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# Slovakia PECS end of period – Executive Summary Report

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# 1 INTRODUCTION

This Executive Summary Report (ESR) is based on the "Slovakia PECS end of period report" (ref. PECS-1807-SK) prepared by ESA PECS and the Slovak Delegation in order to assess the current status of the Slovakian Space landscape after its first period of the Plan for European Cooperating States (PECS) (ref. ESA/LEG/443). This paper details the outcome of the jointly performed Slovakia PECS end of Period assessment. All information presented herein was valid as of the first quarter of 2020.

A high-level summary of the Slovakian PECS status is provided in the table below:

| Number Proposals | Number Activities | Notes |
|---|---|---|
| 66 | 29 | Up to TEB4 |
| 24 | 10 | TEB5 (in approval) |

**Table 1: Overview of PECS Open Calls / Invitations-To-Tender (ITTs)**

TEB5 was held on 5 March 2020 and resulted in the remaining period 1 PECS funding being allocated to ten (10) new industrial activities, hence the entire budget has now been used. As such, there will be no 6th Open Call during this 1st PECS Period.

The key existing competences in Slovakia demonstrated in the PECS Open Calls can be summarised as:

- Space Hardware Instrumentation & Analysis: Space Physics and measurement instrumentation, Capacitive Multiturn Absolute Rotary Encoder, Small satellite components and ICT capabilities.
- Use of Earth Observation Satellite data – Downstream Products & Applications
- Participation in Space Situational Awareness / Tracking

# 2 OBJECTIVES

The overall objective of the PECS programme is to associate the Slovak Republic with Agency programmes and activities and to prepare Slovakia in the most efficient manner for possible closer cooperation and eventual accession to the ESA Convention in the future. To do so, the following specific objectives of PECS are defined:

a) Develop cooperation between scientific and EO applications user communities in the Slovak Republic and those in Agency Member States;

b) Create and strengthen the respective industrial expertise and capacity of the Slovak Republic with a view to allowing a fair and equitable industrial participation in Agency programmes in the future.

c) Provide indirect access to activities within the scope of ESA programmes and access to joint Agency/EC programmes in accordance with the terms and conditions of the applicable legal instruments.

d) Foster the Slovak Republic's understanding of the Agency's organisation and functioning of European space products, standards and procedures.

e) Ensure coherence between the space activities of Member States and the Slovak Republic e.g. by avoiding unnecessary duplication.

The PECS objectives have been achieved by:

- Invitations-To-Tender (ITTs) which draw on existing capabilities and allow entities to become familiar with ESA practices and standards. The ITTs allow for further developing competitive capabilities, products and services with respect to European industry. The specific outcomes of the ITTs are provided in detail throughout this document.

- Developing cooperation between ECS scientific users and industry & potential European partners through support to PECS entities attending Industrial Networking Events (ESA ISD, Tech Final Presentation Days, Phi Week Final Presentations, SARIO: Getting Into Space Diversification Workshop, VýťahConf – Space Talk: Why & How to launch your Space Industry Company, SARIO: Thales Group & Thales AI4EU in Slovakia). In 2020 the Slovak Investment and Trade Development Agency (SARIO) has announced the intention to host a Slovak Space Booth at the next ESA Industry Space Days.

- Education and training including utilisation of the Young Graduate Trainee Programme & entity participation in ESA SME Training Courses. Three (3) International Research Fellows have been employed between 2015 and 2019. Seven Young Graduate Trainees from Slovakia have been hired between 2016 to 2019. Specifically, one (1) was recruited in 2016, four (4) in 2017, one (1) 2018 and one (1) in 2019. The following educational and awareness activities have been funded in the frame of the PECS Calls:

- Space for Education, Education for Space (SEES), Slovak University of Technology (FEI-STU)
- SPACE::LAB, Institute of Experimental Physics, of the Slovak Academy of Sciences
- TUKE Space Forum, Technical University of Košice, Faculty of Electrical Engineering and Informatics

# 3 SLOVAKIAN SPACE ACTIVITIES AND GOVERNANCE

In April 2018, the Slovak Academy of Sciences (SAS) and it's Institutes published "*SPACE RESEARCH IN SLOVAKIA 2016-2017*" which highlighted the accomplishments of it's research teams in the areas of space physics, geophysics, astronomy, life sciences, materials science, remote sensing and space meterology. Of special interest is the fact that SAS has contributed already to the following space projects listed below .

**Table 2: Slovak Academy of Sciences Space Activities outside PECS**

| |
|---|
| 1) ESA-ROSETTA Electronic Support System processor unit; |
| 2) Energetic particle spectrometer (MEP-2) on board of Spektr-R (Radioastron); |
| 3) ESA-BepiColombo Planetary Ion Camera (PICAM) mechanical structures which is part of the space science suite SERENA for particle detection at planet Mercury; |
| 4) The ESA-led IMPRESS (Intermetallic Materials Processing in Relation to Earth and Space Solidification) project to understand the structure of the material at the micro and nano scale, and its final mechanical, chemical and physical properties. |
| 5) Experiment ASPECT-L energetic particle spectrometer for project LUNA-RESURS; |
| 6) Experiment DOK-M device dedicated for charged energetic particles temporal and energy sampling for project RESONANCE; |
| 7) ISS JEM-EUSO (International Space Station Japanese Experiment Module – Extreme Universe Space Observatory) UV background model at the Earth night side; |
| 8) The first Slovak satellite skCUBE was launched 23rd June 2017 and operated until 12th January 2019; |
| 9) ESA Gravity Dependence of CET in Peritectic TiAl Alloys |

The Ministry of Education, Science, Research and Sport of the Slovak Republic (MINEDU) presented the document titled, *"A conceptual framework of space activities in the Slovak Republic"*[1] *also known as, "Koncepcia vesmírnych aktivít v SR"*, at a meeting of the Slovak Government Council for Science, Technology and Innovation in June 2019. This report examined the current programme offerings of the European Union (EU) and ESA, and was created to serve as a basis for the future development of a Slovak National Space Strategy. The document also takes into account the Space Strategy for Europe and United Nations Organisation Committee for Peaseful Uses of Outer Space (COPUOS). The report recognised the following main Slovak Space actors:

[1] *"A conceptual framework of space activities in the Slovak Republic". (24 June 2019). Retrieved from* http://slovak.space/koncepcia-vesmirnych-aktivit-v-sr/K

1. *Decision-making sphere (Government of the Slovak Republic and the Respective Ministries),*
2. *Academic sphere (Institutions: Slovak Academy of Sciences and Universities)*
3. *Industrial sphere (Research and Development organizations, Small and Medium-sized Enterprises)*
4. *Third party sector (Civic and Interest Associations, Non-governmental and Non-profit Organizations)*

The Ministry of Education, Science, Research and Sport of the Slovak Republic has established an advisory body called the "*Commission for Space Activities in the Slovak Republic*". This commission is made up of representatives of the 10 relevant ministries with an interest in Space activities in Slovakia and has two advisory bodies: the "*Scientific Council*" and the "*Chamber of Commerce*". The commission consists of stakeholder representatives with vested interest in the growth of the Space Sector in Slovakia. These advisory bodies will provide inputs to goal setting and the development strategy that is to follow the conclusion of this first PECS period.

On 13th of December 2019 a meeting of the Commission for Space Activities in the Slovak Republic took place in an enlarged format in order to enable the exchange of relevant information among the whole spectre of space actors (academia, industry, cross-cutting ministries, and the third party sector Associations and NGO companies) with the view to set direction to the future development of space activities in Slovakia. Participants of this meeting are aware of the importance of space activities in the Slovak Republic and the need to spread this information among policy-makers, politicians and wider public in order to take appropriate measures regarding long-term sustainable funding and supra-ministerial governance of space activities in Slovakia in the near future that would also reflect the new EU Space programme, calls and be in accordance with the cooperation with ESA beyond 2021.

In addition to the PECS programme activities there has been some space related research funded through the Horizon 2020 EU Research and Innovation Framework programme. In the period 2014-2020 Slovakian entities received 5 grants with an EU contribution of 433,031€. The success rate of Slovak entities in Horizon 2020 space calls is 9%. Only 1 of the 5 entities is an SMEs. None of these Horizon 2020 entities have PECS activities.

Space activities in Slovakia are additionally funded from the National Budget within the framework of VEGA (Scientific Grant Agency of MINEDU and SAS) projects and the Slovak Research and Development Agency (SRDA). Further to this, the Slovak Academy of Sciences participates in *Committee on Space Research (COSPAR)* and *International Astronomical Union (IAU),* as shown in Table 3.

Additionally, there has been five (5) activities funded by the European Commission's Horizon 2020 programme with Slovak participation as shown in Table 4.

These technology developments undertaken by research institutions and academic universities cover areas of high interest for ESA.

**Table 3: Additional Funding of Slovak Space Activities (Non-PECS) 2015-2019**

| Other activities | Activity Title | Participant |
|---|---|---|
| VEGA (Scientific Grant Agency of MINEDU and SAS) | VEGA 1/0750/18: Analysis of selected geodynamic methods including absolute and relative gravimetry and GNSS technology. | Slovak University of Technology in Bratislava, Faculty of Civil Engineering |
| VEGA (Scientific Grant Agency of MINEDU and SAS) | 1. cosmogenic nuclides as process tracers on the surface of space objects<br>2. small asteroids observation<br>3. a human´s role in the universe in the view of modern philosophical and cosmological theories<br>4. space law. | Comenius University in Bratislava |
| Slovak Research and Development Agency (SRDA) | 1. space debris research<br>2. cosmogenic nuclides and their use in early-stage models of the universe<br>3. exotic molecules in the universe. | Comenius University in Bratislava |
| Membership | National Scientific Institution member of the Committee on Space Research (COSPAR) | Slovak Academy of Sciences |
| Membership | Membership: International Astronomical Union (IAU) | Slovak Academy of Sciences |
| Publication | Magazine: Space Research in Slovakia | Slovak Academy of Sciences |
| | | **Total: 324,831 Euro** |

**Table 4: Slovak Horizon 2020 Activities 2014-2018**

| H2020 Call | Activity Title | Participant |
|---|---|---|
| Galileo 2014 | CaBilAvi: Capacity building for aviation stakeholder, inside and outside the EU | Žilina University; Zilina/VÚD,a.s. |
| COMPET 2014 | COSMOS: Cooperation of Space NCPs as and Means to Optimize Services | SLOVAK CENTRE OF SCIENTIFIC AND TECHNICAL INFORMATION (SCSTI SR / CVTI SR) |
| EO 2016 | E2MC: Evolution of Emergency Copernicus services | KAJO, s.r.o. |
| INFRADEV 2016-17 | PRE-EST: Preparatory Phase (PRE) of the European Solar Telescope (EST) | SAS Astronomical Institute |
| SPACE-NCP-2018 | COSMOS2020plus: Strengthening European capacity building in space exploration | SCSTI SR / CVTI SR |
| | | **Total: 433,031 Euro** |

# 4 OVERVIEW OF THE SLOVAKIA-ESA RELATIONSHIP

The ESA Council at its meeting from the 17th to 18th of June 2014 unanimously approved the draft European Cooperating State (ECS) Agreement between the Government of the Republic of Slovakia and the European Space Agency (ref. ESA/C(2014)55). Slovakia signed the ECS Agreement on the 16th February 2015 and PECS Charter on the 4th February 2016, which has a duration of 5 years.

Slovakia's interface with ESA is through a delegation from the Ministry of Education, Science, Research and Sport of the Slovak Republic, whom has been represented at all related PECS meetings (e.g. PECS Committee, PECS Annual Reviews, ITT Debriefs & Activity Selections, etc.) as well as a significant number of meetings to which they have been invited as observers (e.g. IRC, Council).

From the signature of Slovakia's PECS Charter through the 31st of December 2019, 4.14M Euro have been committed back to Slovakia by means of twenty-eight (28) PECS Contracts. The complete list of committed Slovakian ESA activities is provided in Annex 2: PECS activities.

While Slovakia already expressed interest in becoming a full member of ESA some years ago, ESA has, in line with the Council Resolution adopted on 13 December 2018 (ESA/C/R/CCLXXVII/Res.1 (final)), presented only the following options to Slovakia to be taken into account for the future of the Slovakia-ESA cooperation:

- Option 1: An additional PECS period, in which the programmatic conditions should be revised to reflect the current status of development of the Slovakian space industry and to address the recommendations of this report.

- Option 2: Associate Membership with Requesting Party Activities (formerly referred to as a Third Party Programme) in parallel, the programmatics of which should address the recommendations of this report;

# 5 CURRENT SLOVAKIAN INVOLVEMENT IN ESA ACTIVITIES

The number of esa-star registrations in Slovakia has grown steadily since the signature of the ECS Agreement. See Figure 1.

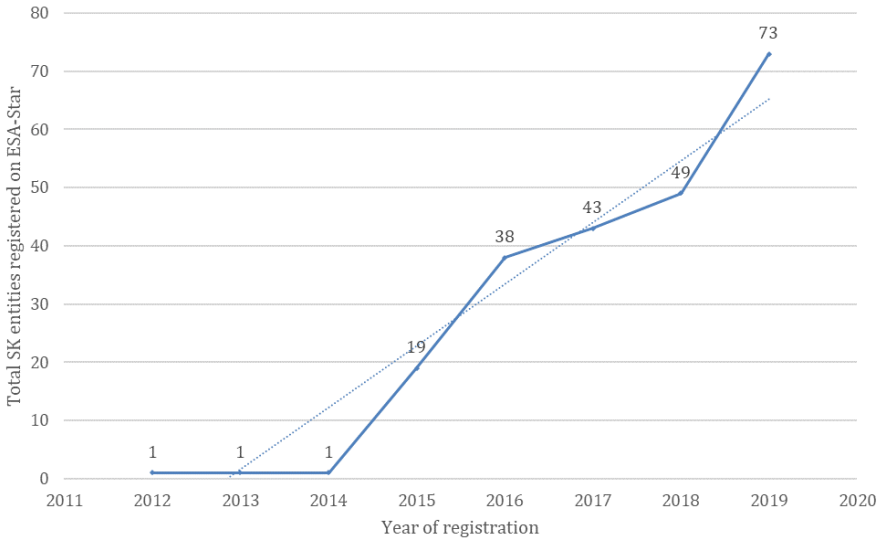


**Figure 1: Growth in esa-star registrations since the start of the cooperation with ESA2**

The number of registrations per unit of GDP is slightly below the average for PECS and the newer ESA member states. It is noted that the majority of the entities registered are industry (54/73) with a high percentage of SMEs compared to the same countries. There are a number of other companies[3] with a clear interest in space technologies and clear potential to work in space, hence, it is concluded that there is still room to improve these statistics.

Up to the 31st of December 2019, 66 proposals have been submitted by Slovakian entities in four (4) PECS ITT open calls leading to the award of 28 contracts, with a 29th, which was committed in January 2020.

The overall success rate is 43.9%, which is above the benchmark of 33% considered in PECS. The average overall weighted marking for the funded proposals is 60.8. This shows that the quality of the proposal writing in Slovakia is higher than nominally expected after only a single period of PECS.

In terms of financial commitments, the industry ratio for Slovakia is 47% (as of 31st December 2019 – i.e. up to and including the 4th Call but excluding the final 5th Call –see Annex for details), as shown in Figure 2. However, it is noted that this shows only the Primes and hence Academia led co-operations with industry are not reflected. This ratio is below the ideal ratio that is strived for and hence a focus on more industry involvement and Academia-industry co-operations is needed.

[2] For entities with multiple registrations on ESA-Star, only the first registration date is recorded here. Two entities of the 74 total registered are missing registration dates in ESA-Star and as such are not included here.

Out of the eighteen (18) entities successful in the first four Calls, only four (4) have received more than one ESA contract. Three of these four were institutions, leaving CTRL s.r.o. as the only Industrial entity to have more than one PECS contract awarded going into the 5th Call.

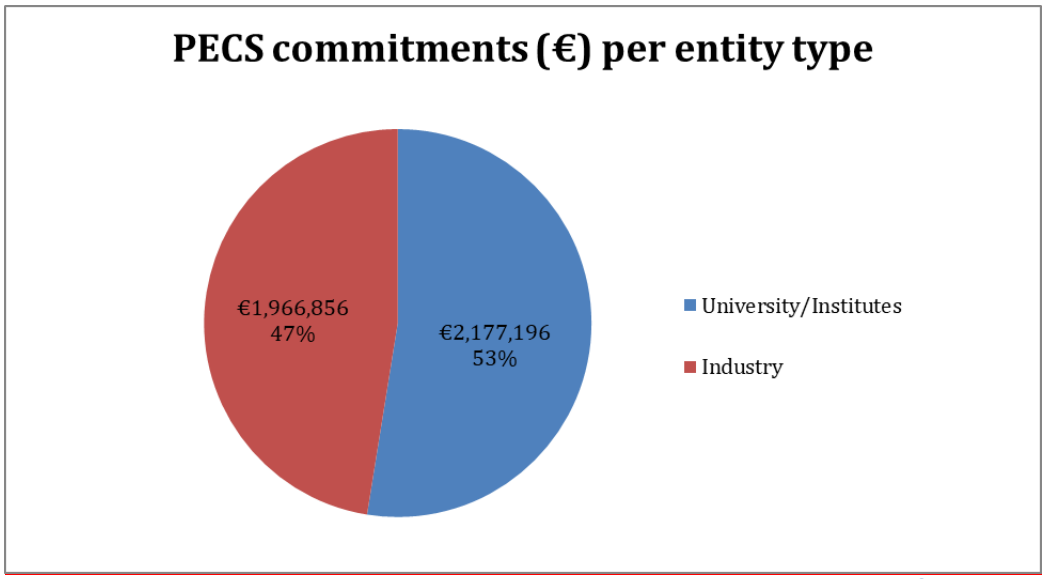


**Figure 2: Slovakia PECS Open Call commitment distribution per type of entity**

As of December 2019, 84% of all awarded activities with a target TRL[4] were targeting TRL of 4 or less. Very few higher TRL or follow-on activities to reach higher TRLs have been performed. It is clear from these assessments that further work is needed to support the industrial entities with an interest in space, a path to develop to higher TRLs with follow on activities is needed if the return on investment is to be secured and for the industry to be competitive in the wider ESA environment. Efforts are also needed to capitalise on and exploit the work performed by the academic institutions.

As of December 2019, the main fields of activity in Slovakia were as follows: Generic Technology and Techniques (37% of activities), Earth Observation (23%), Space Surveillance (14%) and Science (12%) with a minor amount of activity in other areas. The bulk of activities and associated competences map well onto the ESA GSTP and EOEP programmes with lesser volume but still important interest in ESA's SSA and PRODEX programmes. Depending on the level of interest and Governmental support the AM Requesting Party Activities (formerly referred to as a Third Party Programme) could be an alternative to a subscription to PRODEX.

Although, not in the statistics mentioned above, it should be noted that an additional 24 proposals from the 5th and final call were evaluated in March 2020 with 10 being recommended for implementation pending ESA Delegate Body approval and successful negotiation (See Annex 1). The 5th Call average overall weighted marking for the recommended proposals is good (60.2). With this TEB, the overall bidding success rate will remain close to 44%. These 5th Call results align with the recommendations and conclusions.

[4] Technology Readiness Level

# 6 ASSESSMENT OF KEY SLOVAKIAN COMPETENCES

The key existing competences in Slovakia, as seen through and already engaged in PECS, can be summarised (in no particular order) as:

- Rotary Encoders
- Sun Sensors
- Use of Earth Observation Satellite data (Habitat monitoring, Forestry, Land deformation and Gravity Field modelling, ESA-Sen2Agri connection with ESTE (Emergency Source Term Evaluation system))
- LEO object cataloguing and tracking
- Ionosphere monitoring and modelling
- Meteoroid analysis
- Materials (Magnesium composites, Additive manufacturing, Solid lubricants)
- X-ray astronomy

Based on the assessment of Slovakian competences, the ESA Optional Programmes best matching these have been identified as GSTP, EOEP, SSA and PRODEX.

A number of competences and potentially interesting industries have also been identified in Slovakia but have not yet either bid for or won a PECS activity. The key competences covered by these are:

- Electronic Mechanisms / Instrumentation – (CTRL, Needronix, Slovak Academy of Sciences (SAS))
- Software and ICT (Touch4IT, M2M Solutions, 3IPK)
- Materials (ATCrystals, Danubia NanoTech, SAS)
- Cubesats (Needronix, Spacemanic, SAS)
- Robotics (RoboTech Vision, SPINEA Technologies)
- Optical systems for ground based telescopes (Orbisys, TILA, ASTROS, SAS Astronomical Institute)

The table below recalls who are considered as the potential main players in Slovakia most relevant to each of the above ESA Optional Programmes (again listed in no particular order).

| Programme | Expected possible active Slovakian entities |
|---|---|
| GSTP | - CTRL<br>- Needronix<br>- GOSPACE<br>- Touch4IT<br>- M2M Solutions<br>- 3IPK<br>- Slovak Academy of Sciences<br>- Spacemanic<br>- SPINEA Technologies<br>- ATCrystals<br>- Robotech Vision |
| EOEP | - Algoritmy:SK<br>- INSAR<br>- YMS<br>- ABMerit<br>- Slovak University of Technology<br>- National Forest Centre |
| PRODEX | - SAS Institute of Experimental Physics<br>- Comenius University in Bratislava<br>- Slovak University of Technology |
| SSA | - Orbisys<br>- TILA<br>- ASTROS<br>- Comenius University in Bratislava<br>- SAS Institute of Experimental physics<br>- SAS Astronomical Institute |

**Table 5: Slovak potential with respect to ESA Programmes**

# 7 CONCLUSIONS AND RECOMMENDATIONS

Through PECS, several key capabilities have been identified and initial collaboration with ESA programmes and large system integrators has been established. A number of entities have shown capabilities in specific niches that are of interest to ESA and other players within the European space sector. However, the level of industrial involvement and the size of the industrial base still is in need of improvement. Developments to higher TRLs with clear customers are also lacking. The key technology areas that have so far emerged in Slovakia map primarily to the GSTP, EOEP, SSA and PRODEX programmes of ESA.

During the PECS first period, the government of Slovakia has shown very good progress with regard to the organisation and management of the development of the Space industry with a good inter-ministerial cooperation, a national strategy for space and a space law as well as the organisation of numerous events.

The primary options for Slovakia in going forward with ESA are to perform a second period of PECS or to apply to become an Associate Member (AM). The financial commitment needed to be an AM is significantly higher than that of PECS and it also requires and also requires a significant increase in the manpower, travel and support from a Slovakian 'space office'. These aspects should be taken into account in any decision made. Irrespective of the route taken, the next years would benefit from focusing on a the following key aspects:

1. Qualification of products with customers involved and use cases demonstrated,
2. Increasing the industrial base of companies involved in space, in particular with focus on known Slovak compentences that have not been well involved in PECS round 1
3. Furthering the International cooperation of Slovakian space scientist
4. Further developing stronger Customer/Industry/Academic relationships and spinning out the academic research
5. Developing university courses to ensure a suitably educated workforce is available and ready to help advance the for Slovakian space industry

Should a second PECS period be chosen, an increase in funding over that of the first period would be needed to achieve these objectives with a first estimate being a 50% increase.

Irrespective of the route chosen by the Slovakian government, the next years would benefit from a focus on product qualification, increasing industrial base and developing stronger industry-academia links while not neglecting the Slovakian space science. The following key risks for the further development of the Slovakian Space industry were identified:

- Risk 1: Commitments concentrated in a few entities, especially few industrial entities
- Risk 2: Difficulties in leveraging the funding allocated to research/academia
- Risk 3: Limited number of activities targeting high TRL
- Risk 4: High level of competition in Europe in some areas of Earth Observation (e.g. Forestry and Land deformation)

Further findings were that national competences in the field of hardware (upstream) space engineering still need to be strongly reinforced in order to meet the standards of the ESA Science programme, hence it would be clearly premature to consider full membership.

The aforementioned risks were introduced into a brief SWOT analysis based on the information provided in "A conceptual framework of space activities in the Slovak Republic"[1]. Considering the analysis performed, the following recommendations can be made for the next steps in the development of the Slovakian Space capabilities which are largely valid regardless of the path chosen:

- **Recommendation 1:** Encourage greater customer-industry-academia collaboration. This should also include student education as well as relevant research and solutions to industry and customer needs.

- **Recommendation 2:** Broaden the industrial base by encouraging the leveraging of Slovakian core competences and attract new participation, e.g. from robotics, manufacturing, nano-technology, quantum technology.

- **Recommendation 3:** Ensure sufficient support (both financial above the minimum contribution and programmatically) to raise the TRL and get a customer, of the first mature technologies (both in hardware and downstream applications) sufficiently to enter their relevant supply chain and act as examples for other entities.

- **Recommendation 4:** Sufficient support should be given to continue the space science activities in Slovakia. This could be through national funding, a contribution to the PRODEX programme, or under the AM third party programme (a.k.a. Requesting Party Activities), or by dedicating a portion of the PECS funding.

- **Recommendation 5**: Should Slovakia become an AM, it is considered prudent to first focus on GSTP , EOEP and SSA/SST as the optional programmes and ensure a sufficiently large contribution to the Requesting Party Activities('incentive scheme') to further build other competences and should fully leverage the AM industrial training programme.

The assessment report was finalised at the beginning of the COVID-19 outbreak. The scope of the COVID-19 economic consequences and the impact of this Global crisis on available future funding are unclear at this time.

# ANNEX 1: SUMMARY OF 5TH CALL PECS

In the frame of the Plan for European Cooperating States (PECS) in Slovakia, the fifth call for outline proposals (AO/1-10044/19/NL/SC) was issued on EMITs on 1st October 2019, with a closing date of 2nd December 2019. The Delegation elected to increase the total budget for the 5th Call from 700K Euro to 1,128,847.00 Euro. The table below provides the details of which proposals were recommended for implementation. These ten (10) proposals are recommended for possible awarding of contracts. These activities are being submitted to the relevant ESA Delegate Bodies for approval. The approval process is expected to conclude by August/September 2020 (assuming a PECS written procedure that will be sought).

*Table 1: 5th Call proposals selected for implementation*

| # | Prop. ref. | COMPANY | TITLE |
|---|---|---|---|
| 1 | SK5_3 | 3IPK, a.s. | Blockchain Software Tool for Spacecraft Components Incoming and Outgoing Inspection |
| 2 | SK5_19 | UNIBA - Department of Experimental Physics | Potential solid lubricant for extreme temperatures based on vanadium boride |
| 3 | SK5_11 | CTRL S.R.O. | Capacitive Absolute Sensor for Space Applications - CAPSE |
| 4 | SK5_9 | Slovak University of Technology in Bratislava (FEl STU), Institute of Nuclear and Physical Engineering | Space Engineering Through (True) Training (SETTT) |
| 5 | SK5_24 | Trifid Automation | Sky Simulator for Fine Guidance Sensors |
| 6 | SK5_23 | Institute of Experimental Physics, of the Slovak Academy of Sciences | SIREN Space Ionizing Radiation Experts Nursery |
| 7 | SK5_18 | Technical University of Košice - Faculty of mining, ecology, process control and geotechnologies | University course Earth Observation with ESA missions |
| 8 | SK5_17 | Astros Solutions s. r. o. | Slovak Automated Space Surveillance and Tracking Optical System |
| 9 | SK5_15 | Algoritmy:SK s.r.o. | NaturaSat - software for exploring Natura 2000 habitats by satellite data |
| 10 | SK5_1 | M2M Solutions, s.r.o. | Ground Station Scheduling Broker |
| **Approved estimated total budget (€): 1,128,847.00** | | | |

The average overall weighted marking for the recommended proposals is 60.2. It is project that should all these activities be successfully negotiated, the overall bidding success rate will remain close to 44%. The financial commitments are expected in 4Q2020. A projected case should all of the ten 5th Call activities be implemented, is illustrated in the following graphs.

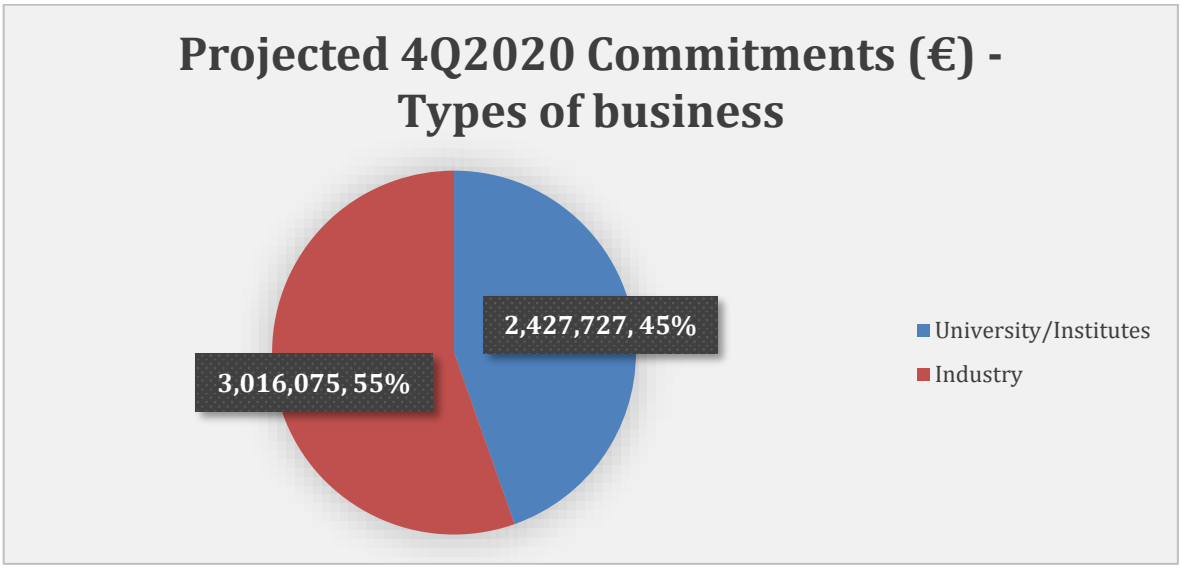


*Figure 1: Projected 4Q2020 Commitments including potential SK5 activities*

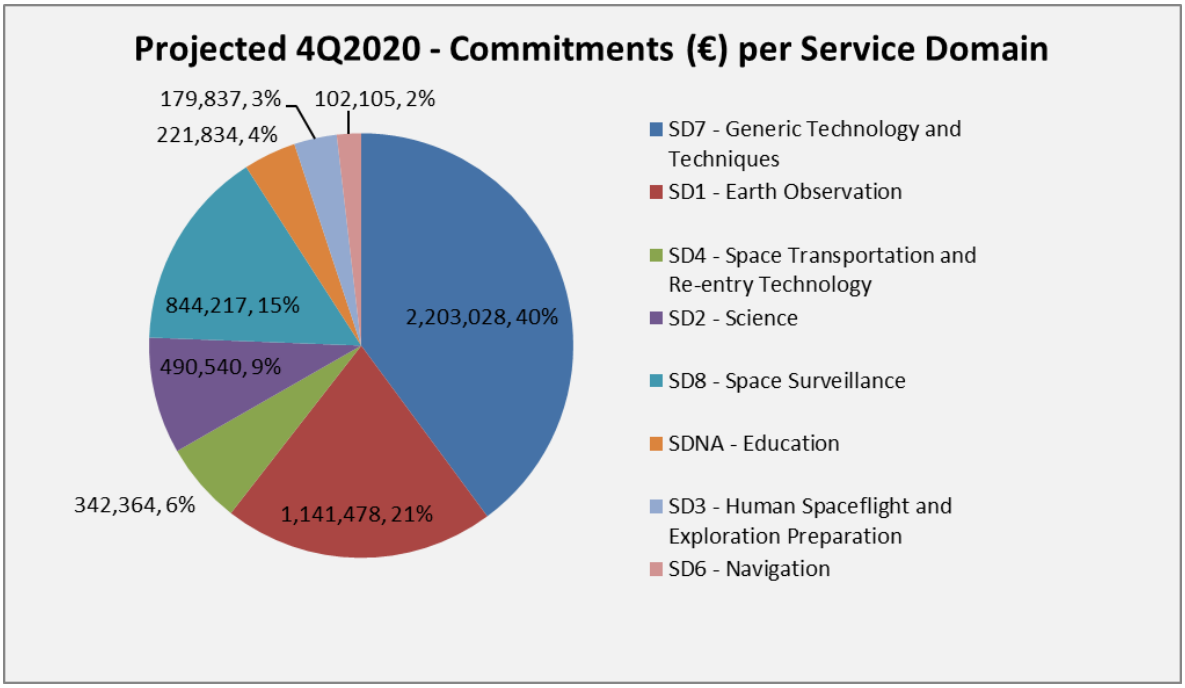


*Figure 2: Projected 4Q2020 Commitments per Service Domain including potential SK5 activities*

The impact of the 5th Call implementation projections align with the trends and observations remarked in the body of this report. Presuming all the SK5 activities are committed in 2020, these activities only serve to further support the aforementioned recommendations and conclusions.

# ANNEX 2: PECS ACTIVITIES LIST

| | PECS Slovakia Suppliers | Status |
|---|---|---|
| | **Slovak Academy of Sciences** | |
| 1 | (SK1_17) NOVEL MAGNESIUM COMPOSITES FOR ULTRALIGHT STRUCTURAL COMPONENTS (MagUltra) | Committed |
| 2 | (SK1_05) FEASIBILITY STUDY TO OBSERVE IONOSPHERIC DISTURBANCES BY ONE PIXEL UV DETECTOR | Committed |
| 3 | (SK2_09) FOLLOW-UP OF FEASIBILITY STUDY TO OBSERVE IONOSPHERIC DISTRURBANCES BY AIRGLOW MONITORING NETWORK | Committed |
| 4 | (SK3_03) SLOVAK CONTRIBUTION TO ESA-JUICE MISSION: DEVELOPMENT OF ANTI-COINCIDENCE MODULE ACM FOR PARTICLE ENVIRONMENT PACKAGE PEP | Committed |
| 5 | (SK3_02) SPACE::LAB - place to attract, educate and involve young generation in space science and engineering | Committed |
| | **CTRL S.R.O.** | |
| 6 | (SK1_19) DEVELOPMENT PREPARATION OF A NOVEL CAPACITIVE MULTITURN ABSOLUTE ROTARY ENCODER FOR SPACE APPLICATION (CAPMARE) | Committed |
| 7 | (SK4_1) ADJUSTMENT OF A NOVEL CAPACITIVE MULTITURN ABSOLUTE ROTARY ENCODER FOR SPACE APPLICATION – BEAM POINTING SYSTEM (CAPMARE2) | Committed |
| | **Comenius University in Bratislava** | |
| 8 | (SK1_03) DEVELOPMENT OF A SUPPORTING OPTICAL SENSOR FOR HIGH-AREA-TO-MASS-RATIO OBJECTS CATALOGUING RESEARCH (HAMROPTSEN) | Committed |
| 9 | (SK3_08) IMPROVEMENT OF EUROPEAN CAPABILITIES FOR LEO OBJECTS TRACKING WITH OPTICAL PASSIVE SENSORS | Committed |
| 10 | (SK4_13) STUDY OF METEOROID COMPOSITION BY METEOR SPECTROSCOPY AND SIMULATED ABLATION OF METEORITES | Committed |
| | **SLOVAK UNIVERSITY OF TECHNOLOGY IN BRATISLAVA** | |
| 11 | (SK1_07) RADIATION INDUCED TERAHERTZ WAVE AND POWER GENERATION IN MAGNETIC MICROWIRES (RIT) | Committed |
| 12 | (SK1_06) SPACE FOR EDUCATION, EDUCATION FOR SPACE (SEES) | Committed |
| 13 | (SK2_08) GOCE_BASED HIGH_RESOLUTION GRAVITY FIELD MODELLING IN A SPACE DOMAIN (GOCE-NUMERICS) | Committed |
| 14 | (SK2_05) ADDITIVE MANUFACTURING OF CERAMIC COMPONENTS BY FDM TECHNOLOGY (AM-FDC) | Committed |
| 15 | (SK3_06) PREPARATION FOR ATHENA MISSION BY ESTABLISHING SLOVAK RESEARCH TEAM ORIENTED TO EXISTING X-RAY MISSIONS & AGN… | Committed |
| | **Orbisys s.r.o.** | |
| 16 | (SK2_18) DISTRIBUTED EUROPEAN NETWORK OF GROUND STATIONS (DENGS) | Committed |
| | **INSAR** | |
| 17 | (SK2_12) RETRIEVAL OF MOTIONS AD POTENTIAL DEFORMATION THREATS USING SENTINEL-1 (REMOTIO) | Committed |

| | PECS Slovakia Suppliers continued… | Status |
|---|---|---|
| | **ABmerit s.r.o.** | |
| 18 | (SK4_10) ESA-SENT2AGRI CONNECTION WITH ESTE | Committed |
| | **International Laser Centre** | |
| 19 | (SK3-04) LASER POST-IONIZATION MASS SPECTROMETER PLATFORM FOR HIGH PERFORMANCE METEORITE ANALYSIS – LAPOM2ET | Committed |
| | **National Forest Centre** | |
| 20 | (SK2_04) ADVANCED TECHNIQUES FOR BIOMASS MAPPING IN ABANDONED AGRICULTURE LAND USING NOVEL COMBINATION OF OPTICAL AND RADAR REMOTE SENSING SENSORS (ATBIOMAP) | Committed |
| | **BioX Technologies s.r.o.** | |
| 21 | (SK4_2) Arthrospira: Biomass Recovery | Committed |
| | **GOSPACE Tech s. r. o.** | |
| 22 | (SK2_11) STRATOSPHERIC AUTONOMOUS LANDING SYSTEM APPLICATION (SALSA) | Committed |
| | **BOROSPACE s.r.o.** | |
| 23 | (SK4_12) WAX FUEL EMBEDDED STRUCTURE (WAFER) FOR HYBRID ROCKET MOTOR | Committed |
| | **YMS a.s.** | |
| 24 | (SK3_05) SENTINEL 2 BASED SUPPORT OF FOREST DISTURBANCE MAPPING AND MONITORING (SEN2FORMAM) | Committed |
| | **NEEDRONIX s.r.o.** | Committed |
| 25 | (SK3_09) SUN SENSOR FEASIBILITY STUDY - RECAP | Committed |
| | **Touch4IT s.r.o.** | |
| 26 | (SK4_4) SBAS GEOMETRY ANALYSIS TOOL | Committed |
| | **Algoritmy:SK s.r.o.** | |
| 27 | (SK2_06) SOFTWARE TOOL FOR MONITORING NATURA 2000 HABITATS BY SATELITE IMAGES (NATURASAT) | Committed |
| | **PAVOL JOZEF SAFARIK UNIVERSITY in Košice** | |
| 28 | (SK1_04) SIMULATING THE COOLING EFFECT OF URBAN GREENERY BASED ON SOLAR RADIATION MODELLING … (SURGE) | Committed |
| | **Technical University of Kosice** | |
| 29 | (SK4_06) TUKE SPACE FORUM | Committed |
| | **1Q2020 Commitments Grand Total** | **€4,314,955** |