

ESA + Slovakia from cooperation to association

In support of ESA Day in Slovakia / Deň ESA na Slovensku

Disclaimer: This presentation is intended as an very brief overview of the Slovakia PECS Programme outcomes with highlights of the starting Associate Membership. Information may be subject to change.

Kay van der Made

16 March 2023 Košice

History Timeline – ESA + SK









→ PECS Plan for European Cooperating

States implementation tool for the R&D priorities of RIS3



- 54 PECS Contracts / ~13.6Meuro
- PECS extension KPIs achieved

EUSO-SPB2 - NASA. PEMMASK - NASA, GRBAlpha



~68 PECS Contracts /~14.5Meuro

• CM22 subscriptions

PECS extension - 18 months

- Increased PECS funding
- Slovak Space Office (SSO) inception
- Dedicated ESA CDO & SARIO & Industry consultations
- SSO networking events
- Top-down ideas + education + training

Publication of "SPACE RESEARCH IN SLOVAKIA 2016-2017" highlighting contributions to ESA-ROSETTA; MEP-2 of Spektr-R, ESA-BepiColobo Planetary Ion Camera (PICAM), ESA-led IMPRESS, ASPECT-L for LUNA-RESURS, DOK-M for RESONANCE, ISS JEM-EUSO, skCUBE, ESA Gravity Dependence of CET, etc...

MINEDU

Publication of "A conceptual framework of space activities in the Slovak Republic" aka, "Koncepcia vesmírnych aktivít v SR"

ESA - MINEDU SK Country Report 2020

- 28 PECS Contracts /~4.14Meuro
- Agreed KPIs: Increase TRL; Increase collaboration academic- industry base (spin-in/out); Increase International cooperation; Develop University courses

towards Prosperity -Research and Innovation Strategy for Smart

Through Knowledge

Specialization of the

Slovak Republic.

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ESA European

Cooperateling State (ECS)

Note: Slovak H2020 activities also contributed to capability development complimenting PECS progress.

Overview of PECS Tenders / Calls 4Q2022







1st PECS Call

19 proposal received, 7 funded

Success Rate: ~37%

Scores range: 52 - 70, Average: 59.9

2nd PECS Call

20 proposal received, 8 funded

Success Rate: ~40%

Scores range: 55 - 75, Average: 61.6

3rd PECS Call

13 proposals received, 7 funded

Success Rate: ~53%

Scores range: 55 – 68.5, **Average: 63.4**

4th PECS Call

14 proposals received, 7 funded

Success Rate: ~50%

Scores range: 47.5 – 62, **Average: 55.3**

5th PECS Call

24 proposals received, 10 funded

Success Rate: ~42%

Scores range: 69 – 52.5, **Average: 60.2**

6th PECS Call

29 proposals received, 14 funded + 1 under negotiation

Success Rate: ~51.7%

Scores range: 50.75 – 76.5, **Average: 59.08**

7th PECS Call

13 proposals received, 3 funded + 4 under negotiation

Success Rate: ~53.8%

Scores range: 62.75 – 73.5, **Average: 67.2**

Top Down Calls preparation for GSTP(2) / S2P(2) / NAV (1) / EO(2)

10 proposals received, 5 funded, 1 under negotiation

ESA Young Graduate Trainees / International Research Fellows / Ext.Consultants

~ 10 YGTs / ~ 4 IRF / ~ 5 external consultants

ESA Programmes – Optional Programmes The 4 programmatic pillars





Slovakia – general country overview



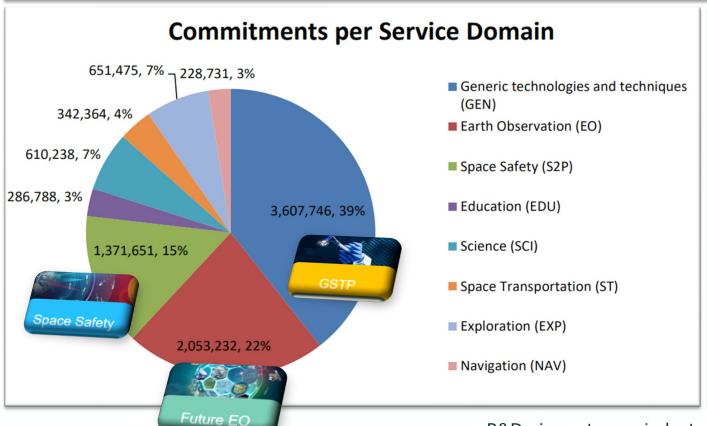


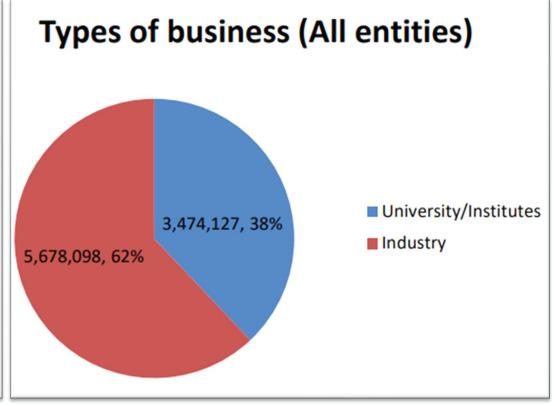


PECS summary: Feb 2016 - Aug 2022 (5 years + 18-month extension)

- Total planned budget: ~14,5 Meuro (2015-2022)
- Number of contracts: **61** (as of 4Q2022 with 7 pending negotiations: 1 SK6, 4 SK7, & 1 EO Top-down)







R&D via customer-industry-academia collaboration

Slovakia – general country overview







AM summary: Oct 2022 - Oct 2029 (7 years)

- Expected AM Budget: ~4.5 Meuro/Year
- Subscriptions from Council 2022
 - 1. GSTP,
 - 2. Future EO,
 - 3. S2P,
 - 4. Scale Up Element 1: BIC,
 - 5. Requesting Party Activities (RPA)





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→ THE EUROPEAN SPACE AGENCY

SK subscriptions ~ available funding sources





GSTP

- Generic Technology developments
- Mainly targeting
 Products and Services
 applicable to multiple
 ESA missions (e.g.,
 Space segment platform
 developments, Ground
 station generic
 developments)
- Mainly TRL 4,5,6*
- Mainly Open ITTs from workplan restricted to countries that send a delegate letter of support for that activity



Future EO

- Covering downstream application development
- Mainly TRL 4,5,6
- Mainly Open ITTs from workplan restricted to countries that send a delegate letter of support for that activity.



Space Safety

- Covering Space
 Weather, Space Debris
 and Planetary
 protection technology
 developments
- Mainly TRL 4,5,6
- Mainly Open ITTs from workplan restricted to countries that send a delegate letter of support for that activity.



Requesting Party Activities (RPA) scheme

- Complimenting ESA
 optional programmes with
 activities falling outside
 their nominal scope & an
 aid to implement a holistic
 national space policy.
- Mainly TRL 1-3 (prep), 3-6 (R&D non-subscribed programmes), 5-8 (Applications)
- Industrial process development
- Space science and payload funding.
- University course development
- Mainly Open ITTs with RPA call specific constraints.



When to use which programme / scheme...



RPA

- All low TRL (1-3) preparatory developments, team building, market research on any topic
- Entry into first customer (TRL 7-8) for Downstream Applications
- Mid TRL developments for any technology area <u>NOT</u> covered by the subscribed optional programmes (GSTP, S2P, Future EO). In particular, the domains of telecommunications, navigation, cybersecurity, human spaceflight, robotics, exploration and space science are areas of continued interest to Slovakia.

Capability developments.

S₂P

- All Space weather, Space Debris and Planetary Defence activities above TRL 3
- ECSS compliance expected for any flight segment developments

Future EO

- All Downstream Application developments starting at TRL 3, 4 or 5

GSTP

- All generic platform equipment developments above TRL 3
- ECSS compliance expected



ESC SIGNET ASSUMPTION OF A STREET ASSUMPTION



SLOVAK



Slovakia PECS Project Examples

Slovakia – example products & services → PECS @esa

- Astros Solutions Develops optical systems, hardware and software, for space safety (SSA & SST).
- **Trifid Automation** Machine vision systems, focusing on industrial measurement and quality inspection. Space product under development is a Sky Simulator for Fine Guidance Sensors.
- Touch4IT SBAS Geometry Analysis Tool for satellite orbit and lonospheric Pierce Points identification for ground stations.
- INSAR.SK EO Downstream Products, Terrestrial & Satellite Geodesy and SAR/InSAR Analysis (change detection, deformation monitoring).
- Abmerit EO Downstream Products related to emergency preparedness and response in case of radiological and nuclear accidents/incidents.
- BOROSPACE WAx Fuel Embedded stRucture (WAFER) for Hybrid Rocket Motor
- M2M Solutions Embedded & Full-stack SW, development & Cloud Native Solutions, Integration services and Automated Testing & Testbeds.
 Ground scheduling broker.
- 3IPK Blockchain Software Tool for Spacecraft Components Incoming and Outgoing Inspection.
- **DECENT Group** Feasibility study of an application level (overlay) end-to-end suite of services designed with blockchain technologies using secure algorithms and techniques for protected data transport from space to ground.
- NEEDRONIX Focused on the development and manufacturing of radio-communication and opto-electronic systems usable in nanosatellites
 and targeting small sats. + analogue sun sensor development. Supplier supporting <u>SOSA skCUBE</u>.

Other entities: BOROSPACE, Spinea, BioX Technologies, SOLARGIS, Masam, Spacemanic, Sygic, INCOFF, RoboTech Vision, Photoneo, ESET, Citadel, Ailter, Elcom, Matador, etc.); See also reference files sario-space-industry-in-slovakia-2022-03-21-online.pdf

Activity Title: ROBOTIC TELESCOPES DEMONSTRATION

Prime Contractor: Astros Solutions s.r.o.

Proj. Mgr.: Jiri Silha
PoC: jiri.silha@astros.eu

Contract No.: 4000124438 / Proposal ID: SK_AD02

Year of Contract: 2021

TO: T. Flohrer / B. Jilete

ESA Org.: OPS-GR

TRL | Initial: 2

Achieved: 5/6

Target: 6

Date: 2022

Background and justification: This activity specifically addresses technology developments for robotic telescopes for observation of space debris and will be directly complementary work, allowing for further progression of the development and providing a path for future cooperation with other ESA Member States, thereby addressing one of the recommendations of the end of period country report. Extending the baseline of existing networking under this activity with Slovak sensors shall ensure compatibility with used and developing data exchange formats, protocols, and standards for applications in the domains of space debris and planetary defence.

Objective(s): The project aims to prepare Slovakia entities to efficiently participate in the international/European campaigns for SD and NEO. Slovak entities and their sensors shall have interfaces for planning/tasking data reception, observation data provision and shall be validated for SD and NEO observations and shall have MPC code available. Additionally, Slovakia/contractor needs to demonstrate its capability/capacity to coordinate network of sensors, Slovak and European ones, including two ESA's TBT sensors.

Achievements and status:

The primary focus was on the conduction of the observation campaign, which was performed with four different national and international partners who operated their own SST/NEO sensors. At the time, several campaigns were ongoing, sensors were being coordinated, and the sensor status was being monitored. The planning data was provided in the required standards (SCM, OSM), along with the tasking message, to the sensors' operators. Technical interfaces had been developed with all the sensors, and legal connections had been established to each sensor to secure the data acquisition and transfer.

Benefits:

The primary benefits are development and validation of the heterogenous sensor coordination function in Slovakia, along with the created legal and technical interfaces with national and international partners. Improved and validated will be tools which will allow Astros to performs such task as routine in the future.



Title: CAPACITIVE ABSOLUTE SENSOR FOR SPACE APPLICATIONS - CAPSE

Prime Contractor: CTRL s.r.o.

Contract No.: 4000132213 / Proposal ID: SK5_11 Year of Contract: 2020

Achieved: TBD

Target: 4 Date: 2022

Proj. Mgr.: Mr Cristian Stratynski cristian.stratyinski@ctrl1.eu

<u>Background and justification:</u> Position sensors have a significant impact on the performance, functionality, and reliability of the space mechanisms and space missions. The innovative **CAP**acitive **SE**nsing technology (**CAPSE**/CAPMARE) being developed by CTRL company can play a significant role in the sensors space market.

<u>Objective(s):</u> Design, development and functional qualification in laboratory conditions of an **innovative sensing technology, demonstrated on a Low/Middle resolution Absolute Sensor - CAPSE**. CAPSE sensor is foreseen to be applicable for different space mechanism:

- · SADM sensor,
- Booms,

TRL Initial: 2

- Antenna,
- · Wheels,
- Mirrors, etc.

<u>Technical Benefits CAPSE/CAPMARE:</u> A novel capacitive absolute analogue sensing system with the ability to measure when unpowered * Contactless system * Ability to work in ambient, lubricant or vacuum condition * Small particles do not affect the performance * Low susceptibility to vibration * Temperature error cancelling system * No laser diode degradation * No sensitive to EMCs * No housing required * In-flight user configuration * Easy and fast design scalability * Lower price in comparison with optical sensors...

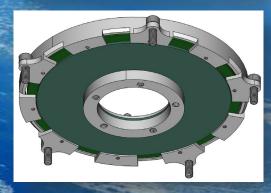
<u>CTRL Achievements:</u> Apart from servicing terrestrial heavy industry, CTRL has utilized the ESA PECS programme to diversify R&D into the Space Sector. CTRL PECS activities involve also establishing new business and project partners and consortiums with Academia and Scientific Institutes and Private Corporations.

CTRL has started business collaborations with Large System Integrators from the EU: Thales Space Alenia, Airbus, OHB, Sener, and different small/middle space oriented companies from Slovakia and abroad and is open to further partnerships.









CAPSE sensors

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Retrieval of Motions and Potential Deformation Threats using Sentinel-1 (remotIO)

Contractor: insar.sk s.r.o.

Contract No.: 4000123625/18/NL/SC

Year of Contract: 2018

Target TRL: 4 Date: April 2020

Project Manager: Matus Bakon matusbakon@insar.sk>

Background and justification: remotIO system provides continuous structural monitoring checks and ensures immediate awareness during deformation processes like landslides or structural collapses. remotIO monitors millimetric changes of man-made objects from Space. These are analyzed to identify potentially hazardous zones by pinpointing anomalous behavior.

Objective(s):

TRL | Initial: 2

bit.ly/remotio paper

- Continuous infrastructure stability monitoring
- Automatic updates of deformation maps
- Near-real-time delivery of InSAR products
- · Easy access to results via web-based platform
- **Data mining** for easier interpretation & risk evaluation

Achieved: Yes

Achievements and status:

As an award-winning and scientifically backed product, an alpha version (TRL 4) of the system has been introduced to its first customers in April 2020 for monitoring landslides, mining subsidence and dams in Slovakia. Platform is accessible from https://remotio.space

Benefits:

- · reducing operating costs for monitoring structures, providing a more detailed and frequent surveillance
- results are easier to interpret and faster to communicate with customers in need for rapid response.

INSAR.SK product suite will offer a robust service ecosystem capable to respond to variety of precise engineering tasks. remotIO now seeks to integrate data from ground monitoring sensors to offer 24/7 structural inspections and introduce innovative products for new and emerging markets such as Real Estate, Insurance, Smart City solution providers and IoT monitoring networks.



Title: Sun Sensor OROL

Prime Contractor: NEEDRONIX s.r.o. Slovakia

Contract No.: 4000126146/ Proposal ID:SK3_09 Year of Contract: 2019

TRL Initial: 3 Achieved: TBD Target: 4 Date: 2021

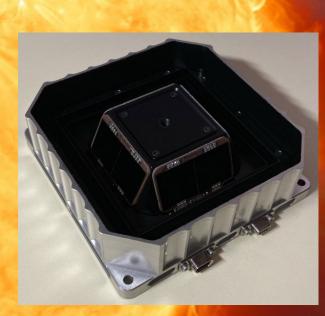
Proj. Mgr.: Dr. Michaela Musilova Email PoC: info@needronix.eu

Background and justification: Sun sensors are necessary for the proper stabilization of a spacecraft (safe modes and de-tumbling) and are primarily used as a backup sensors. We started working on sun sensors for cubesats in the past and would like to expand our area of expertise.

Objective(s): The main goal of this project is **to create a reliable and robust analogue sun sensor solution that is radiation, thermal and vibration tolerant with sufficient accuracy and the ability to function up to 15 years in geostationary orbit.**

Achievements and status: The project started in January 2019 and is expected to conclude in 4Q2021. This project is a first step in establishing large scale manufacturing and the production of aerospace sensing systems in Slovakia.

Benefits: The project also aims to increase the level and competitiveness of the NEEDRONIX company in the field of space technologies. NEEDRONIX is striving to set an example for high quality control via application of ECSS standards and use of best practice guidelines in manufacturing processes.





"WAx Fuel Embedded stRucture (WAFER) for Hybrid Rocket Motor"

Contractor: BOROSPACE s.r.o.

Contract No.: 4000130227 / Proposal: 042019 Year of Contract: 2020

TRL Initial: 2 Achieved: 2-3 Target TRL: 4 Date: 02/2022

Proj. Mgr.: Csaba Boros
Email: wafer@borospace.com

Background and justification:

To become a valid propulsion option, hybrid rocket engines must overcome a critical technical challenge: debonding between the wax fuel and internal wall of the combustion chamber caused by the high contraction rate of the waxes used which may lead to engine malfunction and a mission failure. Hybrid rocket engines propelled by wax fuels have advanced from laboratories to flight testing and this project focuses on design trade-offs and optimisation.

Objective(s):

The aim of the **WAFER** project is to develop and test a novel join between the wax fuel cast and the internal isolation layer of the combustion chamber able to compensate for the contraction of the wax. The wax fuel mixture must demonstrate the capability to withstand very low temperatures during simulated Mars ground environmental tests.

Achievements and status:

Simulations have shown that it is possible to reduce the stress level by optimizing the WAFER structure. When selecting waxes, their combination and the production procedures, we have adopted the requisite methodology for an appropriate prediction of the future properties of the resulting wax mixture. In determining of the thermomechanical properties of waxes, a relatively new measurement methodology is used – Digital Image Correlation. Final ingredients for wax fuel for low temperature has been determined. Measurements showed that at -180°C no evidence of glass transition was observed - this mean, that similar waxes will be useful for deep space missions, which would be a big advantage over solid rocket motors.

Benefits:

The main benefits of WAFER are:

- ability to compensate shrinkage of the wax fuel, allowing storage of wax hybrid rocket engine within a very wide temperature range.
- · excellent wax fuel utilization with very low residuals of wax fuel after firing
- wax fuel radial segmentation possibility





Title: Ground Station Scheduling Broker

Prime Contractor: M2M Solutions s.r.o.

Contract No.: 4000132575 / Proposal ID: SK5_1 | Year of Contract: 2020

TRL Initial: 2 Achieved: TBD Target: 4 Date: 09/2022

Proj. Mgr.: Vladimír Pšenák Email: vladimir.psenak@m2ms.sk

Background and justification: Tailor and spin in an existing M2M Solutions product: Transport Logistics System (TLS) to the domain of ground station scheduling for supporting spacecraft communications to have a fully automated Ground Station Scheduling Broker (base for virtual operator). The activity addresses the expanding market demands for small ground stations serving small missions by matching unused ground station time with the needs of s/c owners/operators.

Objective(s): Achieve TRL 4 Ground Station Scheduling Broker (GSSB)

The main aim of the project is to describe market's needs, design the GSSB and prove viability of GSaaS concept. The GSSB is designed as a cloud web application available for Space Assets Operators and Ground Station Operators, which may simply join and use or provide services of virtual operator.

Achievements and status:

Detailed trade-off analysis is a part of the first phase, which also includes Business Model Description, System Requirement Specification, Design Document and Operations Design Document Preparation. End of this phase is scheduled expected by 4Q2021.

Benefits: Virtual operator for SAO and GSO

The primary benefit of virtual operator (GSSB) for Space Assets Operators are easily accessible and low cost satellite services as well as operational data (such as position and speed, etc.) over an infrastructure provided by Ground Station Operators. Upscaling potential of this whole platform is to offer as B2B not utilized satellite services.



Save the date for other events



Course/ Service (Duration)	NMS/AM	Notes: In country are tailored for a specific audience. Many courses are available frequently in a general format SEE Home ESA Learning Hub
Rate calculation course (half day)	Online 23 May 2023 10:00-12:00	Compliant Industrial Rates for ESA Projects (May 2023) ESA Learning Hub (2 hrs)
PSS-A forms (half day)	Online 25 May 2023 10:00-12:00	Compliant PSS-A Forms for ESA Projects (May 2023) ESA Learning Hub (2 hrs)
Proposal writing EXPRO (1 day)	21 June 2023	Course for 'EXPRO' ITTs and responding to a SoW
Earth Observation	2023	https://eo4society.esa.int/events
ESA Overview (half day)	Nov 2023	General overview of ESA for industry with SKR2 Briefing
Space Project Management & Control (half day)	•	Targeted at startups and SMEs doing business with ESA <u>ECSS M-branch: Space Project Management (March 2023) ESA Learning Hub</u> (4 hrs)

Register for <u>ESA STAR</u>+<u>ESA MATCH</u>



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THANKS FOR YOUR INTEREST

Questions may be addressed to ESA CDO & Support Engineer: (kay.van.der.made@ext.esa.int)

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