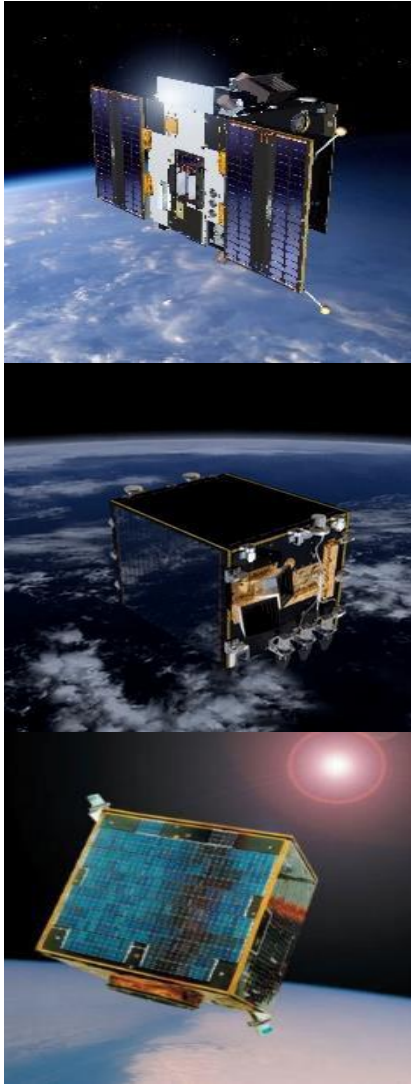
- **Segment 1:** For market oriented activities, entities implement the classical approach and propose product developments targeting commercial market opportunities. They present the nominal business case.
- **Segment 2:** Entities propose developments of strategic relevance (i.e. leverage non-space 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.

| Economic Operator | Outline Proposal | Full Proposal |
|--|------------------|---------------|
| Entry Point 1: Mature (entities with established market/product experience & with financial solidity) | | + |
| Entry Point 2: Intermediate maturity level (with limited experience for the targeted market/product) | + | + |
| Entry Point 3: Limited maturity (entities just created and/or limited commercial market/product experience) | + | + |



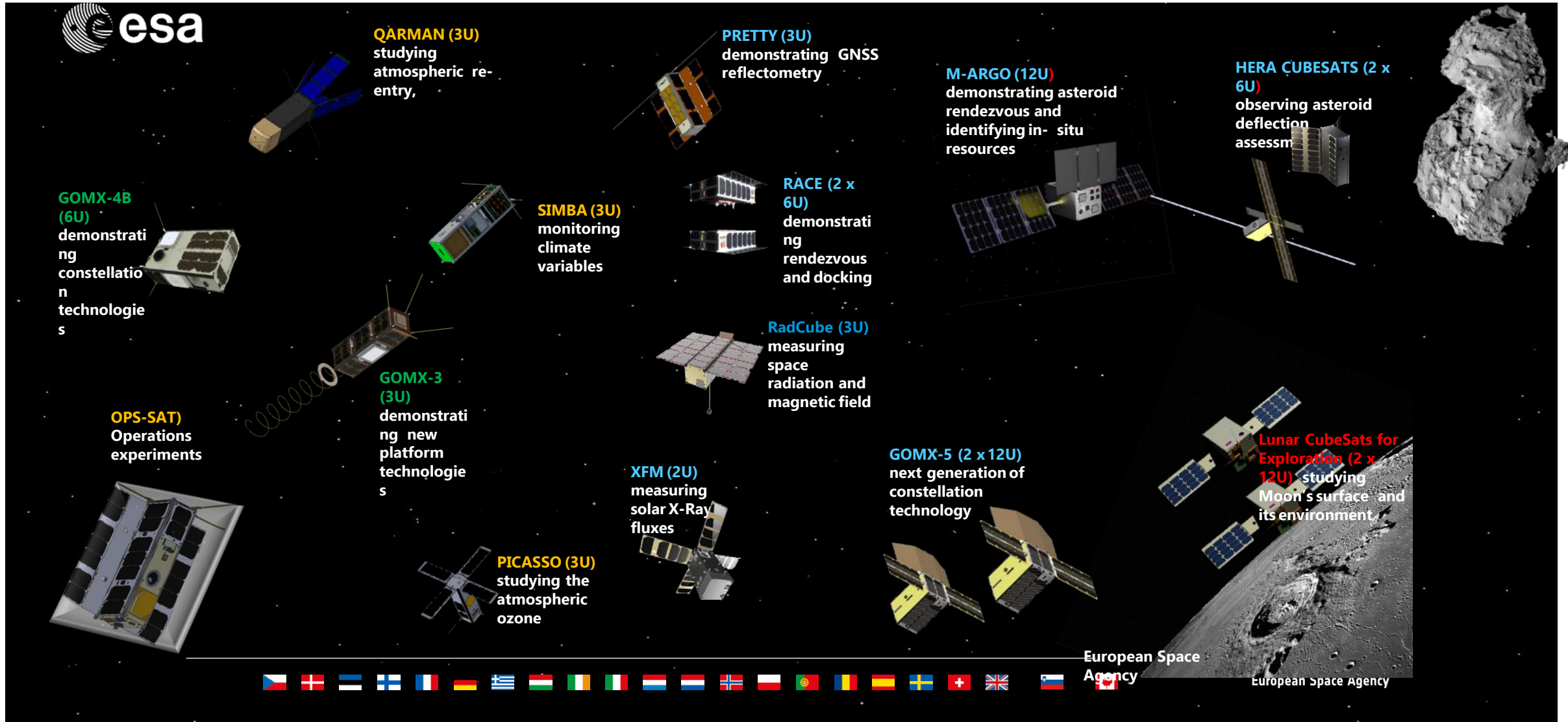


GSTP Element 3 Fly



- 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,

PRETTY (3U)
demonstrating GNSS reflectometry

M-ARGO (12U)
demonstrating asteroid rendezvous and identifying in-situ resources

HERA CUBESATS (2 x 6U)
observing asteroid deflection assessment

GOMX-4B (6U)
demonstrating constellation technologies

SIMBA (3U)
monitoring climate variables

RACE (2 x 6U)
demonstrating rendezvous and docking

RadCube (3U)
measuring space radiation and magnetic field

OPS-SAT
Operations experiments

GOMX-3 (3U)
demonstrating new platform technologies

XFM (2U)
measuring solar X-Ray fluxes

GOMX-5 (2 x 12U)
next generation of constellation technology

Lunar CubeSats for Exploration (2 x 12U)
studying Moon's surface and its environment

PICASSO (3U)
studying the atmospheric ozone

European Space Agency





GSTP in 2019

Road to ESA's Ministerial Conference "Space19+"

Strategic Objectives (1/2)

GSTP Programme Proposal for 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 reactivity 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

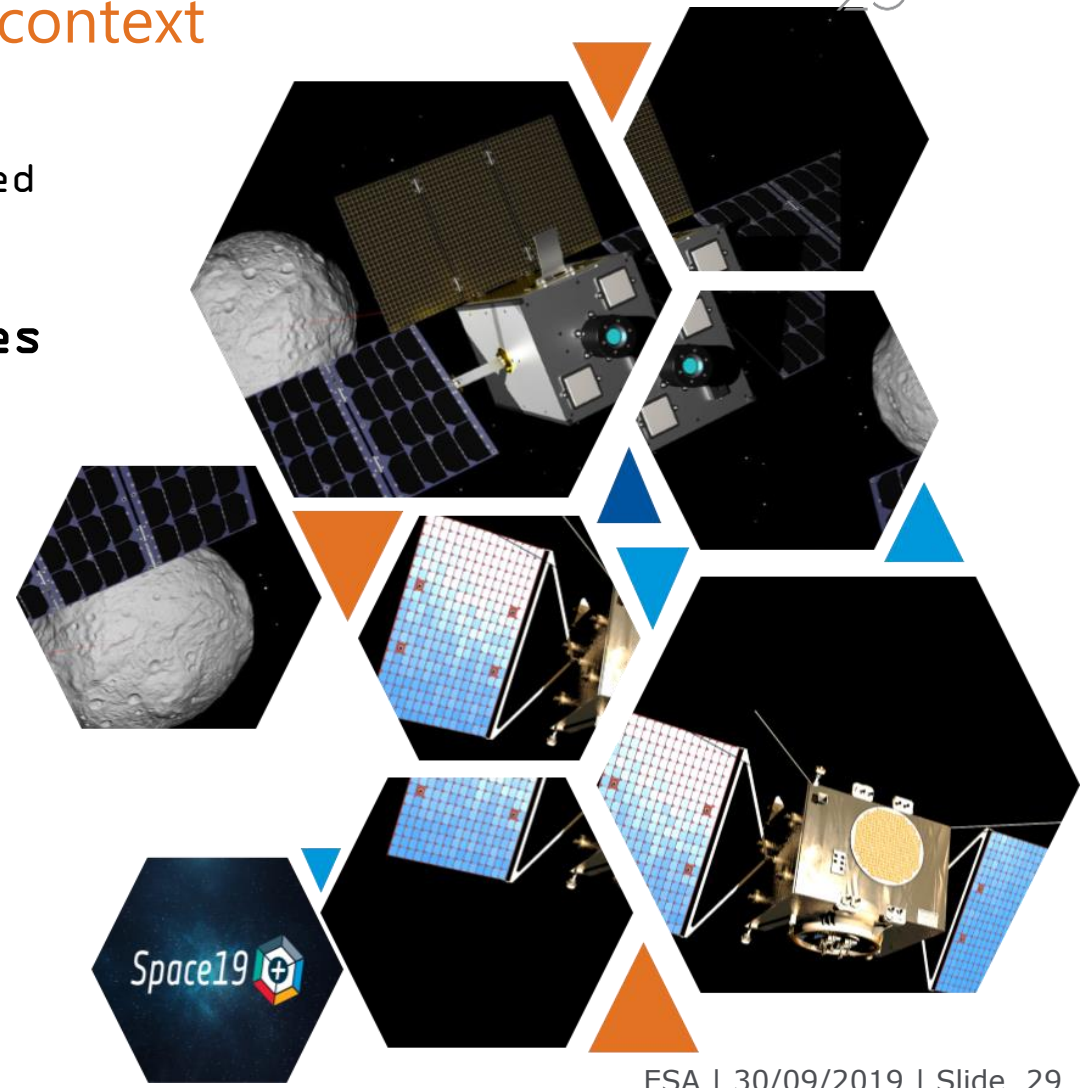
Element 2 segmented to become more dynamic and tailored towards different needs

- ✓ 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.

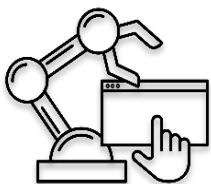
- ✓ Segment 1 - capitalizing on experience
- ✓ Segment 2 - building competence
- ✓ Segment 3 - focus on R&D and Academia





GSTP 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







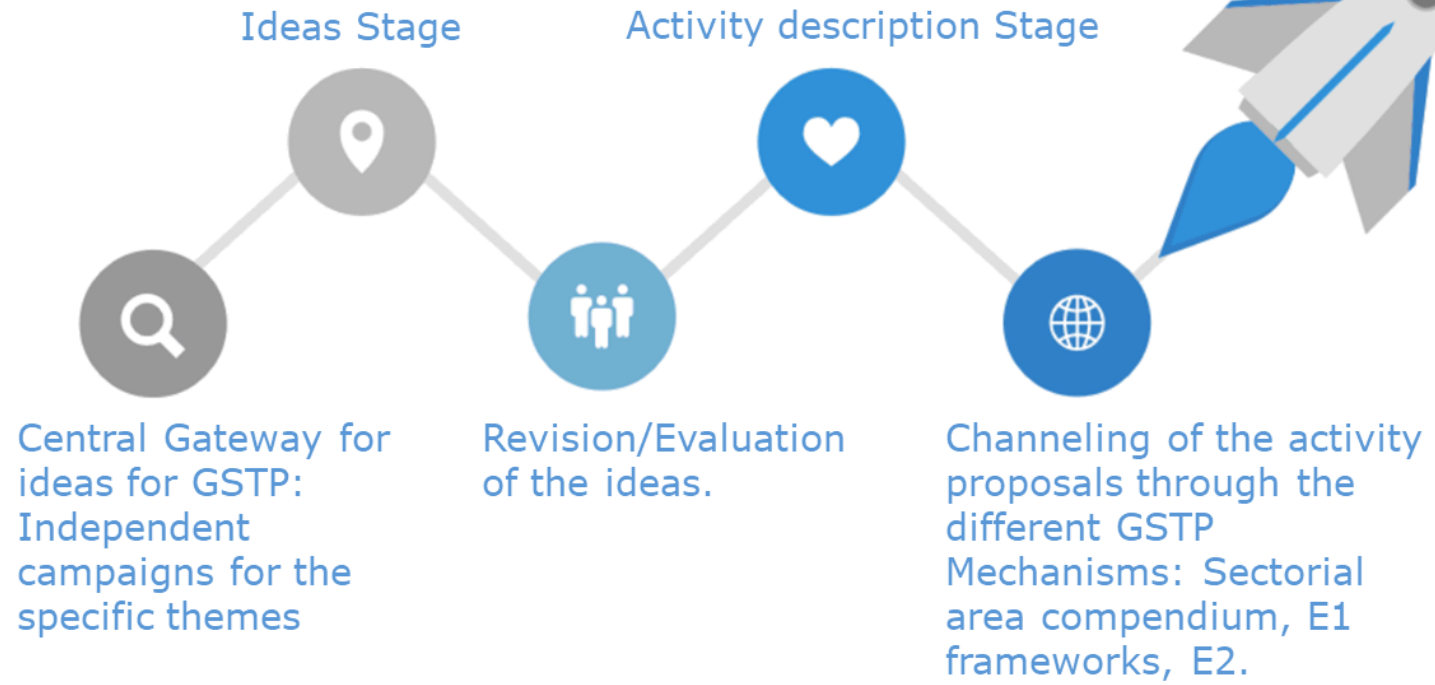
- Implementation in GSTP E1 WP
- Compendia intended to be published **in EMITS NEWS in Q4 2019**
- **ESA Driven:**
 - **Generic Technologies and Techniques** - Activity proposals and selection of activities made by representatives of the technical and application domains and internally coordinated. ~100 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**

GSTP in 2019 – OSIP Campaigns

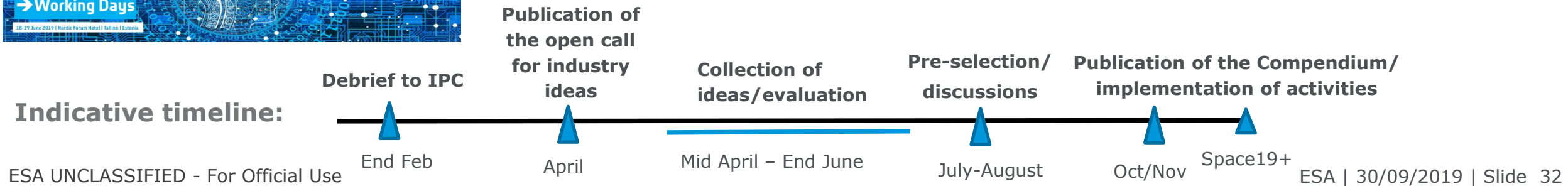


<http://ideas.esa.int>

-  Digital Design-to-Produce
-  Cyber-Safety/-Security
-  Artificial Intelligence for Space
-  Operations Innovation - Call for ideas 2019



Indicative timeline:



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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>

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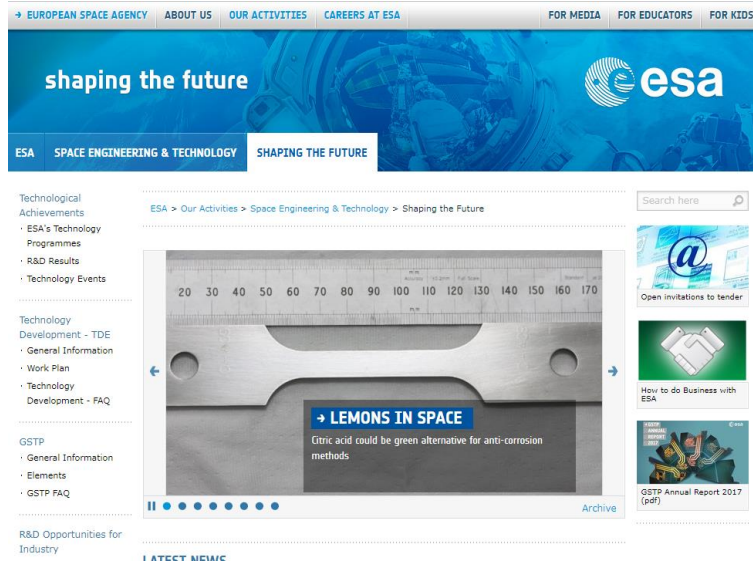
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European Space Agency

TDE & GSTP: Technology results

Web site: Shaping the future

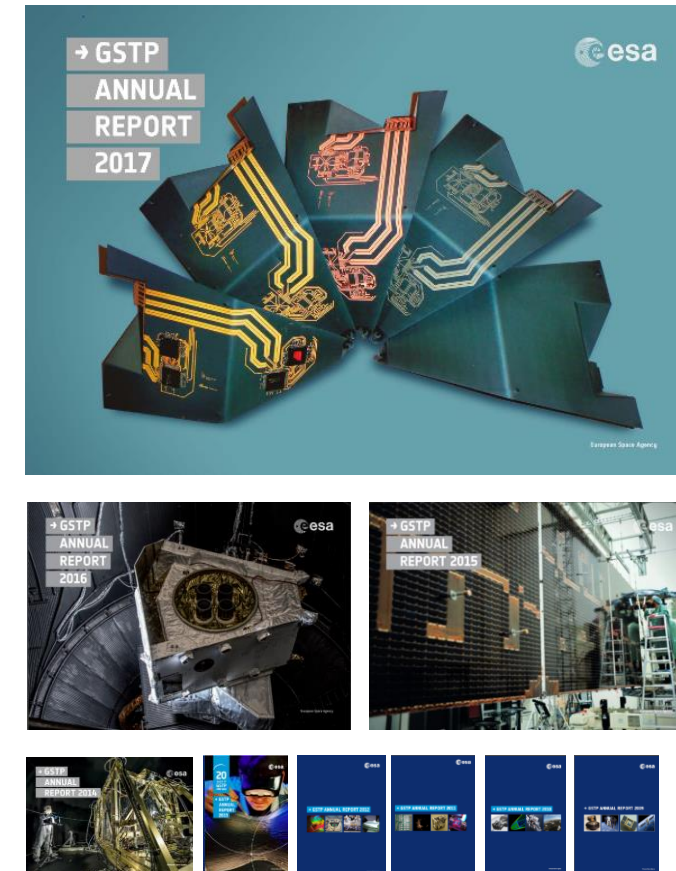


- General information on TDE & GSTP
- Main achievements within technology programmes
- Contacts with the Team

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



Reports:



http://www.esa.int/Our_Activities/Space_Engineering_Technology/Shaping_the_Future

Thank you for your attention

Point of Contact:

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Visit the ESA Web side on "Shaping the Future":

http://www.esa.int/Our_Activities/Space_Engineering_Technology/Shaping_the_Future