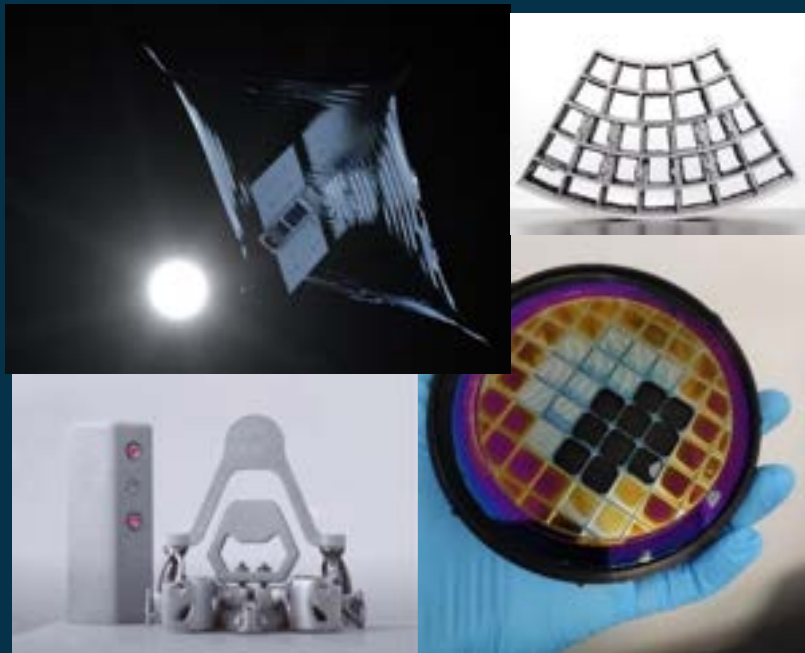


General Support Technology Programme

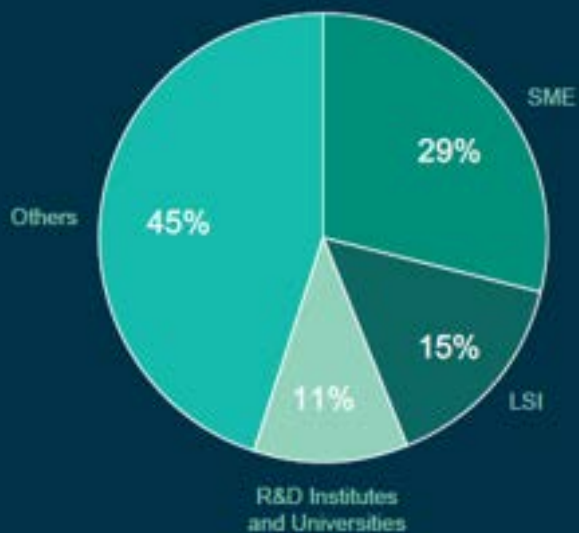
Noelia Peinado, TEC-RT
Directorate of Technology, Engineering and Quality

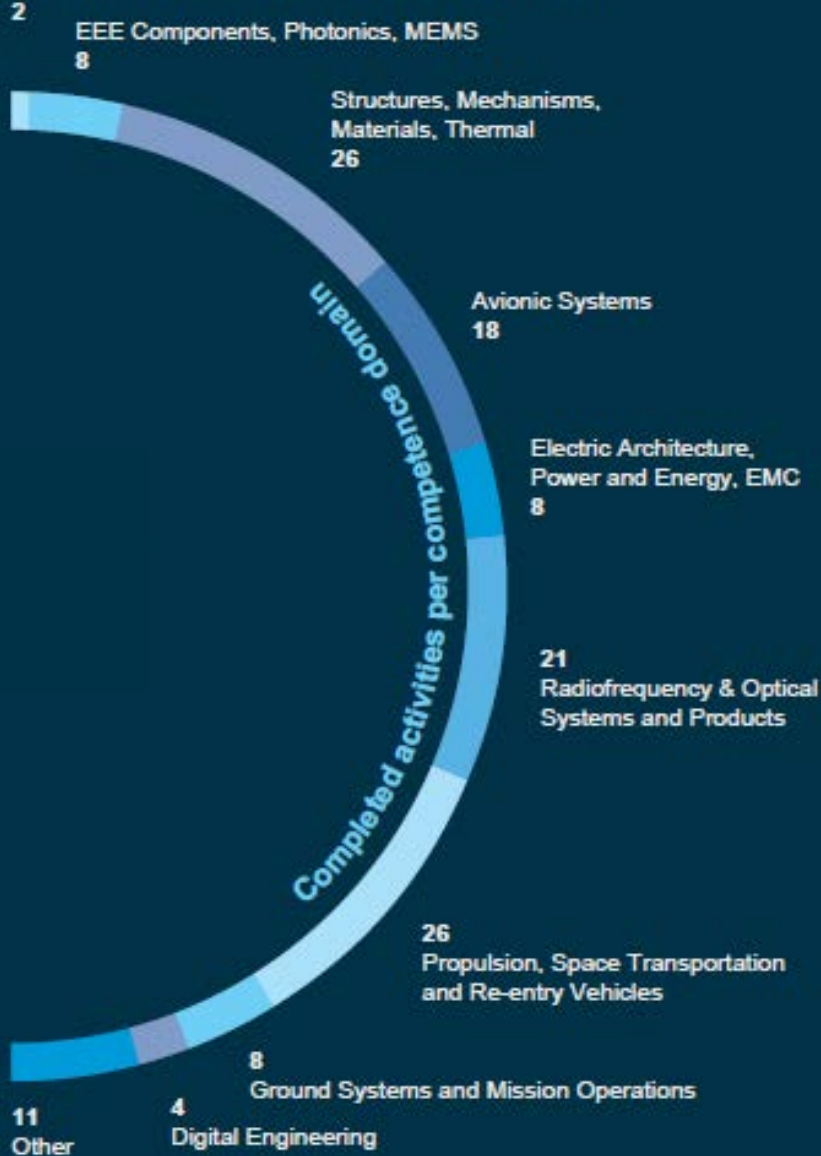
Slovakia, 26th November 2024

GSTP mission



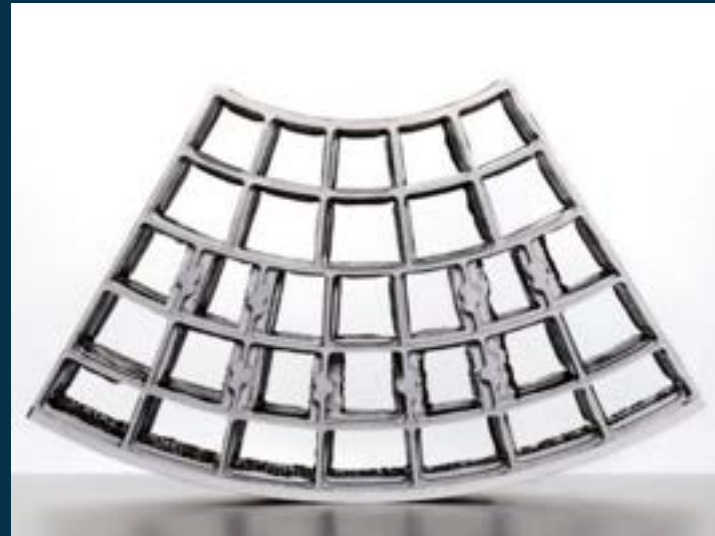
- For more than 30 years, the GSTP has been developing leading-edge space technologies that enable missions and support the competitiveness of European industry.
- GSTP allows companies of all sizes as well as research and academic organisations to perform technology developments and demonstrations
 - 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





27 ESA Member, Associate and Co-operating States are subscribed to GSTP.

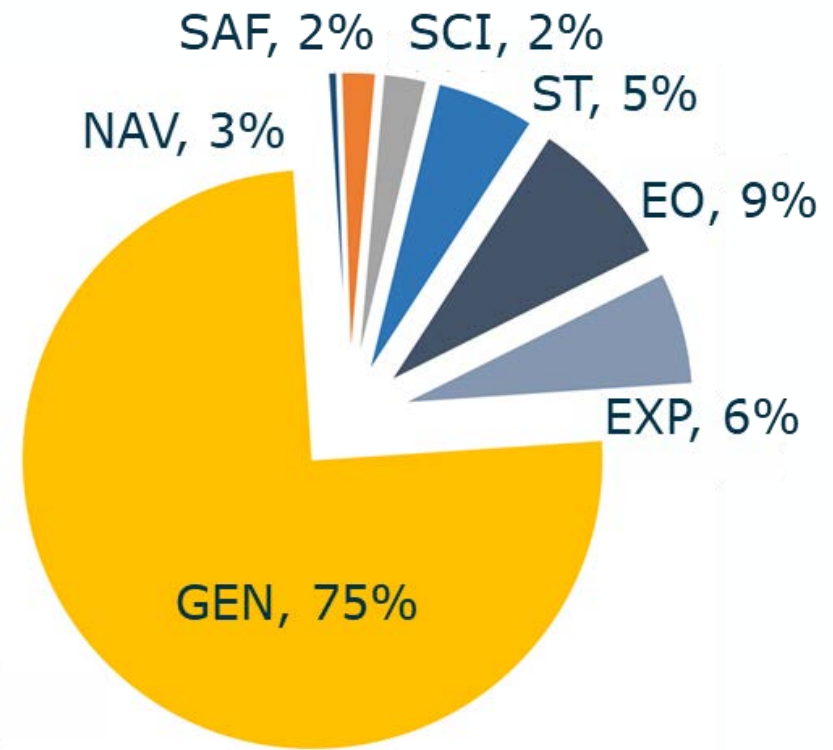
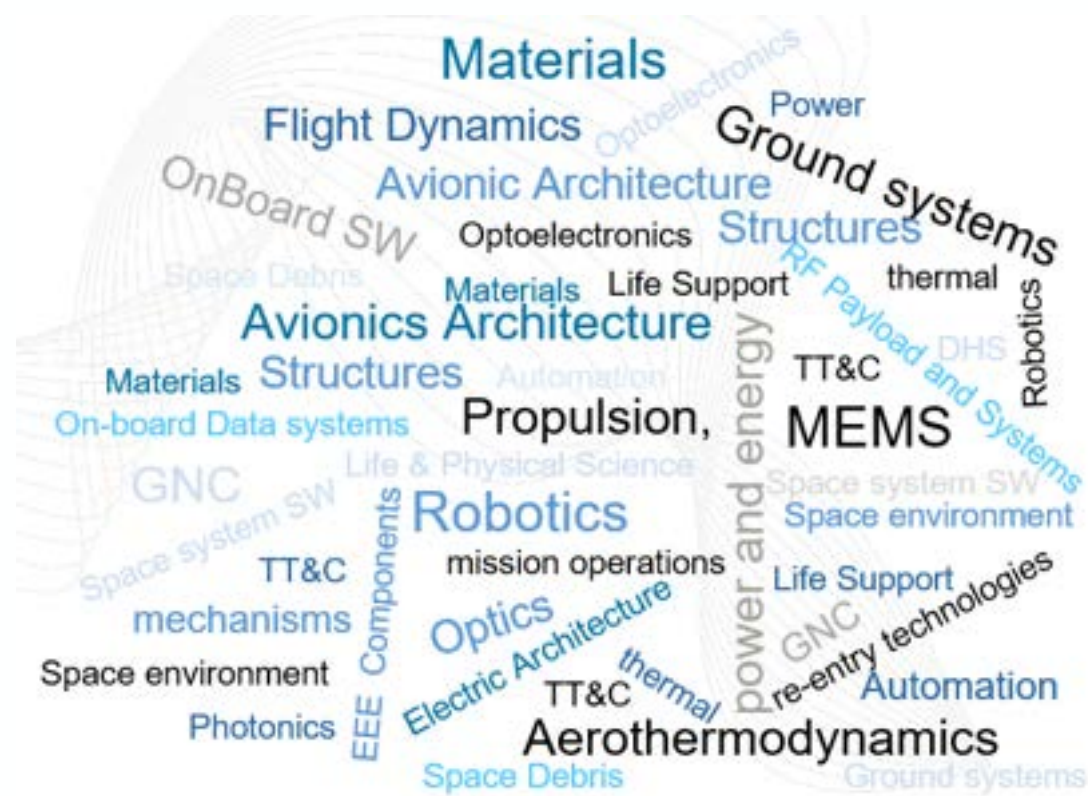
Cooperation is encouraged! It is possible to propose activities and to bid for activities with partners from these States.

Slovakia:

- GSTP Participant since November 2022
- Total subscription: 3 MEuro
- 2 Activities in GSTP: 1 contract and 1 under procurement
- Complements the RPA in Slovakia

GSTP activities will facilitate the participation of Slovakian entities in ESA Programmes (EO, Science, Navigation...)

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 Achievements



Mini space Thruster that runs on water (URA Thrusters)



Compliant Mechanism Based on Additive Manufacturing (CSEM)



Miniature Active Pixel Sensor based Star Tracker to support PLATO mission (TERMA)



Additive manufacturing for novel structural components (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.

- Work Plan, Compendia,
- Frameworks: De-risk, BB



ELEMENT 2: MAKE



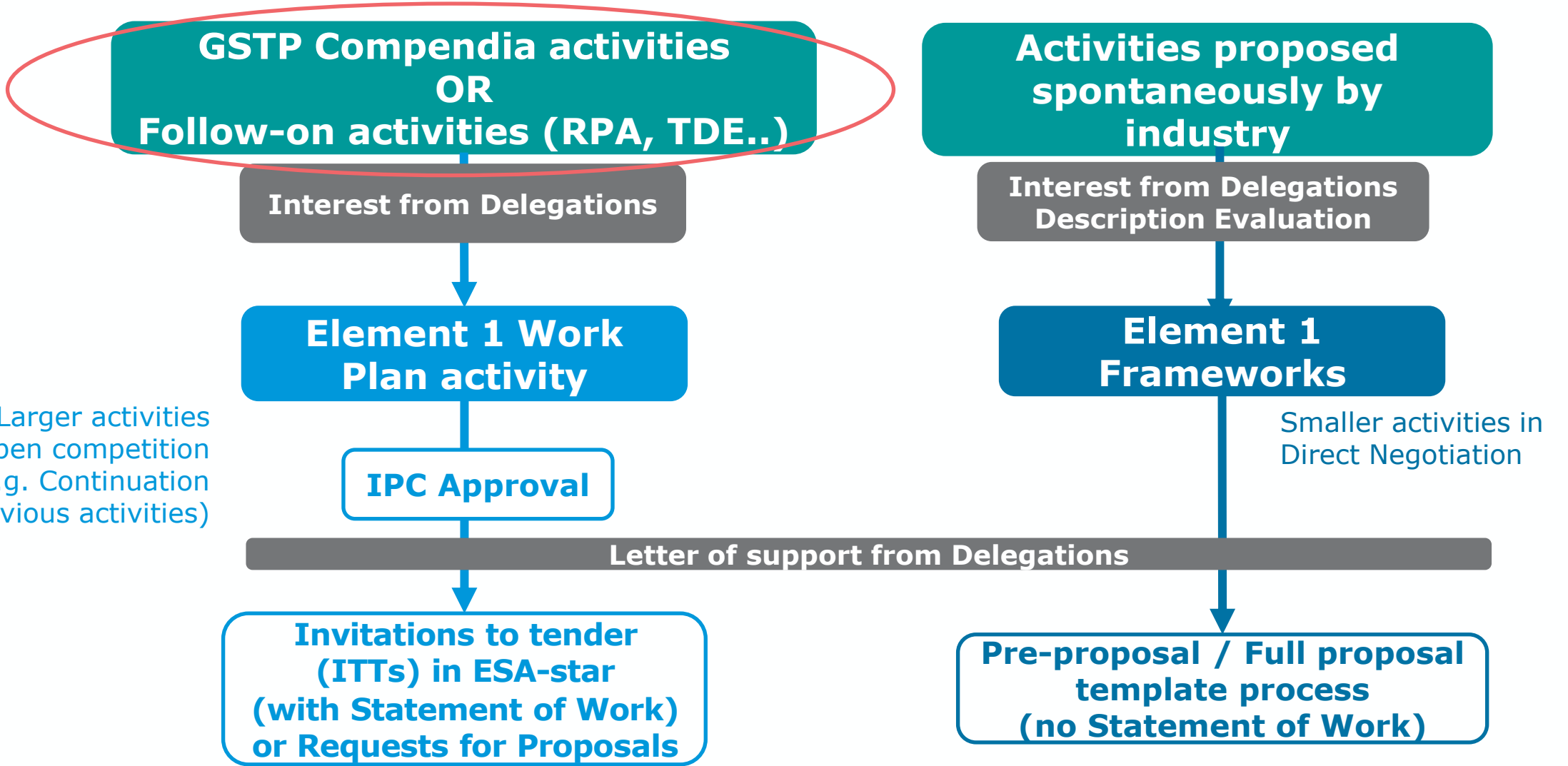
→ Industry initiated and driven co-funded activities to strengthen competitiveness.



ELEMENT 3: FLY



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





GSTP Element 1



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**



- Publication in November 2022
- Since Feb 2023, 61 activities have been included in GSTP WP
- Implementation 2023/25





GSTP Element 1



Publication Date: 28/10/2022
Last Update On: 09/11/2022 09:00 GMT
Classification: Procurement Related News

Restricted by Entity: **Yes**
Restricted by Country: **No**
Restricted to SME Entities: **Yes**
Restricted to LSI Entities: **Yes**
Visible to National Delegates: **No**

The GSTP Element 1 "Develop" Compendia 2022 includes a list of candidate activities for the GSTP E1 "Develop" Work Plan in the following technology themes:

- Generic Technologies ... Read more

Attachments

- Green letter GSTP E1 Develop Compendium 2022.pdf
- GSTP Element 1 Develop Compendium 2022 - Generic Technologies.pdf
- GSTP Element 1 Develop Compendium 2022 - Artificial Intelligence.pdf**
- GSTP Element 1 Develop Compendium 2022 - Digitalisation.pdf
- GSTP Element 1 Develop Compendium 2022 - Quantum Technologies.pdf
- GSTP Element 1 Develop Compendium 2022 - Cybersecurity.pdf

esa-star
Publication

More Details... Access

ESA UNCLASSIFIED - Releasable to the Public

esa

GSTP ELEMENT 1 "DEVELOP" COMPENDIUM 2022: ARTIFICIAL INTELLIGENCE

ESA UNCLASSIFIED - Releasable to the Public

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2. LIST OF ACTIVITIES

GEN - Generic Technologies – Artificial Intelligence

CD3 - Avionic Systems

Programme Reference	Activity Title	Budget (k€)
Guidance Navigation and Control (GNC)		
GT11-602SA	Machine learning for attitude and orbit control systems failure detection isolation and recovery applications	650
GT11-602SA	Artificial intelligence techniques for spacecraft attitude control and estimation	750
GT11-603SA	Advanced verification and validation techniques for neural network-based AOCs/GNC systems	600
GT11-604SA	Deep neural network for robust satellite model matching	500
GT11-605SA	Robust real-time constrained optimal control using machine learning	600
GT11-605SA	AI-based GNC/AOCs systems validation and verification evolution	1,000
AI on the Edge		
GT11-607ED	On-board detection of space weather events	500
GT11-608SW	Qualified software machine learning toolkit for space hardware	900
GT11-609ED	Architecture for offline processing and machine learning in mass memories	800
GT11-610EF	Reference onboard datasets for evaluation of machine learning models	800
GT11-611EF	Closed loop AI cognitive synthetic aperture radar	1,200
GT11-612ED	AI based end-to-end satellite failure management and prognostic	1,400
GT11-613ED	On board processing enablers for AI for operations	500
GT11-614ED	Advanced heterogeneous inference data processing module	2,000
Total CD3		12,200

Page 6/67
GSTP Element 1 Develop Compendium 2022 - Artificial Intelligence
Date of issue: 28/10/2022 Issue: 1 Revision: 0

THE EUROPEAN SPACE AGENCY

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





GSTP Element 1

List of upcoming ITTs in 2025



AI

Cyber

Digitalisation

Quantum

Generic

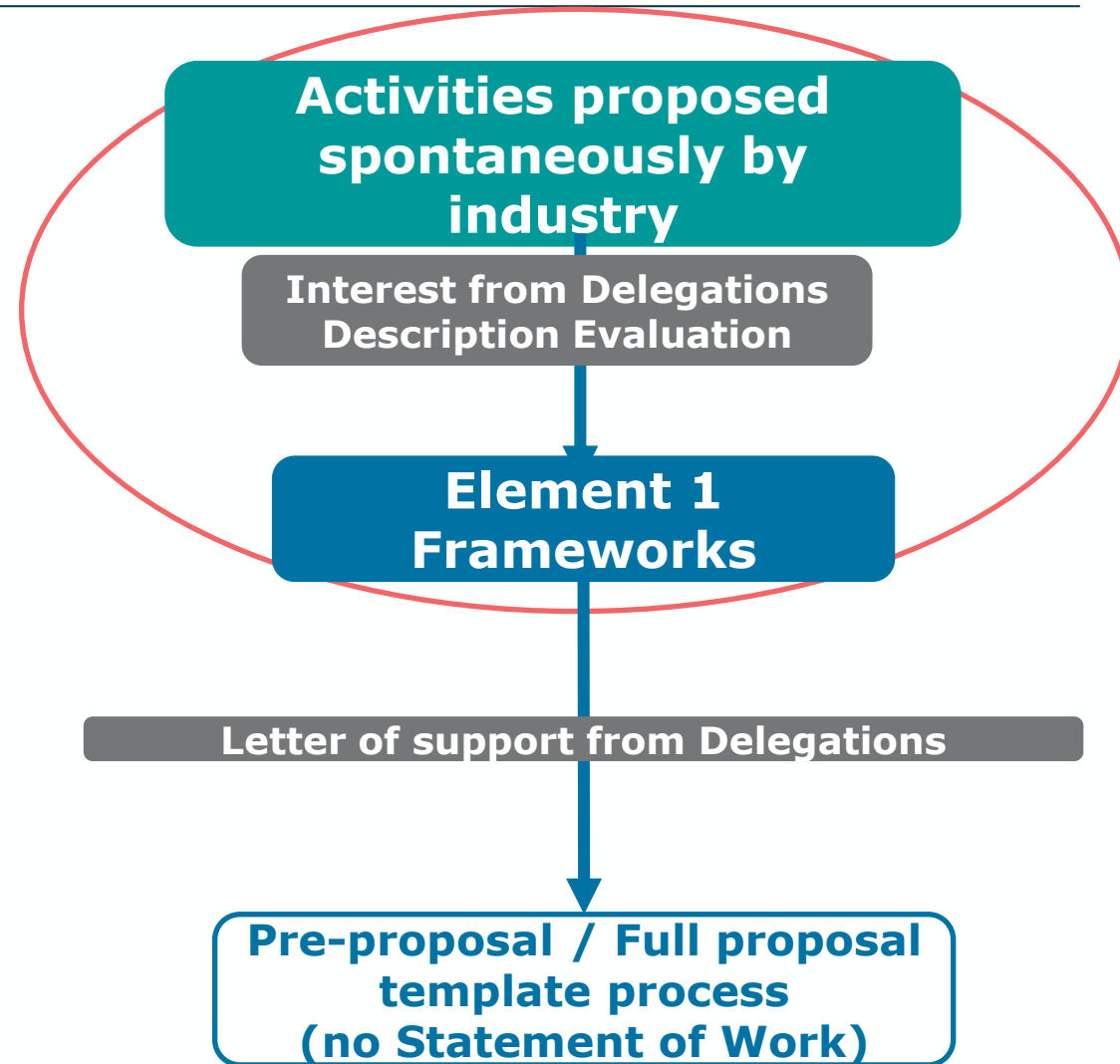
Act. Ref.	Title	Budget (k€)	Status
GT11-608SW	Qualified software machine learning toolkit for space hardware	900	ITT expected by Q2/Q3 2025
GT11-613ED	On board processing enablers for AI for operations	500	ITT expected by Q2/Q3 2025
GT11-614ED	Advanced heterogeneous inference data processing module	2000	ITT expected by Q3 2025
GT11-615MP	Space propulsion test anomalies dataset for machine learning assisted fault detection and isolation	800	ITT expected by Q4 2024
GT1Y-606ES	CCSDS delay-tolerant networking BPsec module	2000	ITT expected by Q4 2024
GT1Y-608ES	Low-cost resilient software defined radio platform for satellite applications	450	ITT will be re-issued
GT1Y-611GD	Security architecture for federated operations	3000	ITT expected by Q3 2025
GT1D-603GD	End to end digital continuity for validation and simulation	600	ITT expected by Q2/3 2025
GT1D-606SW	Model-based system engineering for interface management	500	ITT expected by Q3 2025
GT1Q-601MM	Development of the capabilities and performance metrics in non-linear and hybrid integrated photonics for quantum applications	500	ITT expected by Q2/Q3 2025
GT1Q-602MM	Ultra-efficient compact carrier envelope frequency detection unit for optical frequency combs	500	ITT expected by Q1 2025
GT1Q-603MM	Ultracompact 778 nm rubidium secondary optical frequency standard	1000	ITT expected by Q2/3 2025
GT1Q-605SW	Processing EO/Science products and big data using quantum methods	500	ITT expected by Q2/Q3 2025
GT1Q-607MM	Development of Strontium G-MOT for dual use applications in matter wave interferometry and optical atomic frequency standards	2000	ITT expected by Q3 2025
GT17-600ED	Analog to digital converter for image detector readout applications	1100	ITT expected by Q2/3 2025
GT17-601ED	Space evaluation of chip-on-board assembly for non-hermetic applications	350	ITT expected by Q4 2024
GT17-609QE	FPGA based radiation experiment testbed	800	ITT expected by Q4 2024
GT17-616MS	Actuator design and commanding technologies optimisation for micro-vibration minimisation	500	ITT expected by Q1 2025
GT17-620ED	OBPMark benchmarks for on-board data processing	800	ITT expected by Q2/3 2025
GT17-622ES	Data relay RF simulator system	900	ITT expected by Q3 2025
GT17-623ED	RISC-V instruction set architecture simulation model and emulation in virtual platform for hardware-software codesign	500	ITT expected by Q2/3 2025
GT17-633EP	Very low power DC/DC converter for gate drivers	700	ITT expected by Q3 2025
GT17-634EP	Technologies to accurately estimate the battery state of charge	600	ITT expected by Q2 2025
GT17-642MM	Adaptive optical lenses for compact optical corrections in small satellite payloads	800	ITT expected by Q1 2025
GT17-647EF	Advanced RF integration techniques for application in highly dense millimetre-wave active antennas	800	ITT expected by Q3 2025
GT17-652MP	Miniaturised, high-pressure isolation valve for nanosatellite propulsion	400	ITT expected by Q4 2024
GT17-657SA	Closed-loop control of throttleable engines	1000	ITT expected by Q3 2025
GT17-658MP	Secondary heat exchanger for combustion chamber cooling of rocket engines	500	ITT expected by Q3 2025
GT17-663GS	Manufacturing of high-power frequency selective surfaces using innovative techniques	800	ITT expected by Q4 2024
GT17-675GS	Disruption Tolerant Networking (DTN) network management	900	ITT expected by Q4 2024
GT17-677SY	Immersive space design environment	500	ITT expected by Q1 2025
GT17-681SD	Interface between space traffic and air traffic management units	400	ITT expected by Q2 2025
GT17-682SD	Manoeuvre pattern inference for safe operations	450	ITT expected by Q3 2025
GT17-684SD	Development of daytime and multispectral space debris observation capabilities	500	ITT expected by Q1 2025





GSTP Criteria – Description Evaluation:

- Programmatic: TRLs, Application, Consistency of scope /deliverables /TRLs
- Continuation of previous activities (TDE, frameworks ...)
- Innovation? Competitiveness? Enabling mission?
- Industrial sustainability / Building Capabilities
- Interest from Delegations / National Strategy + Funds Availability





GSTP Element 1 - De-risk framework

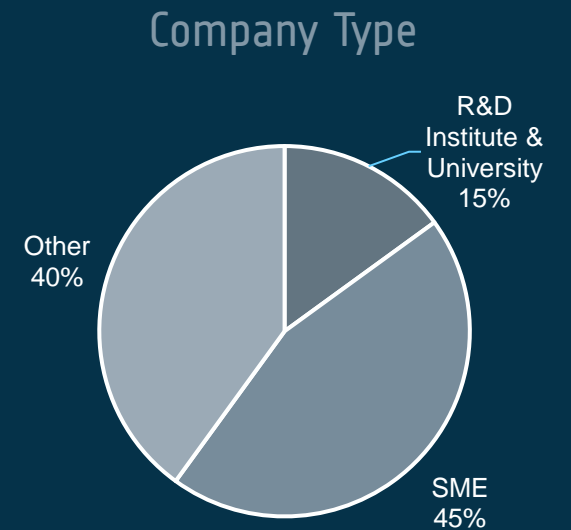



G617-241TA, Assessments to prepare and de-risk technology developments

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	<u>~40 de-risk initiated / year</u>
<ul style="list-style-type: none"> Max budget: €250 K Max duration: 9 months 	<ul style="list-style-type: none"> No budget limit No duration limit ~ 35% de-risk are continued 	<ul style="list-style-type: none"> >200 de-risk so far ~ €40 M overall budget



Permanent Open Call in ESA-Star 





GSTP 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



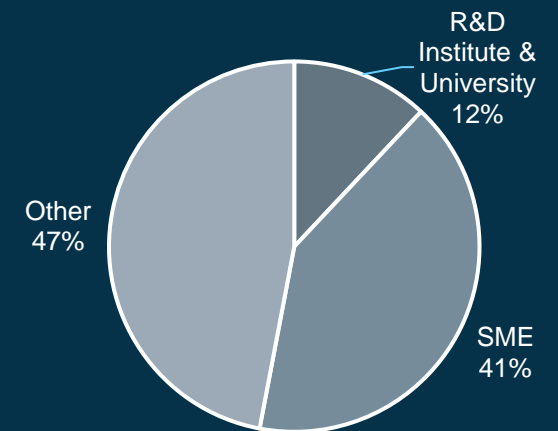
Procurement using a template

- Max budget: €1 M
- Max duration: 24 months

~20 activities initiated / year

- 100 activities so far
- ~ €43 M overall budget

Company Type



Permanent Open Call in ESA-Star





De-Risk

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Building Blocks

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Outline Proposal Review Criteria

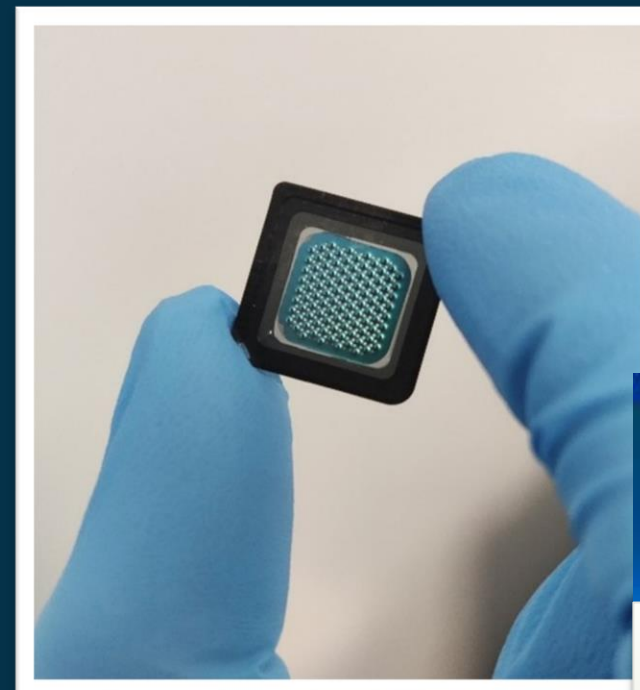
- Clear and credible definition of the technical objectives, key requirements, technical steps and risks to be addressed in this activity.
- Clear indication of the application and potential users of the technology.
- Clarity of the management approach and the adequacy of the proposed costs with the work to be performed
- Clear information about Cost to Completion



GSTP Element 2

Announcement Of Opportunity

- GSTP Element 2 is dedicated towards industry driven co-funded activities enabling the development of technologies and products for market competitiveness and sustainability.
- Industry is invited to submit proposals addressing one of the 3 technology and product development segments:
 - Market Oriented Opportunities,
 - Strategic Opportunities and
 - Implementation of National Priorities.



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





GSTP Element 3

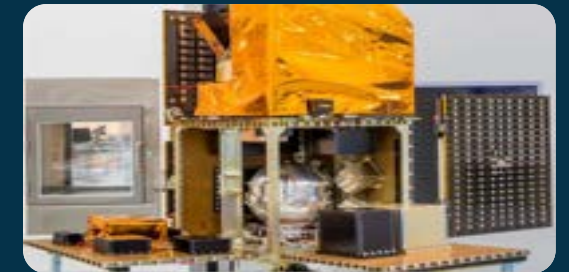
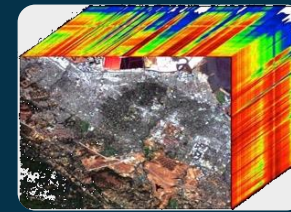
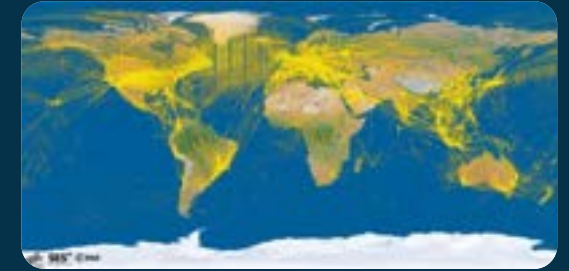
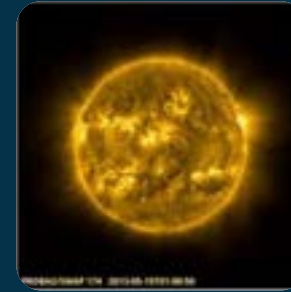
Facilitate Technology Demonstrations

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



GSTP - How to participate for technology developments



	Objective	Type of Procurement	Max Budget	Max Duration	Co-fund	First Step	Main Proc Doc
GSTP E1 Workplan	To develop space technologies up to qualification. Mainly ESA coordinated. Compendium and continuation of framework activities.	Competition and Direct Negotiation	No limit	No limit	Not Mandatory	ESA Star	SoW / DP
GSTP E1 BB fr.	Develop enabling capabilities and the associated building blocks for space related systems and the associated sub-systems	Direct Negotiation	1,000 k€	24 months	Not Mandatory	OSIP	Template
GSTP E1 De-risk fr.	To reduce funding and technical risks linked with new technologies/applications and to facilitate collaboration with new industrial players	Direct Negotiation	250 k€	9 months	Not Mandatory	OSIP	Template
GSTP E2	Industry initiated and driven, co-funded activities to strengthen competitiveness	Direct Negotiation	No limit	No limit	Mandatory	OSIP	Template



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How RPA can help

- All recommendations/indications for RPA apply for GSTP - present a good quality proposal
- Consider presenting targeted activities inspired in **Compendia** – can help future participation in GSTP activities or other ESA programmes – Build Company CV.
- Build your International Cooperation!! - Team up later for **Compendia** or framework activities
- Make use of RPA for further **define/consolidate your company (not only R&D)**
 - Company objective – where will you be in 5 years and in 10 years
 - Technology strengths and products
 - Targeted market/customers, your place in the space supply chain
 - Targeted application

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

Additional considerations:

- **GSTP** is complementary to the RPA scheme
- **Slovakian entities** may request financial support from their delegation to perform technology development/demonstrations
- Consult the GSTP Element 1 **Compendia** for ESA driven activity ideas
- **Slovakian entities** may propose projects for GSTP, notably via the frameworks

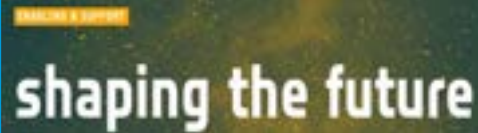
Useful links



- Registration of new companies.
- Invitations to tenders.
- News/Procurement related announcements: TDE WP, GSTP Compendia Publication.



- Channel and Campaign.
- Submission of outline proposals for GSTP.



- TDE/GSTP information.
- TDE/GSTP achievements summary.
- Annual reports and highlights.



The knowledge bank of ESA's R&D programmes

- Closed TDE and GSTP activities with public deliverables



Thank You
