Priedas 4. Lietuvos institucijų ir bendrovių kompetencijų žemėlapis.

	Technologijų sritis		
1	Borto duomenų sistemos	A	Naudingojo krovinio duomenų apdorojimas
		B	Borto duomenų valdymas
		C	Mikroelektronika skaitmeninėms ir analoginėms aplikacijoms
2	Kosminių sistemų programinė įranga	A	Pažangios programinės įrangos technologijos
		B	Kosmoso segmento programinė įranga
		C	Žemės segmento programinė įranga
		D	Žemės segmento duomenų apdorojimas
		E	Žemės stebėjimo naudingojo krovinio duomenų panaudojimas
3	Kosminių aparatų energinė įranga	A	Galios sistemos architektūra
		B	Galios generavimo technologijos
		C	Energijos saugojimo technologijos
		D	Galios kondicionavimas ir paskirstymas
4	Kosminių aparatų vidinė aplinka ir išorės poveikis	A	Kosmoso erdvės aplinka
		B	Aplinkos poveikis
		C	Kosminiai orai
5	Kosminių sistemų kontrolė	A	Kosmoso sistemų architektūra ir autonomija
		B	Kosmoso segmento valdymas, navigacija ir kontrolė
6	Naudingasis kosminis krovinys ir sistemos	A	Telekomunikacijų (sub-)sistemos
		B	Radio navigacijos (sub-)sistemos
		C	Telemetrijos stebėjimo ir kontrolės sub-sistemos
		D	Radijo dažnių naudingasis krovinys
		E	Mikro ir milimetrinių bangų technologijos ir įranga
7	Elektromagnetinės technologijos ir metodai	A	Antenos
		B	Bangų sąveika ir sklaida
		C	EMC/RFC/ESD modeliavimas ir testavimas
8	Sistemų konstravimas ir bandymai	A	Misijų ir sistemų specifikavimas
		B	Saveikaujanti ir lygiagrečioji inžinerija
		C	Sistemų analizė ir dizainas
		D	Surinkimo, integracijos ir patikrinimo sistemos
9	Misijų valdymas ir antžeminės duomenų sistemos	A	Pažangių sistemų koncepcijos
		B	Misijų operacijos
		C	Žemės duomenų sistemos
10	Skrydžio dinamika ir globali palydovinės navigacijos sistema	A	Skrydžio dinamika
		B	GNSS sistemos ir žemės susijusios technologijos
11	Kosminės šiukšlės	A	Matavimai
		B	Modeliavimas, duomenų bazės ir rizikos analizė

		C	Didelio greičio poveikis ir apsauga	d	1
12	Žemės stotys ir tinklai	A	Žemės tinklai ir jų koncepcijos	d	1
		B	Žemės komunikaciniai tinklai		0
13	Automatika, vaizdo perdavimas ir robotika	A	Pritaikymas ir koncepcijos	d	3
		B	Automatikos ir robotinės sistemos	d	2
		C	Automatikos ir robotiniai komponentai ir technologijos	a	5
14	Gyvybės ir fiziniai mokslai	A	Gyvybės mokslų palaikymo instrumentai	d	7
		B	Fizinių mokslų palaikymo instrumentai	d	4
		C	Taikomosios gyvybės mokslų technologijos	d	4
		D	Taikomosios fizinių mokslų technologijos	a	8
15	Mechanizmai ir tribologija	A	Kertinės mechanizmų technologijos		0
		B	Nesprogstančios paleidimo technologijos		0
		C	Tyrinėjimo instrumentų technologijos		0
		D	Kontrolės elektronikos technologijos	d	1
		E	MEMS technologijos	d	2
		F	Tribologijos technologijos	d	2
		G	Mechanizmų inžinerija	d	4
16	Optika	A	Optinių sistemų inžinerija	d	9
		B	Optinių komponentų technologijos ir medžiagos	a	10
		C	Optinė įranga ir instrumentų technologijos	d	7
17	Optoelektronika	A	Lazerių technologijos	a	10
		B	Detektorių technologijos	a	4
		C	Fotonika	a	7
18	Aerotermodinamika	A	Skaičiavimo įrankiai		0
		B	Žemės įranga		0
		C	Skrydžio testavimas	d	1
		D	Tarpdisciplininiai įrankiai		0
19	Trauka	A	Cheminės traukos technologijos	d	1
		B	Elektros traukos technologijos		0
		C	Pažangios traukos technologijos		0
		D	Traukos technologijų pagalbiniai instrumentai		0
20	Konstrukcija ir pirotechnika	A	Konstruktyvo projektavimas ir patikrinimo metodai ir įrankiai	d	1
		B	Aukšto stabilumo ir tikslumo struktūros	a	2
		C	Pripučiamos ir dislokuojamos struktūros		0
		D	Aukštos temperatūros struktūros		0
		E	Aktyvios/besiadaptuojančios struktūros	d	2
		F	Tolerancija pažeidimams ir sveikatos monitoringas	d	1
		G	Paleidėjai, pakartotinio naudojimo transportas, planetų tyrinėjimo priemonės		0
		H	Įgulos gyvenimo sąlygos, saugumas ir EVA kostiumai		0
		I	Apsauga ir analizė nuo meteoroidų ir kosminių šiukšlių		0
		J	Pažangios struktūrinės koncepcijos ir medžiagos		0
		K	Pirotechnikos technologijos		0
21	Termo įranga	A	Karščio transporto technologijos		0
		B	Kriogenika ir šaldymo technologijos	d	1
		C	Termo apsauga	d	2
		D	Šilumos saugojimas ir atidavimas		0
			Termo analizės instrumentai		0

22	Aplinkos kontrolė gyvybės palaikymui ir in-situ resursų optimizavimas	A	Aplinkos kontrolė ir gyvybės palaikymas	d	1
		B	In situ resursų panaudojimas		0
23	Elektros, elektromechanikos ir elektronikos komponentai ir jų kokybė	A	Atsparumo radiacijai užtikrinimo metodai ir procesai		0
		B	EEE komponentų technologijos		0
24	Medžiagos ir procesai	A	Naujos medžiagos	d	6
		B	Medžiagų procesai	d	5
		C	Švara ir sterilizacija		0
25	Kokybė, patikimumas ir saugumas	A	Sistemos patikimumas ir saugumas	d	1
		B	Programinės įrangos kokybė		0
26	Kita			d	2

Aukšto intensyvumo kompetencija (kompetencijos, pažymėtos EKA ekspertų kaip tinkamos PECS)

Vidutinio intensyvumo kompetencija (kompetencijos, identifikuotos pačių subjektų, kurių skaičius daugiau nei 2)

Identifikuota, bet išsibarsčiusi kompetencija (kompetencijos, identifikuotos pačių subjektų, kurių skaičius toje kompetencijoje mažiau nei 3)

Kompetencijų neidentifikuota

Priedas 5. Išplėstinė santrauka anglų kalba

Extended Summary

I. Competencies of Lithuanian business and scientific institutions are consistent with general space technology development trends globally and in Europe.

The analysis of the space-related competencies of Lithuania‘s business and scientific institutions, conducted in the context of ESA member–states technology competency list has demonstrated that Lithuania‘s competencies are consistent with the general space technology development trends globally and in Europe. Lithuania’s business entities, research and education institutions have potential and are capable of successfully integrating into R&D&I activities on both national and international institutional program levels, as well as participate in the space sector value chain on a commercial level.

The space industry is moving towards greater efficiency of technologies, services and products. Greater processing systems efficiency, constantly improving power and storage solutions, developing smart systems and new materials highlight the trends of new generation of spacecraft, for providing a wider range of services and solutions while increasing the satellite operational efficiency.

As demand for earth observation and navigation services grows, so does the need for more flexible data capturing, data precision and systemic processing. These requirements will be achieved by combining systems and sensors with complementary technical characteristics. But all these new more powerful earth observation instruments pose new challenges to space systems as a whole, particularly with regards to mass, power dissipation, thermal stability, and data processing aspects. Space applications blend increasingly more technologies from non-space sectors, such as biotechnology, materials and nanotechnologies, electronics and embedded systems, robotics, fuel cells, etc.

Recently, spacecraft mass challenges (high cost of launch, long production lead time) caused the explosion of small spacecraft development. With the decrease of satellite manufacturing and launch costs it is becoming possible to orbit earth observation and mobile communication systems faster, with uninterruptible service provision capabilities in any part of the globe.

II. The competencies of Lithuanian business, scientific and education institutions are competitive and viable in specific niche areas of technology fields, which traditionally have been strong in Lithuania; they are also consistent and complementary to the areas, where Lithuanian researchers and businesses have the ambition and motivation to strive for more: for example, to become integrated service providers.

The research conducted as part of this study has shown that the competencies of Lithuanian business and scientific entities are potentially competitive and viable in the following technology areas:

ESA technology tree technology domain	Technology subdomain
13.A	Automation, Telepresence & Robotics – applications & concepts
14.D	Applied Physical Science Technology

16.A	Optical System Engineering
16.B	Optical Component Technology and Materials
16.C	Optical Equipment and Instrument Technology
17.A	Laser Technology
17.C	Photonics
24.A	Novel Materials
20.E	Active/adaptive structures
21.C	Thermal protection
22.A	Environmental Control & Life Support (ECLS)

*Based on ESA Technology Tree

In short and medium term, these areas are compatible in principle with potential areas identified by ESA for PECS cooperation, as well as priority areas of the National space science and research program currently under consideration:

- Fundamental and applied research in the field of space exploration (space science);
- Earth observation research and applications (environmental monitoring, meteorology, geodesy and aeronomy);
- Telecommunications (service demonstration and satellite navigation);
- Microgravity research (space biology and medicine, as well as the processing of materials);
- Ground segment engineering and applications, including data-processing and storage.

These areas are also compatible with the motivation and the momentum of the members of the Lithuanian Space Association of working in the adjacent niche areas at the national level: small satellite projects, development of services of building and operating unmanned aerial vehicles and small robotics.

III. Possibilities for Lithuanian business entities to integrate in a tight and highly competitive global space industry value chain lies in the individual entities' abilities to specialize in their niche areas and more in the development of space-enabled services, rather than through the entry into the upstream (production) part of the value chain. Due to dispersed expertise and lack of experience in working on integrated projects, the support and co-ordination of associated structures is of utmost importance.

In addition to focusing on the R&D&I areas of the Lithuania space sector, one of the objectives of the study was to look at the opportunities to integrate into the global space industry value chain, in terms of upstream and downstream domains. Due to the highly concentrated and vertically integrated industry, with high entry barriers, the potential entry of Lithuanian entities into the space industry value chain is seen as follows:

1. To use the downstream part of the space industry value chain as an entry point, Lithuanian entities which already have experience in the space sector or those wanting to get involved, should focus on their specialist technologies, in particular through institutional orders.
2. It is advisable to initially develop the products and services in the satellite value chain (ground segment, satellite component or payload), because this industry is the most dynamic and more lucrative; here, Lithuanian entities' commercial relationships, infrastructure and experience has the largest critical mass.

3. By exploiting the benefits of European geographical return through the ESA membership (originally in the framework of the PECS plan and thereafter through the full-fledged ESA membership), to participate in the relatively small but promising markets, where Lithuanian entities possess competitive competences. These are markets of satellite payload applications where Lithuanian entities can make use of their competences in the fields of telecommunications, navigation systems and sub-systems, environmental & life support systems (biotechnology, medical) and microgravity research segments.

4. Niche and non-traditional segments, such as space tourism also may open up opportunities for Lithuanian entities to enter the space industry value chain.

5. In the area of integrated products and services, it is recommended to focus on the small satellite segment, since it is one of the most dynamic, most promising, but at the same the cheapest and least risky area. Lithuania has gained considerable momentum here: the motivation and the success of the first nano-satellite missions have enabled Lithuanian space sector to earn significant credit in the eyes of the public. This area is developing rapidly at both the commercial and institutional levels (i.e. NASA).

IV. The updated Strategic R&D&I plan for 2014-2020 of the National space technology platform is focused on activities geared towards achieving a sustainable balance between institutional programs and participation in commercial space industry value chain, in order to ensure the competitiveness and technological superiority of the sector, and its impact on the economy as the engine of innovation.

Based on the above analysis of the competencies of Lithuanian space sector entities in light of the global space technology trends and prospects, the renewed directions of the National space technology platform Strategic R&D&I plan for 2014-2020 is summarized in the table below.

The renewed directions of the National space technology platform Strategic R&D&I plan for 2014-2020

<table>
<tr><th colspan="2">In the short/medium term (2014-2019)</th><th>Vision for 2020 m</th></tr>
<tr><td>Internationally</td><td>1. Validation of existing capacities through participation in the ESA PECS plan, Horizon 2020 program and the framework of the national programs in these areas:
Life and physical sciences, fundamental and applied research (space science, applied life science technologies (space biology, medicine);
Earth observation R&D&I and applications (environment monitoring, meteorology, agriculture, geodesy, EO data processing);
Payload and systems (telecommunication sub-systems, optics, optoelectronics, radio navigation, micro-and millimeter wave technologies);
Novel materials for space system applications;
Ground segment engineering and applications;
11. Integration into ESA R&D&I project value chain in the above-identified priority areas;
12. Development of the area of microsatellites, while exploiting co-operation opportunities with NASA Small satellite program and other similar strategic, including commercial, initiatives.
13. Identification and realization of international commercial market opportunities for integration into the space industry value chain.</td><td rowspan="3">Overall sector vision:
Achievement of sustainable balance between institutional programs and participation in commercial space industry value chain, in order to ensure the competitiveness and technological superiority of the sector, and its impact on the economy as the engine of innovation.
Strategic objectives:
7. Full ESA membership, integration into other international agencies and networks (NASA, Eurospace, UNOOSA)
8. Strong specialization in niche areas: well developed component design, manufacturing and services competencies in select key areas, in accordance with smart specialization concept:
Satellite systems control (i.e. piezoelectric actuators);
Ground segment services;
Payload and systems (signals, image processing, optics, optoelectronics, photonics);
Applied life science research for space applications;
Development and production of novel materials;
9. Leadership in specific integrated products/services – microsatellites, through integrating abovementioned key technology competencies for development of systemic product (micro-satellite formation systems for specific EO, telecommunications applications).
10. Coordinated integration into the commercial space industry value chain, whereby national business entities generate substantial part of high technology industries' value added.</td></tr>
<tr><td>Locally</td><td>7. Exploitation of local demand by using EU structural funds, private funding instruments, as well as novel financing instruments (pre-commercial procurement) in these priority areas:
Small robotics systems and components;
Unmanned aerial vehicles.
8. Consolidation of achievements in the area of small satellite missions and execution of further missions by raising the innovation bar of satellite systems and payloads.</td></tr>
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