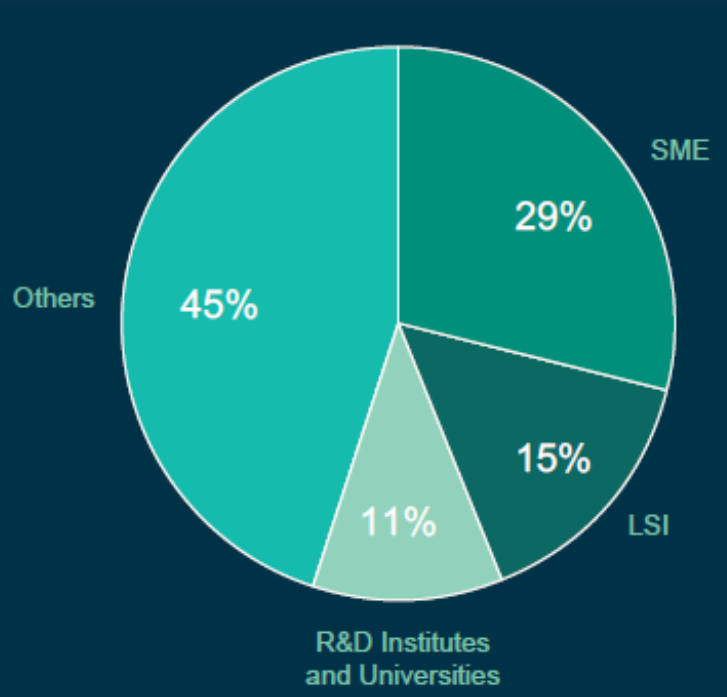
General Support Technology Programme (GSTP)

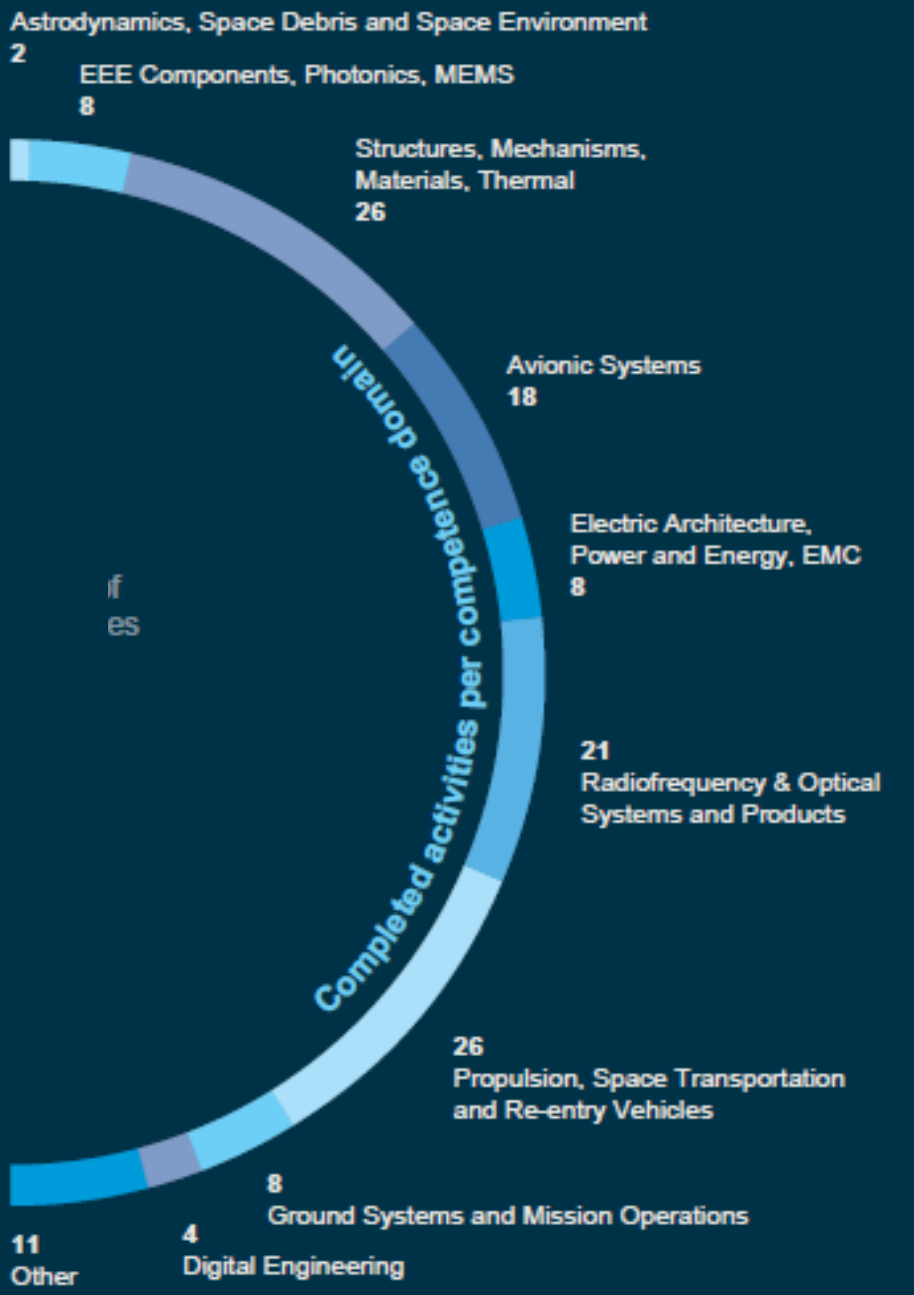
Matthew Bullock, TEC-TI
Directorate of Technology, Engineering and Quality

GSTP's mission



- For more than 30 years, the GSTP has been developing leading-edge space technologies that enable missions and support the competitiveness of European industry
- GSTP allows companies of all sizes as well as research and academic organisations to perform technology developments and demonstrations
  - Building capacities, fostering innovation and creating and improving products and services
- GSTP is an optional ESA programme with the participation of all ESA Member, Associate and Co-operating States
  - 27 Participating States in total

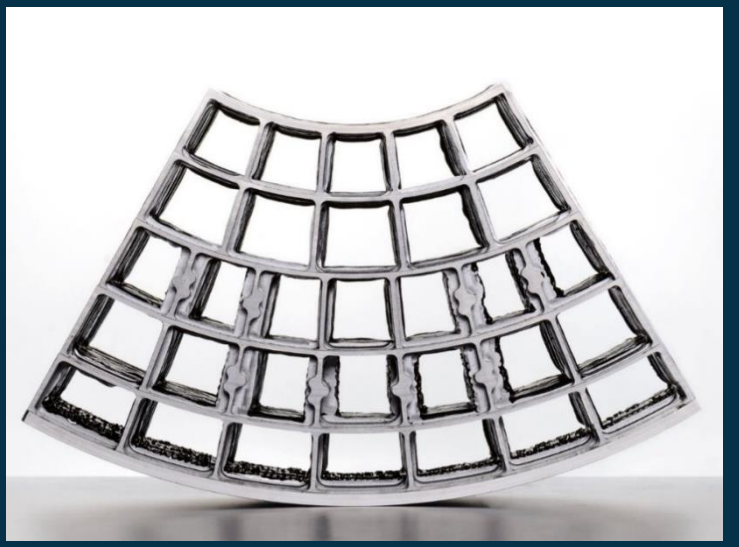
GSTP: 2023 at a glance



Around 600 running activities

110 activities completed

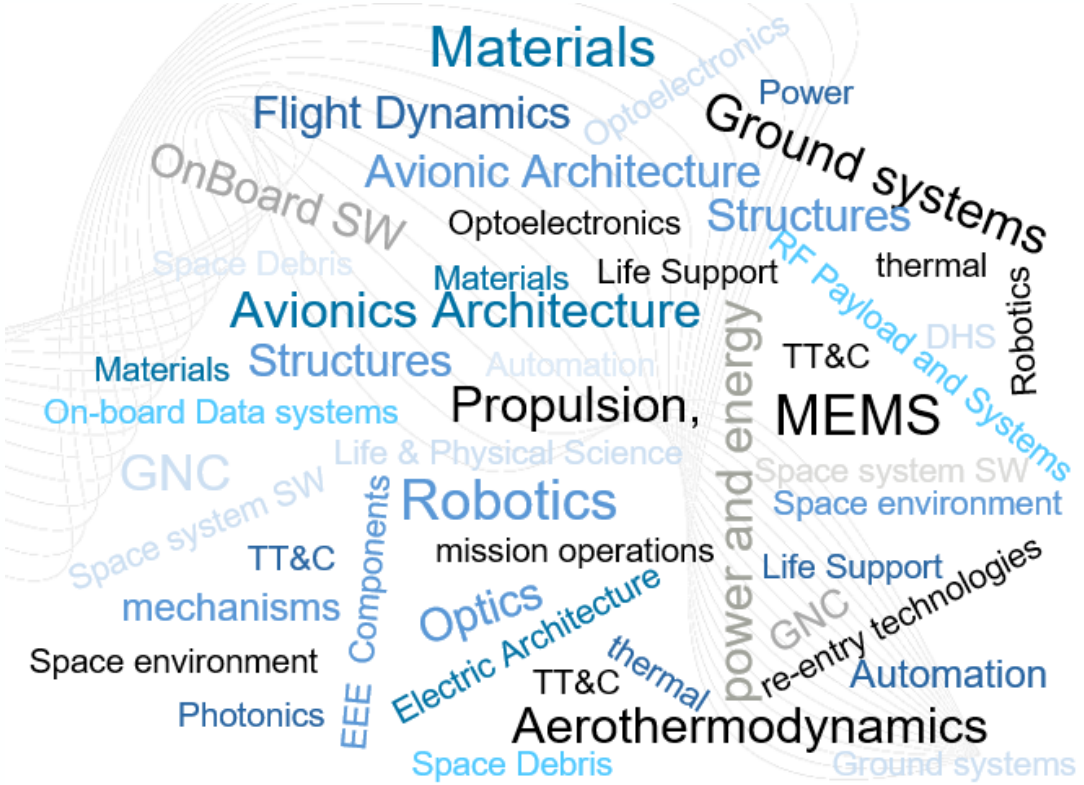
140 technology development and demonstration activities initiated, representing over 110 MEuro in contracts

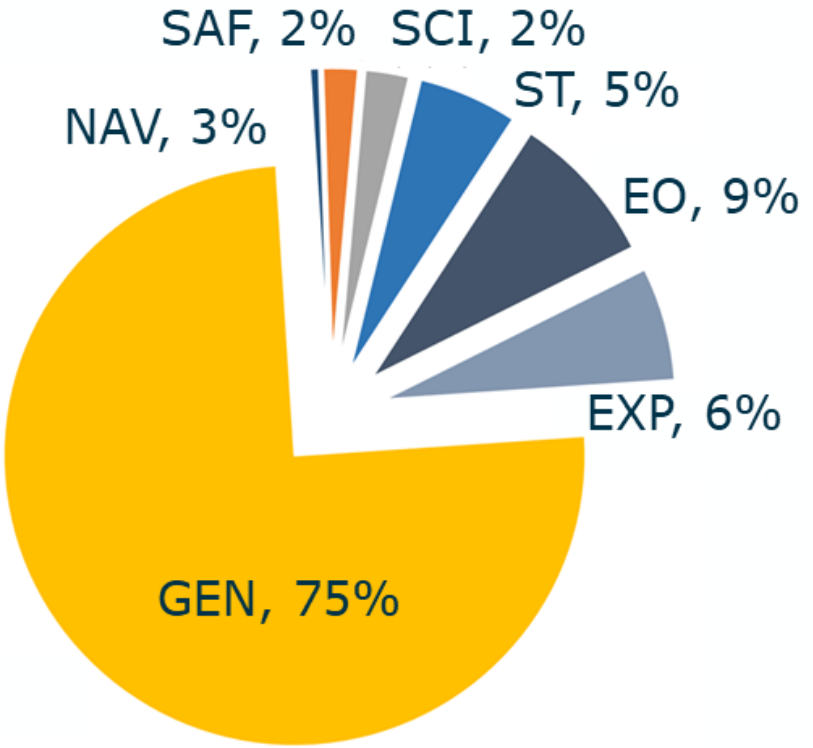


GSTP Participating States

- 27 ESA Member, Associate and Co-operating States are subscribed to GSTP
- It is possible to propose activities and to bid for activities with partners from these States

GSTP Technology and Application Areas





GSTP addresses practically all technology areas for generic or specific application needs for the space segment as well as the ground and space transportation segments

GSTP activities

Photo of the ICE-Cube thruster chip

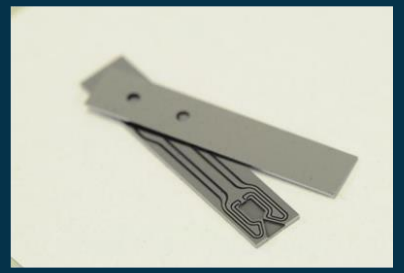


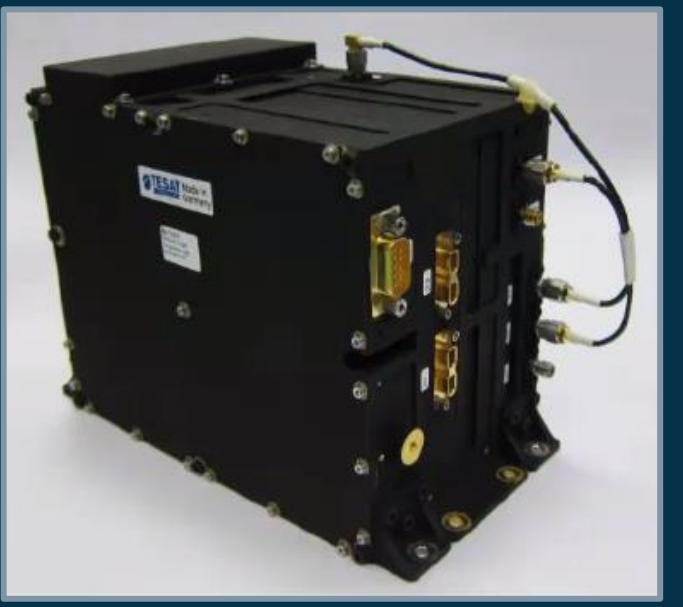
Photo of the thruster chip with cover

Development of the Iridium Catalyses Electrolysis Cubesat Thruster (URA Thrusters)

Compliant Mechanism Based on Additive Manufacturing (CSEM)

Miniature Active Pixel Sensor based Star Tracker Engineering Qualification Model (TERMA)

Additive manufacturing for novel structural components (CATEC) (demonstrated in JUICE)



Reconfigurable telemetry transmitter for Earth observation satellites (TESAT)

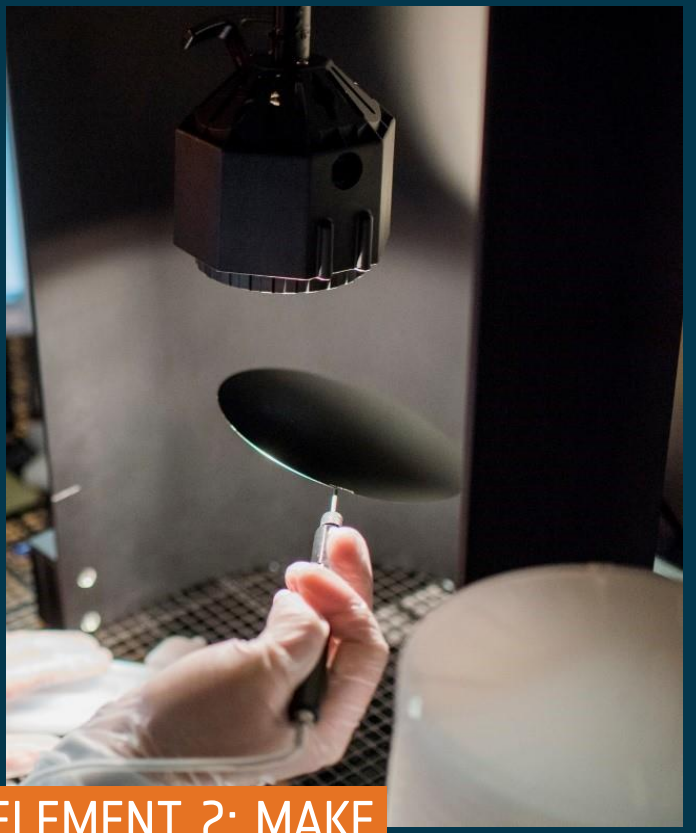
GSTP STRUCTURE

COMPONENTS

PRECISE FORMATION FLYING COMPONENT
EEE Space Component Sovereignty for Europe EuropeaN Devices Using Radioisotope Energy (ENDURE)

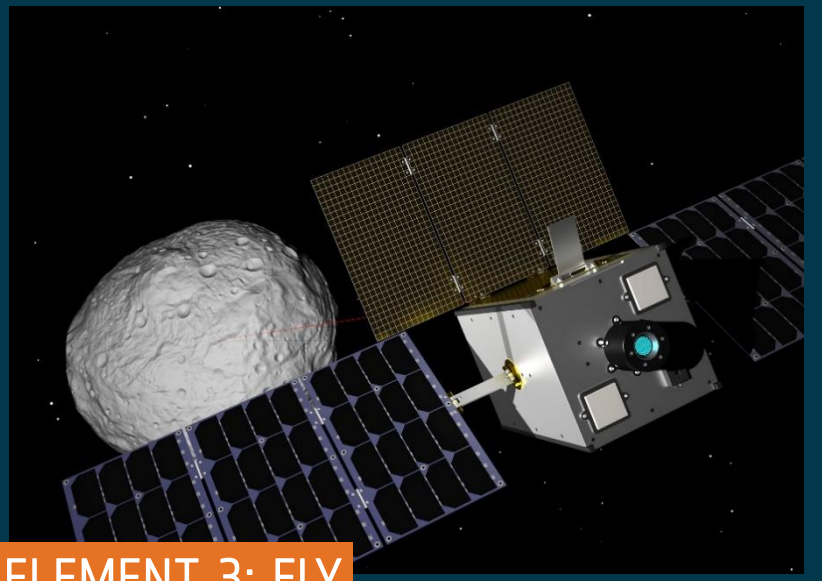
ELEMENT 1: DEVELOP

→ Supports technology developments up to qualification, capacity building & ESA technology aims.
→ Compendia, Work Plan.
→ Frameworks.



ELEMENT 2: MAKE

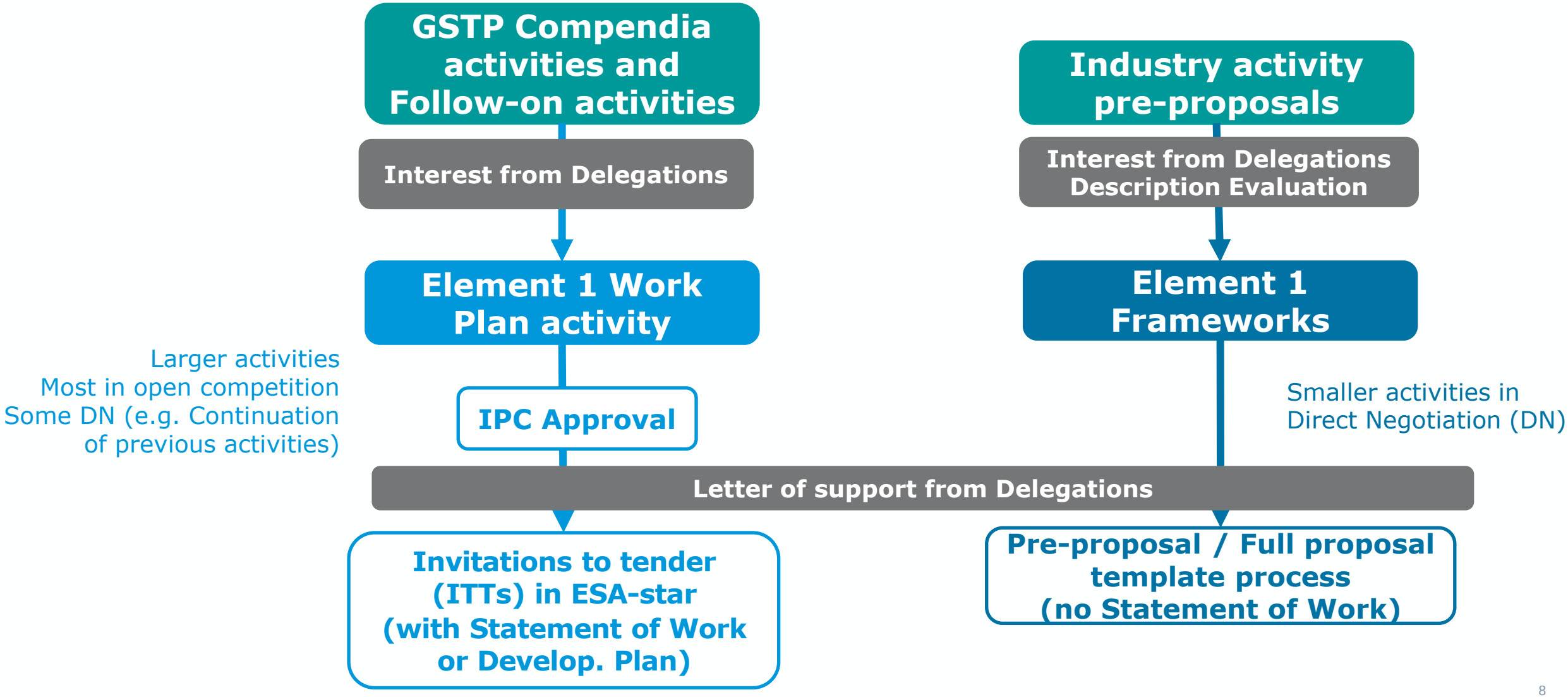
→ Industry initiated and driven co-funded activities to strengthen competitiveness.



ELEMENT 3: FLY

→ On-ground and in-orbit demonstrations of technologies in need of acquiring in-orbit validation.

GSTP Element 1



GSTP ELEMENT 1 DEVELOP

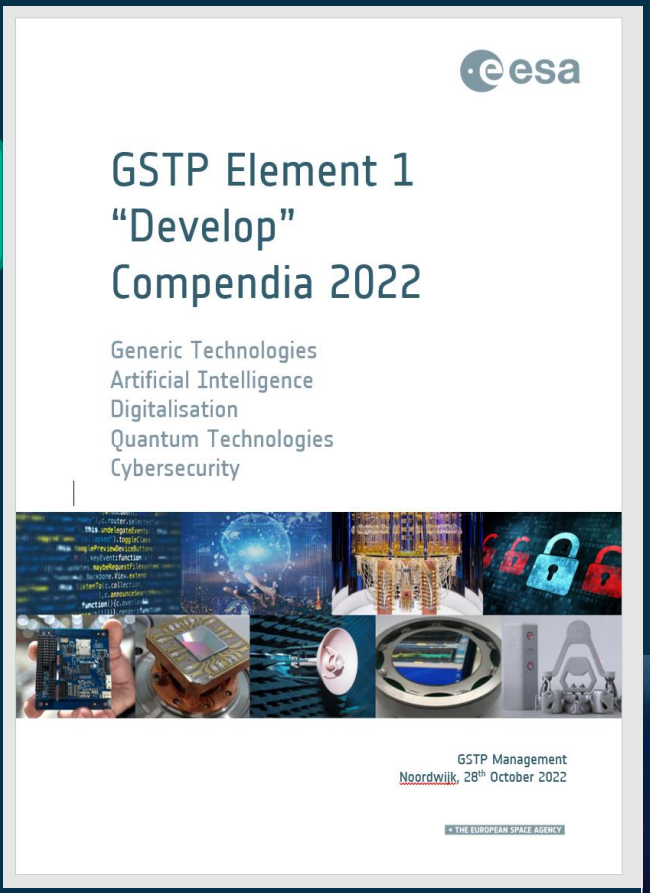
Compendia 2022: under execution

ESA Driven:

- Generic Technologies

Industry Driven:

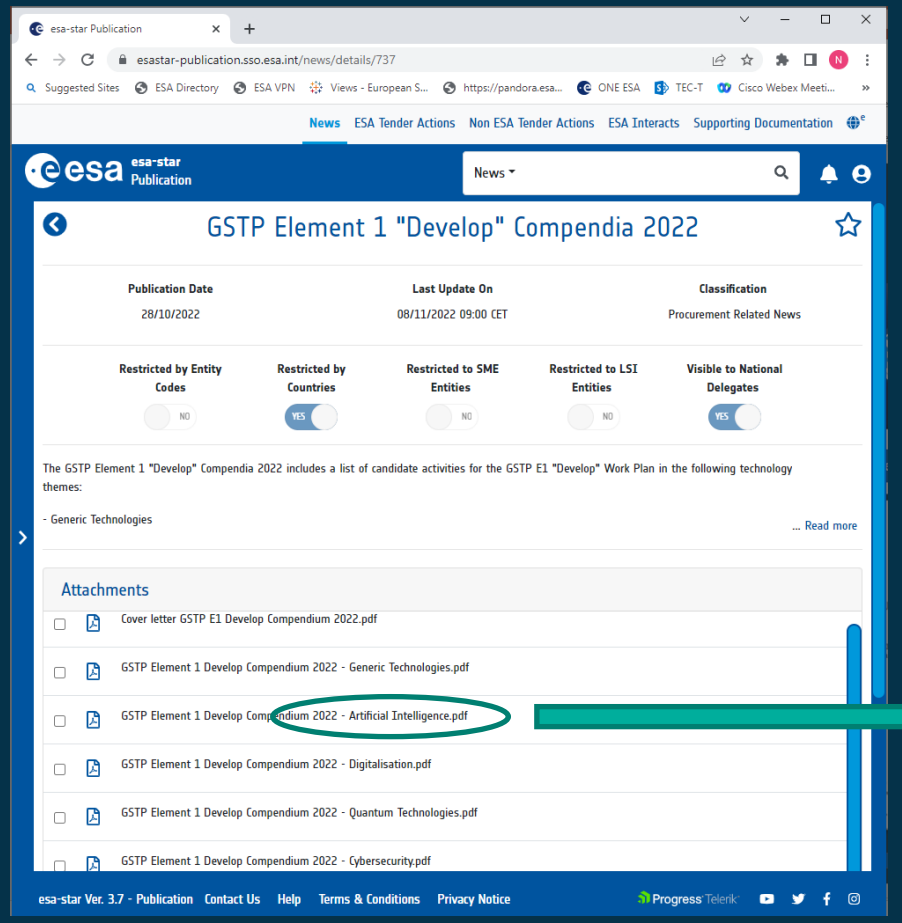
- **Artificial Intelligence** - Edge/AI on Board, GNC, Mission Operations
- **Digitalisation** - Data Management, MBSE, Simulation, Digital Twin
- **Quantum Technologies** – Quantum Sensing, Atom interferometers, Atomic frequency standards, Quantum Computing, Quantum Memories…
- **Cybersecurity**

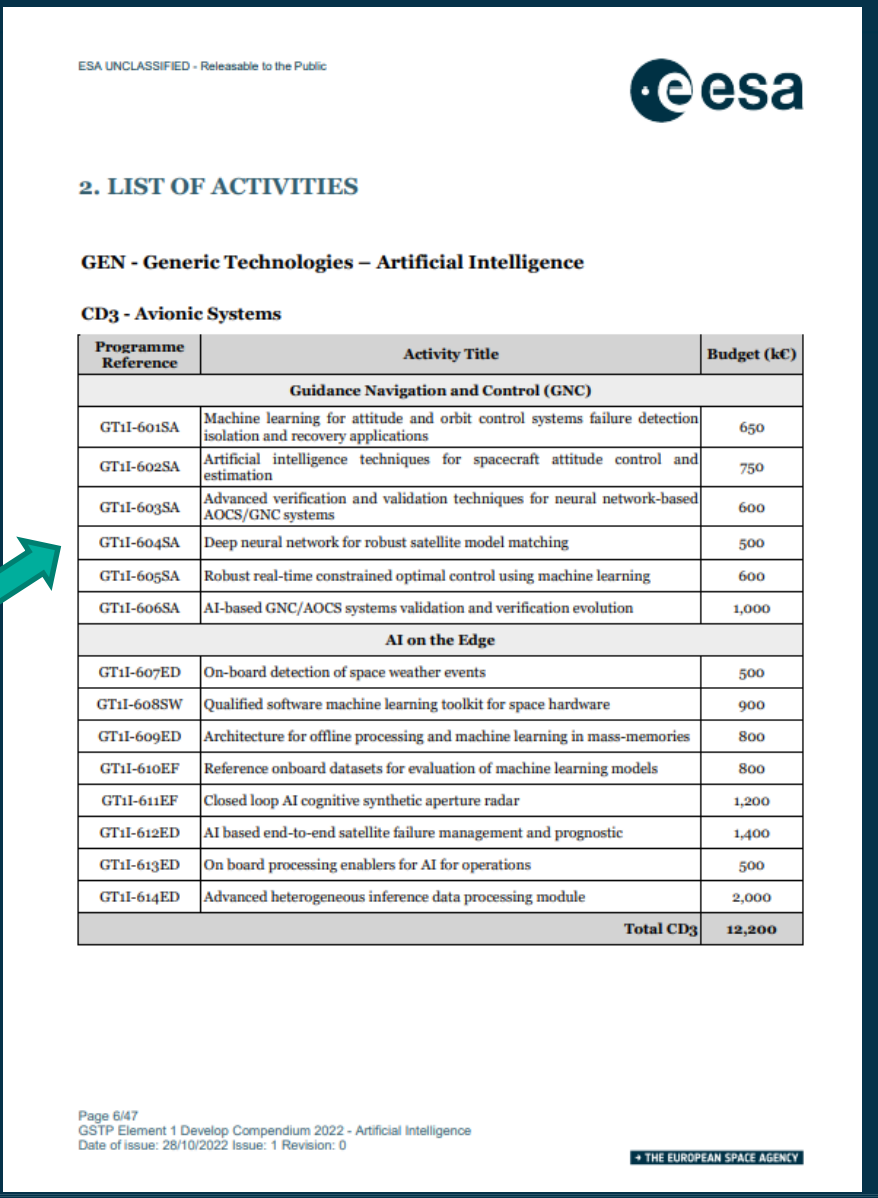


esa-star Publication

- Publication in November 2022
- Since Feb 2023, 35+ activities have been included in GSTP WP
- Targeting implementation 2023/25

GSTP Element 1



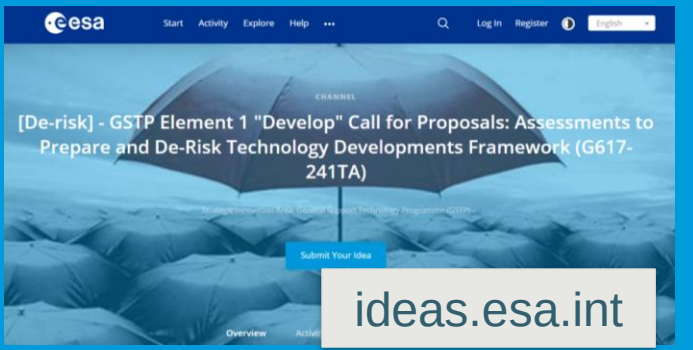


https://esastar-publication.sso.esa.int/news/details/737

ELEMENT 1 - De-risk framework

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

Approved by IPC in November 2016 "...to allow for assessments that will help prepare and de-risk potential development activities".

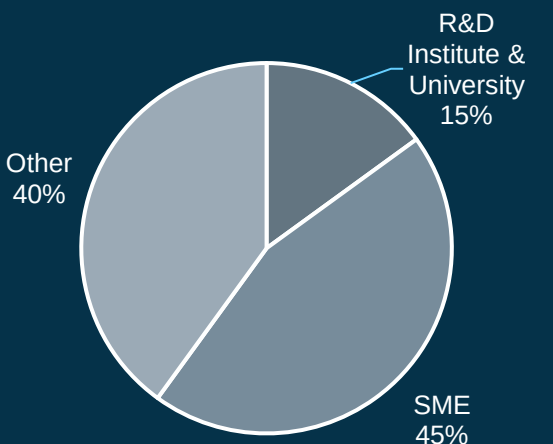


Procurement using a template	Follow-on using a template	~40 de-risk initiated / year
· Max budget: €250 K · Max duration: 9 months	· No budget limit · No duration limit · ~ 35% de-risk are continued	· >200 de-risk so far · ~ €35 M overall budget

Permanent Open Call in ESA-Star

esa-star Publication

Company Type

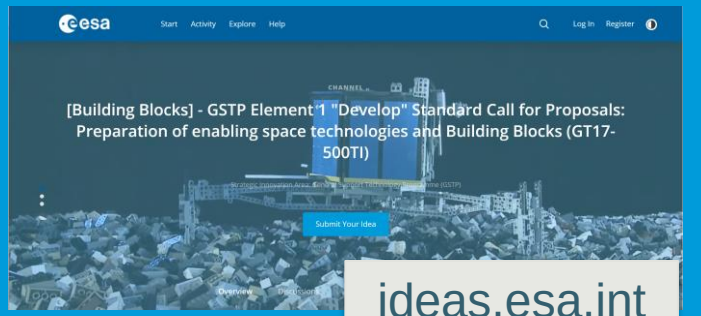


ELEMENT 1 – Building Block framework

GT17-500TI, Preparation Of Enabling Space Technologies And Building Blocks Framework

Approved IPC April 2018 and updated October 2022 (operative from mid March)

"…to prepare and to develop enabling capabilities and the associated building blocks for space related systems and the associated sub-systems." Targeted and coordinated development of capabilities across different GSTP Participating States

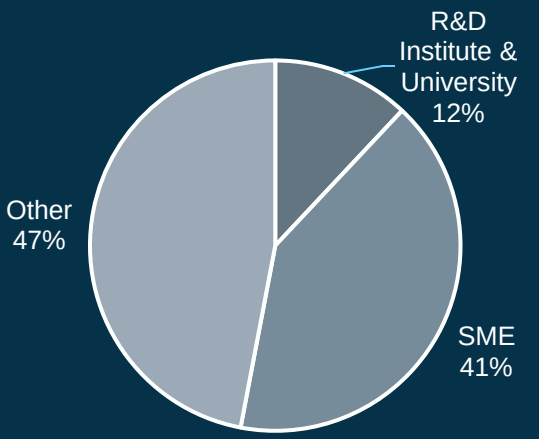


Procurement using a template	~20 activities initiated / year
· Max budget: €1 M · Max duration: 24 months	· 100 activities so far · ~ €43 M overall budget

Permanent Open Call in ESA-Star

esa-star Publication

Company Type



Framework procurement process

[Building Blocks] - GSTP Element 1 "Develop"

[De-risk] - GSTP Element 1 "Develop"

Initial contact between bidder and National Delegation (no ESA involvement)

ideas.esa.int

Not-Official ESA procurement

Communications allowed with ESA Technical Officer and GSTP

Outline Proposal in OSIP

Outline Proposal evaluation

Activity scope refinement

Official ESA procurement

Communications allowed only through ESA assigned Contract Officer

Proposal submission using ESA-Star

ESA-star

TEB & Negotiation

Commitment

GSTP ELEMENT 2 MAKE

Announcement Of Opportunity

2020: First full year with the current structure

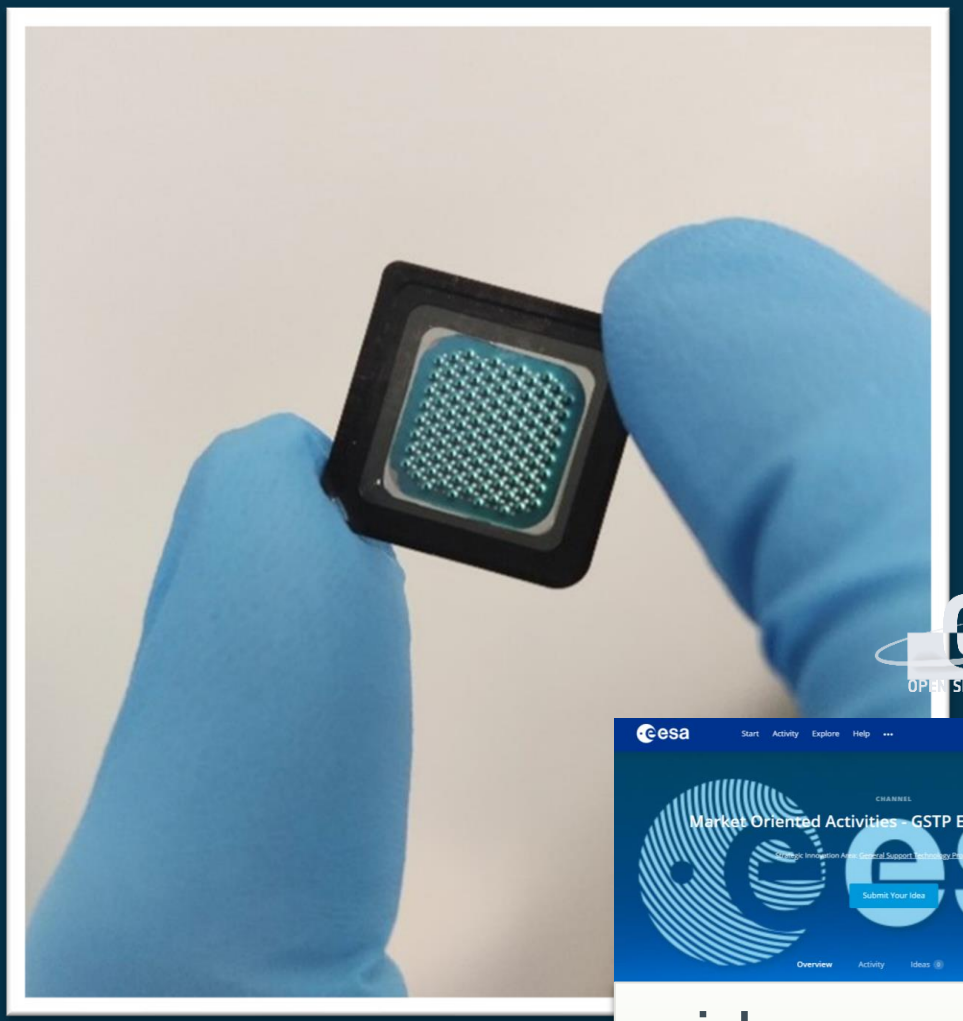
3 segments:

- Market Oriented Opportunities,
- Strategic Opportunities and
- Implementation of National Priorities

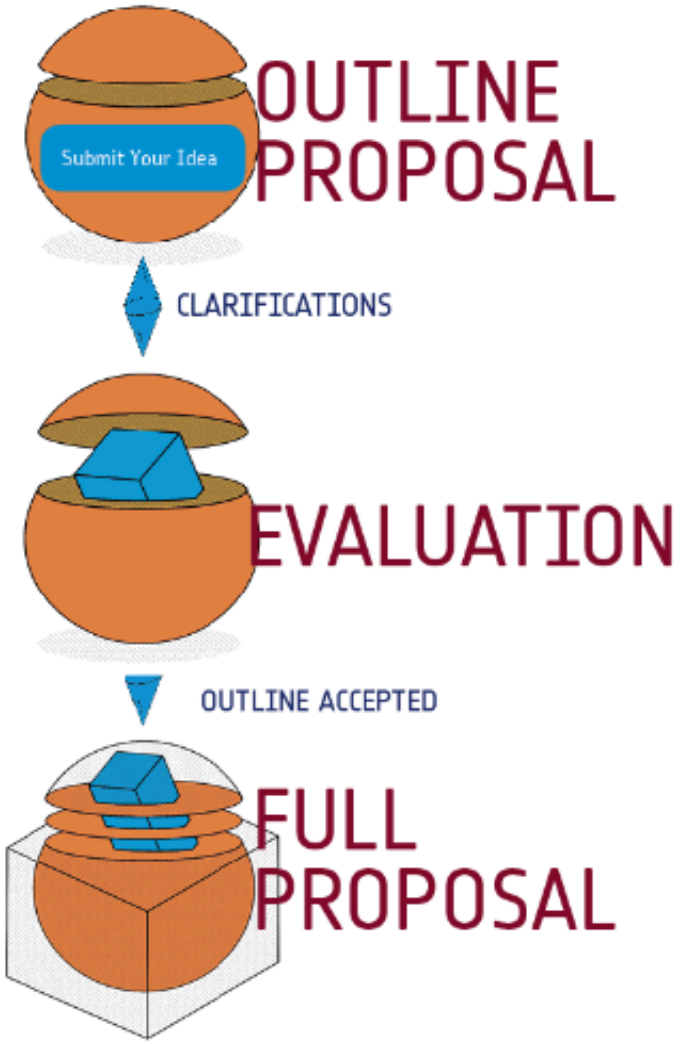
Use of OSIP channel (ideas.esa.int) for outline proposal evaluations.

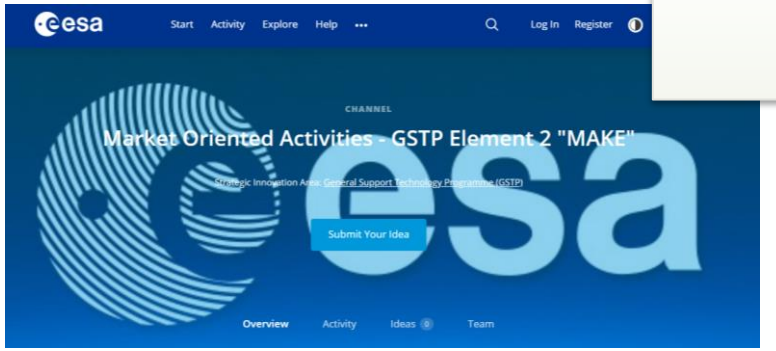
2020 – 2023: significant increase in proposals received

25-30 activities committed per year (€30 M - €35 M)



GSTP E2 Make: Implementation





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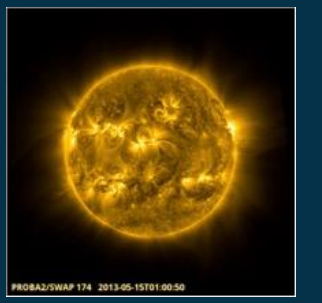
OUTLINE PROPOSAL EVALUATION CRITERIA

- Clarity and credibility of the business opportunity and market context (for segment 1) or the strategic opportunity and market context (for segment 2)
- Credibility and quality of the technical requirements, technical solutions versus activity objectives
- Credibility and quality of the proposed development plan, deliverables and schedule
- Credibility and quality of the bidder's background, experience and facilities
- Credibility and quality of the cost breakdown

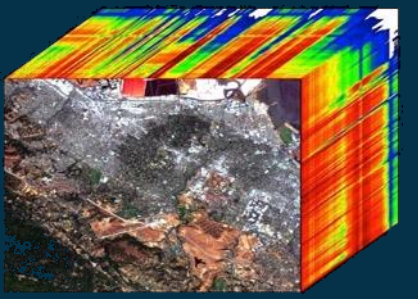
GSTP ELEMENT 3 FLY

Facilitate Technology Demonstrations



The main objectives related to Element 3 are to:

- Ensure the successful implementation of the Missions and In-Orbit Demonstrations currently in preparation.
- Identify/prepare new mission/IOD opportunities.
- Expand and enhance the demonstration approach.

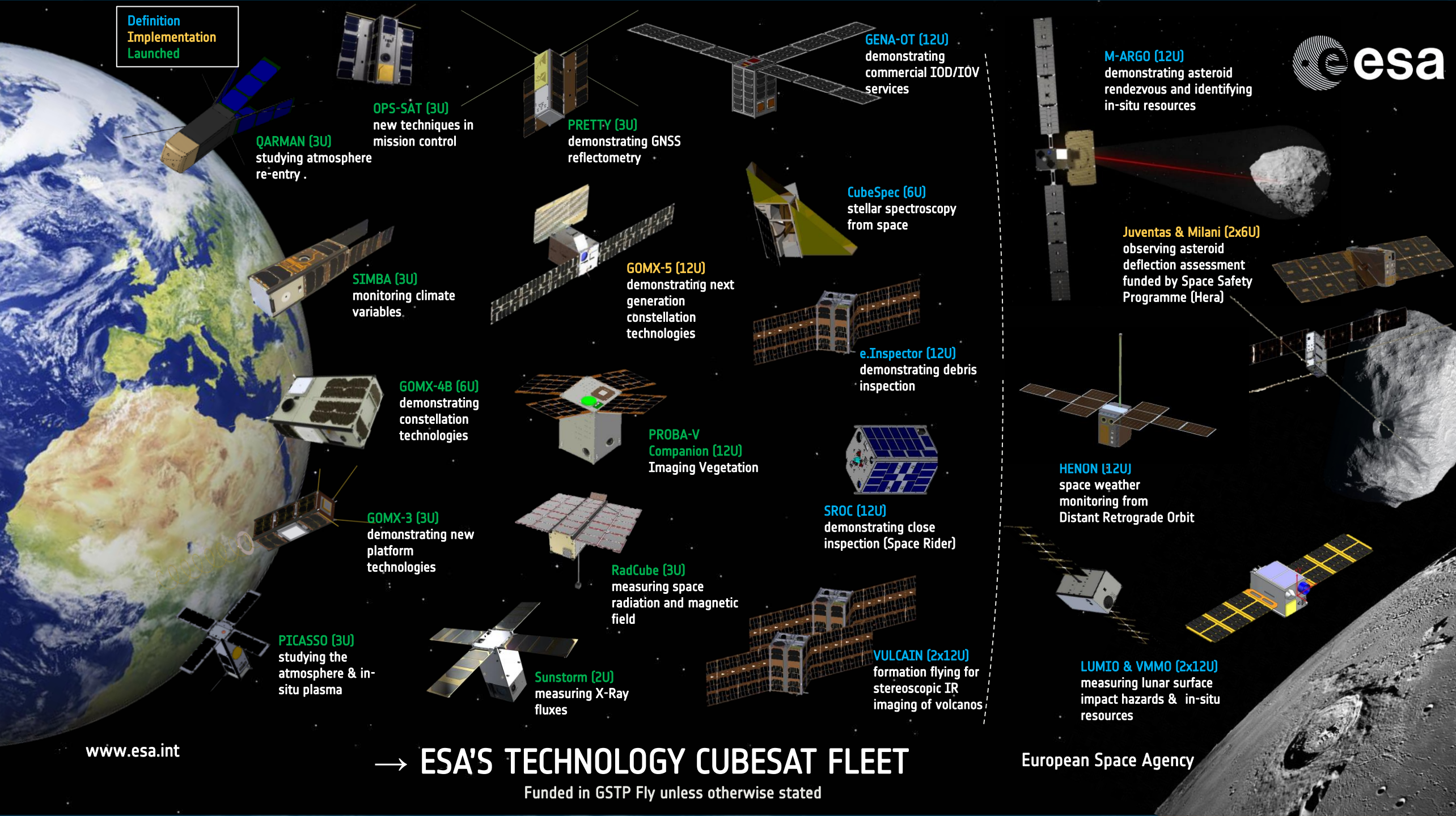


Opportunities cover:

- Demonstration of technology (e.g. platform units, Li-ion batteries).
- Demonstration of techniques (e.g. ADS-B, hyper-spectral, …).
- First demonstrations of potential capabilities.

Cubesat framework

Definition
Implementation
Launched



QARMAN (3U)
studying atmosphere re-entry .

OPS-SAT (3U)
new techniques in mission control

PRETTY (3U)
demonstrating GNSS reflectometry

GENA-OT (12U)
demonstrating commercial IOD/IOV services

CubeSpec (6U)
stellar spectroscopy from space

SIMBA (3U)
monitoring climate variables

GOMX-5 (12U)
demonstrating next generation constellation technologies

e.Inspector (12U)
demonstrating debris inspection

GOMX-4B (6U)
demonstrating constellation technologies

PROBA-V Companion (12U)
Imaging Vegetation

SROC (12U)
demonstrating close inspection (Space Rider)

GOMX-3 (3U)
demonstrating new platform technologies

RadCube (3U)
measuring space radiation and magnetic field

PICASSO (3U)
studying the atmosphere & in-situ plasma

Sunstorm (2U)
measuring X-Ray fluxes

VULCAIN (2x12U)
formation flying for stereoscopic IR imaging of volcanos

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

Juventas & Milani (2x6U)
observing asteroid deflection assessment funded by Space Safety Programme (Hera)

HENON (12U)
space weather monitoring from Distant Retrograde Orbit

LUMIO & VMMO (2x12U)
measuring lunar surface impact hazards & in-situ resources

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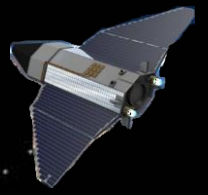
→ ESA'S TECHNOLOGY CUBESAT FLEET

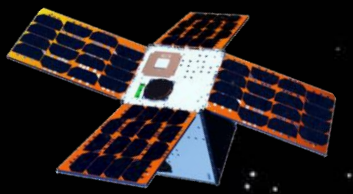
Funded in GSTP Fly unless otherwise stated

European Space Agency

SMALLSAT MISSIONS



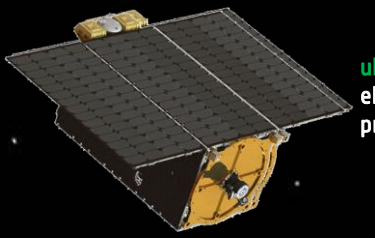
SkimSat (VLEO)
electric
propulsion



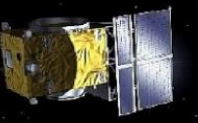
PVCC
Earth
Vegetation

PCDSat
Electric propulsion
Flying Deployer IOD

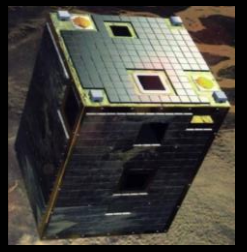
CHEOPS
CHaracterising
ExOPlanet Satellite



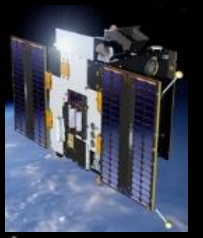
uHETSat
electric
propulsion



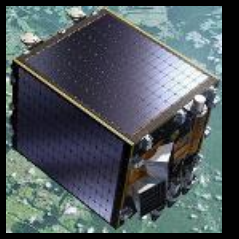
Proba-3 (HEO)
Sun Corona study
& Formation Flying



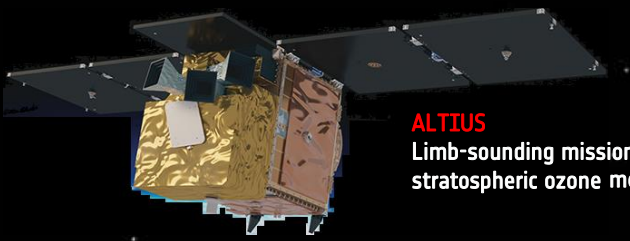
Proba-1
Autonomous
operations



Proba-2
Solar
observation



Proba-V
Earth
Vegetation



ALTIUS
Limb-sounding mission measuring
stratospheric ozone measuring

Launched

To be launched 2024

To be launched

LINKS

esa-star procurement portal

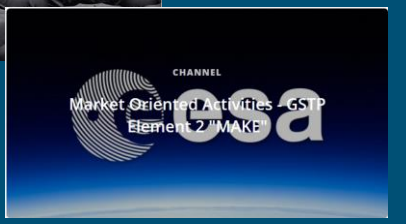
a source for:

- Registration of new companies to do business with ESA
- Invitations to tender
- News/Procurement related announcements: GSTP Compendia Publication

www.esastar-publication.sso.esa.int

Open Space Innovation Platform

channels/campaigns for submitting ideas, and outline proposals



www.ideas.esa.int

Shaping the future website

- Articles on the latest GSTP funded space technology R&D developments
- GSTP annual reports

www.esa.int/Enabling_Support/Space_Engineering_Technology/Shaping_the_Future

GSTP Conclusions/Summary

For 30 years, GSTP allows companies of all sizes and research and academic organisations to perform technology developments and demonstrations.

- more than 150+ activities are started per year in **27 Participating Countries**

Activities are implemented through:

- **Element 1 Work Plan activities**, building on the GSTP Compendia and large industry driven activities
- **Element 1 Frameworks** (De-risk, Building Block), for smaller industry driven activities
- **Element 2 AO** for market oriented co-funded industry driven activities
- **Element 3** for technology demonstrations (in-orbit…) as well as missions