

# FEASIBILITY STUDY OF LITHUANIAN SPACE SECTOR DEVELOPMENT

**Final report**

The logo for Visionary Analytics, featuring the company name in a white serif font on a dark blue rectangular background.

VISIONARY  
ANALYTICS

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The final report of the feasibility study of Lithuanian space sector development is prepared in accordance with ESA Contract No. 4000125525/18/NL/SC. The study activities were carried out through a programme of PECS Lithuania and funded by the European Space Agency.

Disclaimer: the views expressed in this report can in no way be taken to reflect the official opinion of the European Space Agency. The report has been prepared without access to ESA internal documents. Therefore, the report is subject to a certain margin of error.

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## 1. INTRODUCTION

### The purpose of the study

Lithuania's period of participating in the European Space Agency's (ESA) Plan European Cooperating State (PECS) is getting close to an end at the time of preparing the report. The implementation of the PECS programme has revealed the potential of Lithuanian entities to contribute to the space economy and helped strengthen the sector further. The end of the PECS period also marks the time for choosing how Lithuania could collaborate with ESA further, as both continuing PECS and more involved collaboration is possible. In this context, the project had the aim of producing a feasibility study of Lithuanian space sector development, which covered the mapping Lithuania's industrial and academic entities' potential to contribute to the development of space industry; identification of probable scenarios of the sector's development in the light of future collaboration with ESA; identification of the steps needed to strengthen the sector; and proposing policy recommendations.

Future collaboration with ESA is an important factor in determining Lithuania's space sector development path. The PECS participation was the main source of funding over the past several years, and investment through ESA can aid thorough provided technical help, in addition to other benefits (as discussed in Section 3). Therefore, Lithuania's space sector development is mostly discussed in the light of future collaboration with ESA in the present study.

The study was implemented during November 2018 – December 2019, with close involvement of the Lithuanian sector's stakeholders and ESA. Both the business and research sectors were included, since Lithuania's participation in PECS demonstrated that both the industry and the academia are important for Lithuania's space undertakings.

### The structure of the final report

The report has the following structure. The next section outlines the methodology that was used during the study. The third section focuses on the options of further Lithuanian space sector's development in the context of possible collaboration with ESA. It compares the continued PECS, Associate Membership and Full Membership scenarios. The fourth section outlines the main recommendations for further sector development. Finally, conclusions follow with suggestions on how the collaboration with ESA could look like.

## 2. METHODOLOGY

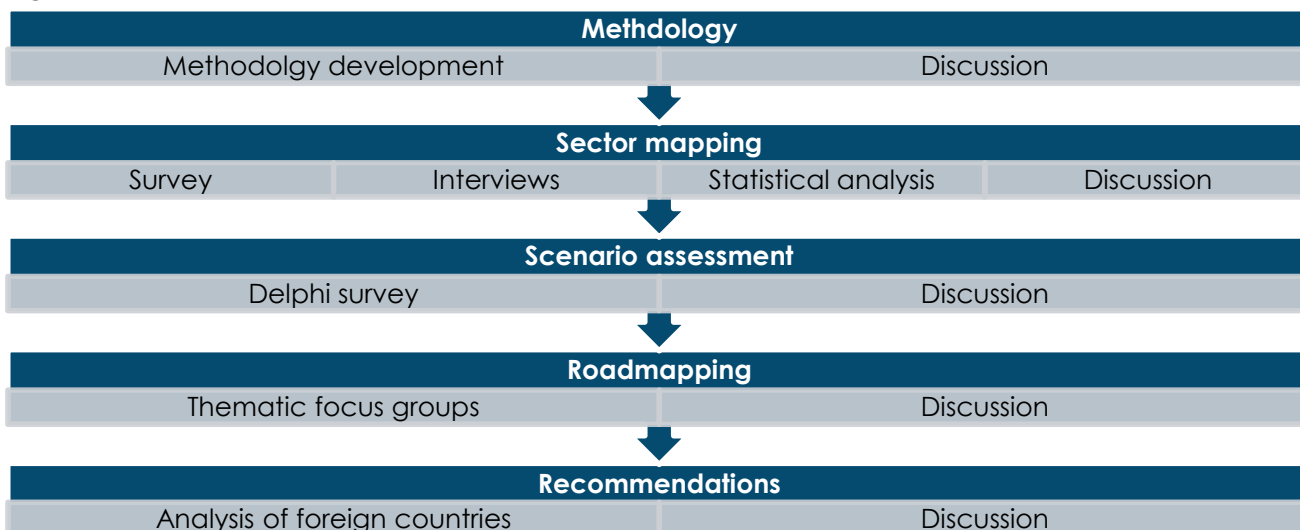
### The structure of the study

At the beginning of the study, three main methodological pillars have been developed, to ensure the relevance of the study:

- The involvement of stakeholders in order to identify the needs and expectations (thus ensuring the relevance of the study and finding agreement on the discussed issues)
- The identification of the scope of the Lithuania's space sector through a combination of methods
- Ensuring the validity of the analysis by combining a variety of methods

The project was implemented in five stages as outlined in Figure 1 below.

**Figure 1. The study structure**



Source: Visionary Analytics, 2019.

## Sector mapping

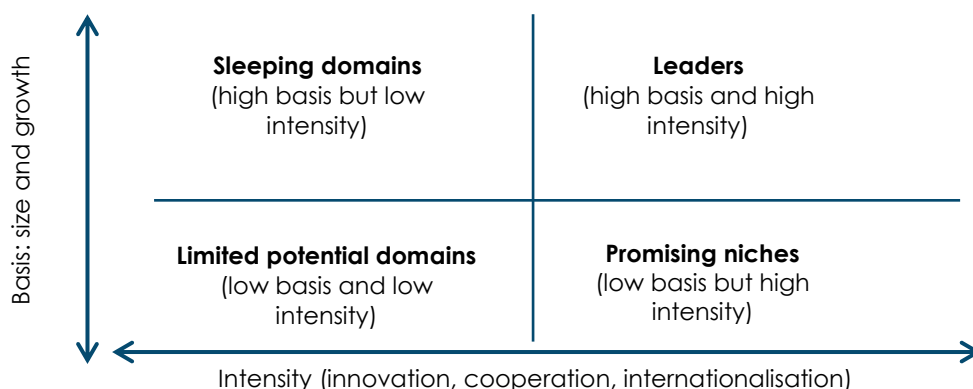
Data for sector mapping was collected by combining several methods. First, desk research helped to find existing data on the sector and its entities. Second, interviews allowed obtaining in-depth information from the selected entities. Finally, survey invitations were sent to a large number of business and research entities working in areas potentially related to space undertakings. Due to the large number of entities contacted and the relatively low interest in space economy, the number of relevant entities was limited. Nonetheless, it helped to identify the potential Lithuania's strengths across ESA's technology domains, as defined in the ESA Technology Tree.

The strength across technology domains was assessed based on two dimensions:

- The size and potential for growth (e.g. the number of entities, personnel, turnover, recent changes, etc.)
- The intensity of undertakings (e.g. the number of patents, implemented relevant projects, TRLs, etc.)

The collected data was standardised and values for technology domains and subdomains were calculated as composite indicators. The technologies were then assessed based on a two-dimensional matrix, as depicted in Figure 2 below.

**Figure 2. Sector mapping matrix**



Source: Visionary Analytics, 2019.

## Scenario assessment, roadmapping and recommendations

Three scenarios have been considered: continued PECS, Associated Membership, and Full Membership in ESA. Lithuania's space sector relies heavily on involvement in ESA activities. Therefore, all scenarios are related to collaboration with ESA. Scenario assessment relied on the data collected during sector mapping as well as additional data from interviews with ESA and Lithuanian officials, a two-round Delphi survey, thematic focus groups and discussions with the Lithuanian stakeholders.

The Delphi survey consisted of two rounds and covered questions on collaboration with ESA, ESA's programmes, preferences on investment, and potential sector's development. The Delphi survey results served as a basis for the analysis of sector's potential and possible development scenarios. It also helped to identify specific clusters of interests, on which focus groups were planned: Earth observation, optics and optoelectronics, research, and other business. Discussions have contributed to developing a proposed roadmap (success factors, needed actions and expectations for sector's development). Finally, recommendations were developed based on the discussed roadmap and the analysis of good space policy practice implemented in other countries. Options for potentially relevant actions were developed based on this information.

## 3. OPTIONS

There are three basic options for country's involvement in ESA activities:

- PECS agreement (e.g. continued for the second round in the case of Lithuania)
- Associated Membership
- Full Membership

ESA's Ministerial Council of 2018 introduced new changes into how countries can proceed to become Full Members of ESA. Prior to it, a PECS country could choose between the Associated and Full Membership based on the assessment of its PECS performance. Since the end of 2018, such choice will be limited, as a country will have to become Associated Member before becoming a Full Member.

Lithuania joined PECS in 2015. Therefore, given the pre-2018 rules, it could still ask to become a Full Member. However, there are related challenges. Even if Lithuania asked to be accepted as a Full Member, all ESA Member States would have to agree on it unanimously. It is highly unlikely to happen, after the Ministerial Council accepted the new membership scheme in 2018. Furthermore, the Ministerial Council's decision introduced specific requirements that a country must meet before becoming a Full Member and Lithuania does not meet them at the end of its first PECS round. There is also return on investment to consider.

These reasons show that there are current limits on participation in ESA's activities, despite local stakeholders' enthusiasm for greater Lithuania's involvement. A significant share of Lithuanian stakeholders suggested that preference should be given to the Full Membership during the discussions (though the position was not unanimous). It shows that there is willingness in the sector to get more engaged in ESA's activities and to develop Lithuania's space sector. It shows a general enthusiasm about the collaboration and positive outlook for the sector's future.

Table 1 below assess the three scenarios in terms of several criteria.

**Table 1. Assessment of different options for Lithuania's further collaboration with ESA**

Criterion	PECS	Associated Membership	Full Membership
<b>Scope</b>			
<b>Accessible programmes</b>	PECS	Optional Programmes and the Third Party Programme	Mandatory and Optional Programmes
<b>Mandatory contribution</b>	No	General Budget (70% intensity)	General Budget (full intensity), Guiana Space Centre, Mandatory Programme
<b>Country-specific activities</b>	PECS programme	Third Party Programme (consisting of national programme and Industry Incentive Scheme) and capacity building from contribution to General Budget	Industry Incentive Scheme for the initial eight years (45% of mandatory contribution)
<b>Length</b>	Five years	Seven years	At least eight years
<b>Likely benefits</b>			
<b>Capacity building</b>	<b>Medium.</b> Enables entities to implement space projects and to collaborate with ESA.	<b>High.</b> Allows a country to implement the national programme and to develop the most relevant sectors for selected Optional Programmes through a PECS-like Industry Incentive Scheme (both through the Third Party Programme with ESA facilitating the implementation). A large share of the mandatory contribution to the General Budget would also be used to build public sector and industry's capacities.	<b>High.</b> Allows a country to develop the most relevant sectors for participation in ESA programmes through a PECS-like Industry Incentive Scheme for the first eight years.
<b>International dimension</b>	<b>Low.</b> Only a very limited share of projects can be implemented by entities from outside Lithuania.	<b>High.</b> Opportunities to collaborate with foreign partners in ESA projects and work in international consortia, possibility to use the Third Party Programme (through national programme) to collaborate with other countries.	<b>High.</b> Opportunities to collaborate with foreign partners in ESA projects and work in international consortia.
<b>Geographic return<sup>1</sup></b>	<b>High.</b> Return to entities equals 85% (15% is considered as ESA overhead).	<b>Medium-high.</b> Return to entities equals approx. 67% (also depending on the chosen Optional Programmes), additionally, 10-12% of total investment could return for capacity building (from the contribution to General Budget).	<b>Medium-low.</b> Return to entities equals approx. 38% through Industry Incentive Scheme for the first eight years (-15% for ESA overhead accounted for), and additionally possible but not guaranteed small return from TRP (<5%).
<b>Opportunities for science</b>	<b>High.</b> Opportunities exist on the condition that lower TRL projects could be financed.	<b>High.</b> On the condition that the Third Party Programme foresees funding for low TRL projects (instead of the mandatory TRP) or the use of Science programme data. There are also opportunities in the Optional Programmes, albeit they may be smaller than for the industry.	<b>Medium-low.</b> The main opportunity for research sector in the Mandatory Programme is the TRP. However, its size is very small in the whole structure of the mandatory contribution. Otherwise, it depends on the opportunities in the Optional Programmes (which are likely to be more directed towards industry). The Science programme requires contribution to providing high TRL equipment, while Science programme data is analysed through national programmes instead, and would require separate funding scheme.

Source: Visionary Analytics, 2019.

<sup>1</sup> Calculations are based on the following assumptions: 1) €3m annual investment; 2) €0.5m mandatory contribution in the Associated Membership scenario; 3) €2.5m mandatory contribution in the Full Membership scenario, and high return from the chosen Optional Programmes. The actual investment and mandatory contribution may be different.

The assessment provided in Table 1 above outlines the benefits of different scenarios. They suggest that Associated Membership is currently the most suitable, balancing the advantages and risks of greater involvement. The data shows that Lithuania has already outgrown PECS and is ready to apply for membership in ESA. The Lithuanian stakeholders involved in the study clearly agree that closer involvement in ESA activities is needed. The benefits would be numerous, including opportunities for internationalisation and capacity building. Of the two types of membership, Associated Membership provides more obvious benefits at the current stage. In addition, the changes to ESA membership path introduced in 2018 make the acceptance of Lithuania's as a Full Member state highly unlikely without at least a period of Associated Membership. Furthermore, even if Full Membership were allowed, the funding that can be given to space economy is limited and the return of investment would be lower.

## 4. RECOMMENDATIONS

There are three types of recommendations that come from this study:

- the recommendations related to Lithuania's collaboration with ESA
- the recommendations related governance of space sector and establishment of favourable regulatory environment
- the recommendations on specific actions regarding strengthening of space sector and its entities

Each type of recommendations is discussed in greater detail below.

### Collaboration with ESA

Proceeding from PECS to any type of membership also presupposes the selection of Optional Programmes, where Lithuania could successfully participate. The implemented mapping of Lithuania's strengths in relevant technology domains showed that the country has business and research advantages in:

- RF Systems, Payloads and Technologies
- Life & Physical Sciences
- Optics (especially Optical component technology and materials and Optical equipment and instrument technology)
- Optoelectronics (especially Laser technologies)
- Materials and Processes (especially Novel materials and materials technology)

The business sector also has strengths in:

- Space System Software (especially in Earth observation payload data exploitation)
- Electric, electromechanical & electronic (EEE) Components and quality (especially in component technologies)

Some technologies may not be highly developed yet, but show promise for the future, according to the discussion with the Lithuanian stakeholders. They include robotics, onboard data systems and ICT activities for space needs. ICT activities play an increasingly important role in Lithuania's economy. Switching ICT work tasks towards space-needs would likely be possible. Biotechnology industry is another sector, where intense development could take place. However, it remains to be seen how many enterprises are willing to enter the space-market.

Based on collected data, including from discussions with Lithuanian stakeholders, the following Optional Programmes are of potential interest for Lithuania:

- Third Party Programme for implementing Industry Incentives Scheme and a national programme with technical support from ESA
- General Support Technology Programme (GSTP) for developing space technologies across a wide variety of domains (except telecommunication technologies)



- Earth Observation Envelopment Programme (EOEP) mainly for exploiting Earth observation data, although it is broader than only these activities
- Advanced Research in Telecommunications Systems (ARTES) Core Competitiveness for developing telecommunication technologies
- ARTES ScyLight for developing optical telecommunication technologies
- European Exploration Envelope Programme (E3P) for human spaceflight and robotic exploration technologies (although hitherto life sciences entities' attention to space has been limited in Lithuania)

The programmes are numerous and it is not likely that the Lithuania would be able to invest in all of these programmes, given likely budgetary constraints. Lithuania's annual spending during the first PECS round was approx. €1.5m. The increase in the case of membership will have to be noticeable. It could be suggested that an amount comparable to that of PECS spending could be attributed to the Third Party Programme, which could serve as a partial replacement of PECS. Its Industry Incentives Scheme could be used to help entities to prepare participate in the selected Optional Programmes, while limiting the competition to companies specifically from Lithuania. Its national programme element can help to strengthen Lithuanian space entities across different domains without being bound to the Optional Programmes. It also allows funding low TRL projects similar to the Technology Readiness Programme (TRP) and a variety of other activities, such as working with Science programme's payload data. Therefore, the scope of possible objectives of the Third Party Programme is broad with guaranteed return to Lithuania.

GSTP is a broad programme with guaranteed return, which is an important factor for making investment decisions. First, the broadness of the programme opens door to Lithuanian entities working in very different technology domains. Second, guaranteed return ensures that funds are not used by entities from other participating states but returns to Lithuania. The ARTES and ARTES ScyLight programmes are more domain-specific, but also provide guaranteed return. Lithuania's space sector has potential in these programmes despite their specificity. Finally, EOEP and E3P are also relatively specific but do not provide the guaranteed return option. While Lithuanian entities proved their capacities in activities relevant to EOEP during the PECS, the potential realisation of existing capacities in E3P is less clear.

### **Governance and regulatory environment**

Space sector governance and the regulatory environment need improvement in order to help the sector develop more rapidly. The priorities for improving space sector governance are improved legal framework (e.g. adoption of space law) and improved coordination (e.g. assigning multi-institutional coordination to a specific entity). Business environment regulation mostly affects research, development and innovation (RDI) policy as well as policy instruments in general, not necessarily specific to space undertakings. On the other hand, a regulatory environment friendly for space industry also requires providing opportunities for new companies to emerge (e.g. through incubation services). Table 2 below outlines the main recommendations related to these areas.

**Table 2. Options for developing Lithuania's space sector**

Area	Recommendation	Possible actions
Governance	Defining Lithuanian space policy and strategy	Raising space policy high on the national agenda
		Assigning clear leadership
		Adopting a clear space policy strategy/programme
	Improving coordination and implementation of space policy	Establishing a coordinating entity or assigning the responsibility of coordination to an already existing entity
		Assigning clear roles and responsibilities
	Raising public sector's awareness on space science and technologies	Educational conferences and/or seminars
		Workshops and round-table discussions
		Conferences, visits and events abroad
Establishing legal framework for space undertakings	Developing a legal framework for space undertakings	
Regulatory/ business environment	Fostering RDI, including the field of space science and technology	Incentivising industry-academia collaboration
		Establishing RDI support programmes across the TRL range
		Ensuring continuous support to higher education institutions (HEIs) based on performance
		Reducing administrative burden for RDI measures
	Space business incubation	Establishing an incubator for start-ups next to one of the leading universities or business and science parks or extending opportunities in the existing ones
		Undertaking preparations to establish the ESA business incubation centres (BICs)

Source: Visionary Analytics, 2019.

### Actions to strengthen space sector and its entities

Specific actions should also be aimed directly at space undertakings. Three main areas have been distinguished:

- human capital, needed to ensure that there are sufficient high quality human resources (e.g. by providing specialized courses or opportunities to gain work experience)
- funding, needed to implement space undertakings, due to high risks (e.g. through ESA programmes, or national programme based on the Third Party Programme)
- market size, demand and internationalization, needed to ensure that space undertakings are continuous and entities see long-term benefits in their implementation (e.g. facilitating partnerships, public sector's acquisition of space-based services, etc.)

Table 3 below lists the identified possible options for action.

**Table 3. Options for developing Lithuania's space sector**

Area	Recommendation	Possible actions
Human capital	Raising awareness on space science and technology	Information campaigns and educational undertakings for a wider audience
		Educational undertakings at school-age
	Increasing accessibility of general and specific university courses/modules relevant to space science and technology	Removing barriers to select general space-related courses from any STEM discipline
		Introducing general university courses/modules to HEI curricula
		Establishing specialised courses at local HEIs
		Establishing a scheme for students to study abroad
	Providing financial support to students' space projects and research undertakings	Establishing a scheme where students' projects in space science and technologies could be funded
Continuing support to student internship placements at ESA and NASA		
Funding	Improving funding schemes to fit space undertakings	Establishing separate measures for space undertakings
		Funding space undertakings on the basis of the current policy mix
		Developing a national scheme of the Seal of Excellence
		Assessing the needs for infrastructure
Market size, demand, and internationalisation	Creating demand for space technology applications	Raising public sector's awareness of space science and technologies and their use
		Setting up mechanisms for innovation in the public sector
	Encouraging and supporting participation in international undertakings and/ or programmes	Providing financial support to entities willing to participate in international undertakings
		Providing other means of support to entities willing to participate in international undertakings
	Participating in international events and trade fairs	Participating in international events and trade fairs
		Organising international events in Lithuania

Source: Visionary Analytics, 2019.

## 5. CONCLUSIONS

The study showed that Lithuania's space sector has outgrown the PECS programme and the country could become more involved in ESA activities. The recommended path is Associated Membership due to the higher geographic return, greater opportunities for capacity building, and the Full Membership requirements adopted by ESA by the end of 2018. The Lithuanian stakeholders have expressed willingness to apply for Full Membership, but given the restrictions and the potential advantages / disadvantages, the acceptance is both highly unlikely and more risky.

The Associated Membership could be supported through an investment of €3m or larger, meaning a doubling of PECS investment levels. Change in the type of collaboration will also require an increase in the number of government personnel working with space due to increases in workloads, creating additional costs.

Two programmes available for Associate Member States could clearly be preferred choices for investment. First, the Third Party Programme, which integrates the Industry Incentive Scheme (for building capacity relevant for the selected programmes) and the national programme. The Third Party Programme would allow directing funds specifically to Lithuanian entities, and it could be considered that an amount up that comparable to PECS could be directed to those needs (i.e. approx. €1.5m). The second programme, GSTP is very broad and could benefit a large number of companies working across different technology domains. Therefore, this programme could also be given certain preference and relatively larger share, with, for example, €1m annual investment.

Finally, several other Optional Programmes are potentially relevant. They mainly include EOEP, ARTES, and ARTES ScyLight, though Lithuanian stakeholders also discussed E3P. The annual investment there could be lower (e.g. €0.5m annually) due to the narrower scope of these programmes. However, while they are potentially relevant, the final distribution of resources depends on the funds that the government allocates to space in general and collaboration with ESA in particular.