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THE IMPORTANCE OF PUBLIC-PRIVATE SECTOR SPACE PARTNERSHIPS FOR THE CZECH REPUBLIC

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INTRODUCTION

The proliferation of space systems and related data, products, and services has accelerated significantly in the past several years. The decreasing costs of access to space enabled by new commercial providers (e.g., SpaceX, Rocket Lab, etc.) and innovative technologies (e.g., miniaturization of microprocessors and other satellite components, etc.) have created opportunities for other commercial companies in various space sectors (e.g., Planet, Astroscale, etc.). Moreover, a large number of new nations are deriving space-related benefits from their own space capabilities or actively investing in the same. There are currently more than 70 countries with space agencies and a dozen more underway.[1]

The developed world has become largely dependent on space for both socioeconomic development and defense/security needs. On a daily basis, space enables the flow of information and services to support global communications, civilian economies, safety, and emergency management, as well as the environment, transportation, and health. The war in Ukraine has demonstrated the critical nature of space assets (including commercial ones) for national security and military purposes. In short, the rapid expansion of global space activities has created new competitive pressures and cooperative benefits that warrant the priority attention of governments of every size.

SPACE IN THE CZECH REPUBLIC

The Czech Republic, thanks to its long-established expertise in engineering, managed to survive the harsh period of the 1990s when the Czech space industry had to restructure away from the Soviet economic sphere. Since the beginning of the new millennium, the situation has gradually improved.[2] A major milestone was the Czech Republic's entry into the European Space Agency (ESA) in 2008,[3] which represented an opportunity for the Czech Republic to participate in international space programs. According to the

1 "Countries with Space Programmes". 2022. *Worldpopulationreview.com*. https://worldpopulationreview.com/country-rankings/countries-with-space-programs.

2 "Česko má vesmírný potenciál, ale schází šikovní absolventi a dodavatelé". 2020. *idnes.cz*. https://www.idnes.cz/ekonomika/domaci/kosmicke-cesko-kosmicky-prumysl-budoucnost-vesmirna-mise.A200805_154322_ekonomika_kou.

3 "Czech Republic accedes to the ESA Convention". 2008. *ESA*. https://www.esa.int/About_Us/Plan_for_European_Cooperating_States/Czech_Republic_accedes_to_the_ESA_Convention.

Ministry of Transport of the Czech Republic's website, there are currently 50 companies and 23 research institutions and universities participating in various ESA programs.[4]

Participation in these ESA programs has always been conditional on the development of domestic space capabilities. For example, the Czech Republic is not part of the production chains in the Galileo program because, at the time of its inception, the Czech Republic was not a full ESA member and did not possess sufficient industrial capacity. Accordingly, when this project was approved by the European partners, the manufacturing chains were established elsewhere. Today, the Czech Republic has enough industrial and scientific capabilities to participate in a number of EU and ESA space programs.

Indeed, from 2008 to 2018, the Czech Republic was involved in more than 350 space-related projects.[5] These projects have not only given the Czech companies international standing but also the necessary experience to engage in more sophisticated and lucrative projects. The benefits of the space industry will, however, only become apparent in the coming years due to the long-term planning and technical complexity of most missions. According to Pavel Sobotka, director of *Frentech Aerospace*, out of the approximately 87 projects currently underway involving over 20 Czech companies, over 1,5 billion EUR will flow into the Czech space industry over the next 18 years, with a further billion flowing into associated sectors.[6]

Companies such as *Iguassu Software Systems* are developing onboard software for Ariane 6, *UNEX* delivered a giant chassis for the mobile assembly hall to the spaceport in French Guiana, and *MCS Slaný* installed a giant exhaust deflector at the space port for the rocket's engines.[7] A Brno-based company, *SAB Aerospace*, developed a multiple-launch rideshare system for the VEGA rocket, supporting the first "ride-sharing" service for the European market.[8] The Czech Republic is involved in the Asteroid Impact and Deflection Assessment (AIDA) collaboration, specifically in the European HERA mission.[9] In this project, the Czech firm *OHB Czechspace* is responsible for the probe's complete structure, providing all necessary interfaces with the scientific instruments and service devices, such as the solar arrays, batteries, antenna, and the computer, as well as the main interface with the rocket.[10] Moreover, the HERA satellite will serve as a mothership for two CubeSats Juventas and APEX (Asteroid Prospection Explorer). These CubeSats will be conducting further measurements of the Didymos asteroid. APEX CubeSat was developed by the Swedish-Finish-Czech-German consortium. From the Czech side, the participating entities are scientists from the Geological Institute of the Academy of Science and the Czech private company *Space Systems Czech*.[11]

Another Czech company, *ATC Space*, produces parts for the Ariane 5 rocket and, since 2020, has delivered parts of the P120C engine of the new ESA rocket Ariane 6. This resulted from a long-term effort by the Ministry of Transportation to win the ESA contract with an investment of €20 million. This project should

4 "Interactive Map of Czech Entities Involved in Space Activities". 2022. *Czech Space Portal* https://www.czechspaceportal.cz/en/successes-of-the-czech-republic/interactive-map-of-czech-entities-involved-in-space-activities/.

5 "Česko má vesmírný potenciál, ale schází šikovní absolventi a dodavatelé". 2020. *idnes.cz*. https://www.idnes.cz/ekonomika/domaci/kosmicke-cesko-kosmicky-prumysl-budoucnost-vesmirna-mise.A200805_154322_ekonomika_kou.

6 "Česko má vesmírný potenciál, ale schází šikovní absolventi a dodavatelé". 2020. *idnes.cz*. https://www.idnes.cz/ekonomika/domaci/kosmicke-cesko-kosmicky-prumysl-budoucnost-vesmirna-mise.A200805_154322_ekonomika_kou.

7 "V Česku se vyrábí díly pro raketu Ariane 6, vydělají stovky milionů korun". 2020. Idnes.cz. https://www.idnes.cz/ekonomika/domaci/ariane-6-raketa-dily-vesmir-ceska-republika.A200814_095324_ekonomika_kou.

8 "Vega Rocket Launched Into Space Equipped With Brno-Made Satellite Launch Device". 2020. *BrnoDaily*https://brnodaily.com/2020/09/04/brno/vega-rocket-launched-into-space-equipped-with-brno-made-satellite-launch-device/.

9 „Planetary Defenders: After NASA'S DART Comes ESA'S Hera". 2021. ESA. https://www.esa.int/Safety_Security/Hera/Planetary_defenders_after_NASA_s_DART_comes_ESA_s_Hera.

10 "Hera". 2022. *OHB Czechspace*. https://www.ohb-czech.cz/our-projects/hera.

11 "Misi Hera bude doprovázet satelit, na jehož vývoji se podílejí Češi". 2019. *Czech Space Portal*. https://www.czechspaceportal.cz/sdileny-let-malych-druzic-na-rakete-vega/.

generate hundreds of millions of Czech crowns in revenue, according to Václav Kobera, Director of the Department of ITS and Space Activities, Research, Development and Innovation at the Czech Ministry of Transport.[12] This example of a public-private partnership demonstrates the potential windfall that the space sector can bring to the Czech economy.

There are currently over 100 different entities in the Czech Republic involved in space activities to varying degrees. These include educational institutions such as the University of Technology in Brno and Charles University in Prague, government and international agencies such as the Czech Ministry of Transport and the European Union Agency for Space Programme (EUSPA), and private firms that either focus on the actual production of hardware or applications using data from space (see figure 1 below).[13]

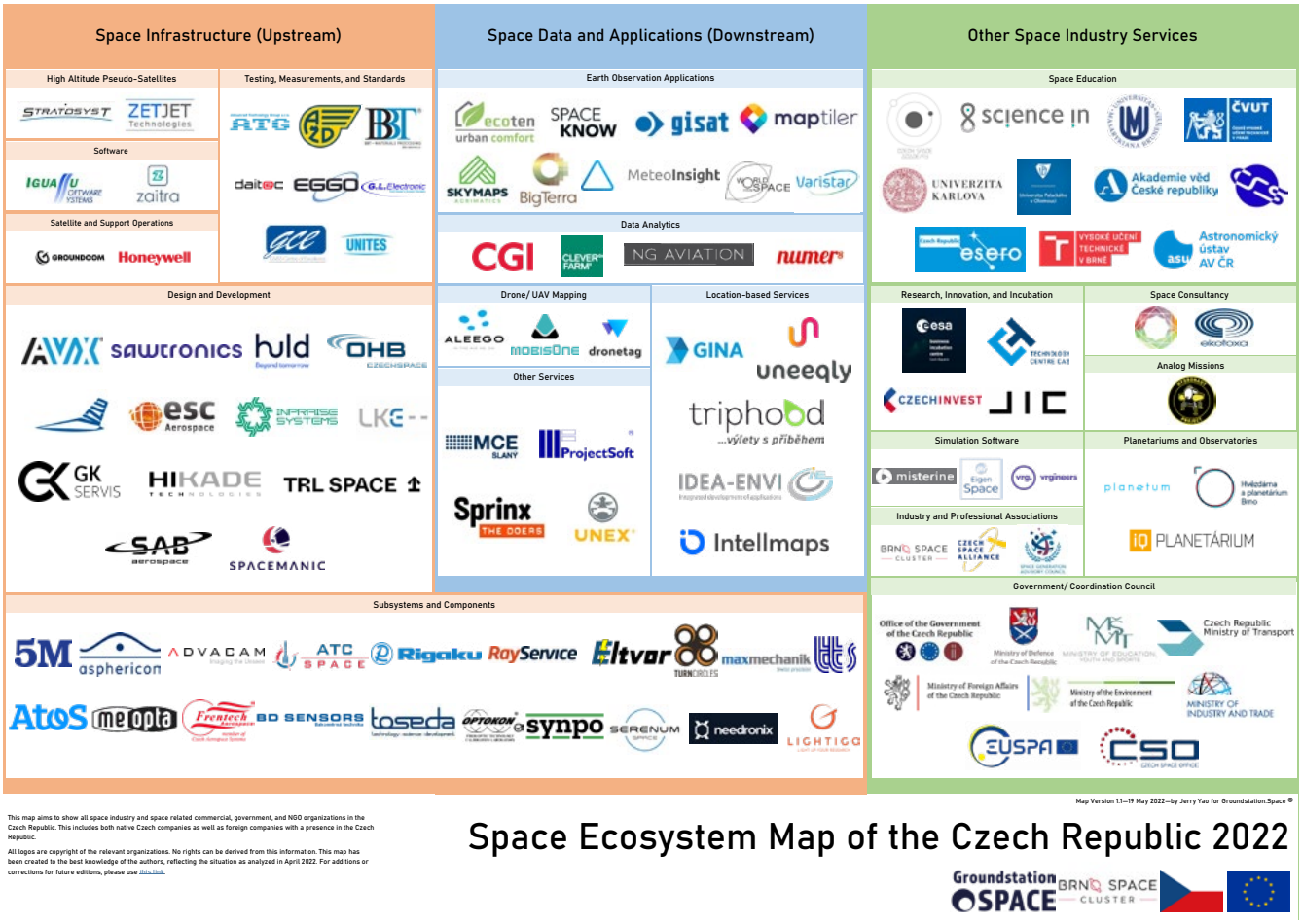

Figure 1: A visual depicting entities engaged in the Czech space ecosystem. (Source: Groundstation.space)[14]

At PSSI's 6th Space Security Conference, Mr. Kobera stated that the Czech Republic is the most advanced post-communist European space actor. Regarding Czech space priorities, the current National Space Plan for 2020-2025 addresses two main focal points. The first is building indigenous space capabilities

12 "V Česku se vyrábí díly pro raketu Ariane 6, vydělají stovky milionů korun". 2020. *Idnes.cz*. https://www.idnes.cz/ekonomika/domaci/ariane-6-raketa-dily-vesmir-ceska-republika.A200814_095324_ekonomika_kou.

13 "Space Ecosystem Map of the Czech Republic 2022". 2022. *Groundstation.space*. https://www.groundstation.space/space-ecosystem-map-of-the-czech-republic-2022/.

14 "Space Ecosystem Map of the Czech Republic 2022". 2022. *Groundstation.space*. https://www.groundstation.space/space-ecosystem-map-of-the-czech-republic-2022/.

through participation in ESA programs. In short, the Czech industry is slowly moving away from just the integration of components to being able to assemble larger and more sophisticated systems. For example, *Otespace* is developing a Czech indigenous small launcher that should be able to carry payloads up to 250kg to Low Earth Orbit (LEO).[15] The second priority is to be more visible, especially with regard to the country's competencies and capabilities. In this regard, ESA and EUSPA provide important platforms.

With regard to the EU, to respond to the rapidly evolving geopolitical landscape and rising global tensions, there has been an emphasis on the concept of strategic autonomy in security and defense.[16] For space, the main focus has been on independent access to space, accompanied by a secure European connectivity constellation to complement the successful programs of Galileo and Copernicus and on boosting Europe's launcher sector. The EU is currently working on its Space Strategy for Security and Defense to be published at the end of 2023.[17] Should only traditional corporate players continue to be involved in the implementation of this strategy, smaller private companies, including the Czech ones, may find themselves left behind in the competition for the EU space budget. This would be most unfortunate and short-sighted.

The Czech Republic also contributes to NATO's space activities. The Czech Republic, thanks to the SATCEN CR, which is managed by the Czech Military Intelligence, supplies the Alliance with satellite imagery.[18] The SATCEN CR currently uses commercial imagery, but plans to deploy a domestically-developed satellite called GOLEM (globální orbitální elektrooptický systém) and a stratospheric balloon called STRATOM. Both projects are being managed by the Czech Aerospace Research Centre (VZLÚ).[19]

THE PRIVATE SECTOR ROLE IN THE NEW GLOBAL SPACE RACE

The Czech Republic allocated 1.53 billion Czech crowns in annual funding for its National Space Plan 2020–2025.[20] Of this amount, some 1.2 million Czech crowns come from the Ministry of Transportation budget. These funds will go to the Framework Project Implementing ESA's Support of Space-Related Activities in the Czech Republic (C3PFP) and to ESA's industry-oriented optional programs. The remainder of 325 million Czech crowns are provided by the Ministry of Education and are used for ESA's Mandatory Activities, its contribution to Guiana Space Center (GSC), and ESA's Research and Development (R&D) oriented optional programs.[21]

In 2021, the ESA budget was €6.49 billion. The Czech Republic contributed €43 million to the common budget (0.9% of the total – see Figure 2 below). Compared to the companies from large European countries and the United States, Czech companies generally have fewer opportunities to raise capital that would help them drive innovation and participate in longer-term, larger projects. In addition, the financial resources that the Czech Republic can offer its domestic companies are, like in many countries of similar size, quite limited.

15 "Czech Sparrow". 2022. *Otespace*. https://www.otespace.eu/czechsparrow/.
16 "A Strategic Compass for Security and Defence". 2022. *European Union External Action Service*. https://www.eeas.europa.eu/eeas/strategic-compass-security-and-defence-1_en.
17 "A Strategic Compass for Security and Defence". 2022. *European Union External Action Service*. https://www.eeas.europa.eu/eeas/strategic-compass-security-and-defence-1_en.
18 „Vojenské Zpravodajství | Satelitní Centrum SATCEN ČR". 2021. *Vzcr.Cz*. https://www.vzcr.cz/satelitni-centrum-satcen-cr-47.
19 "Česká armáda chce disponovat vlastními vesmírnými kapacitami". 2022. *Echo24*. https://echo24.cz/a/SK8AR/ceska-armada-chce-disponovat-vlastnimi-vesmirnymi-kapacitami.
20 The amount may change due to changes of exchange rate between EUR and CZK.
21 "National Space Plan 2020-2025". 2019. *Ministry of Transportation of the Czech Republic*. https://www.czechspaceportal.cz/wp-content/uploads/2020/08/NSP2020-2025_EN.pdf.

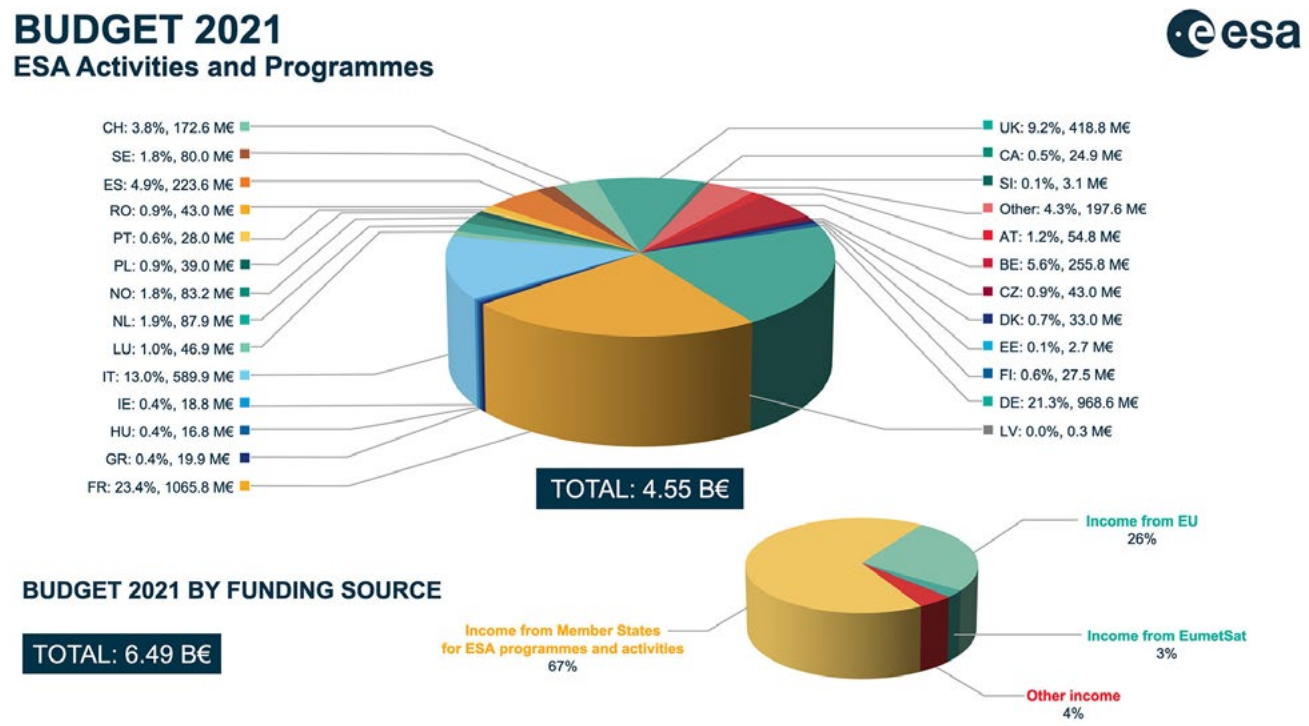

Figure 2: ESA budget for 2021 (source: European Space Agency).[22]

Senior government and industry representatives that attended the high-level conference organized by the Prague Security Studies Institute (PSSI) in Prague in June 2022[23] agreed that more robust public-private partnerships are required to be able to stay abreast of the intensifying global space competition.

The ability to incorporate private sector expertise into the government's space priorities is a key element of efforts to enhance the stature and effectiveness of the country's space sector over the longer term. This is especially relevant for mid-size and small space actors as they enter the broader space market competition. There are several areas that warrant special attention. One of them is the establishment of clear parameters for public-private space partnerships so that companies, both domestic and foreign, can operate in a predictable, stable environment conducive to long-term investment and fair competition. Another is the ability of the government to translate overarching national strategic objectives into effective policies and investments that would provide clarity to the private sector concerning requirements and desired outcomes. The coordination and deployment of all available development and investment organizations to leverage the country's position in the emerging space economy should be viewed as an urgent task.

Moreover, the industry needs greater clarity regarding market regulations. These rules need to be data-driven and aligned with fast-paced technological developments to ensure that the government does not over-regulate this nascent sector. As the competition in the space sector continues to grow, European governments have to weigh when and how to permit fellow companies to join their space programs to make them more effective and competitive. In addition, beyond the reliance on the "big primes", there should be a mechanism to encourage the involvement of small and medium-sized companies to meet future requirements.

22 "ESA budget 2021". 2021. ESA. https://www.esa.int/Newsroom/ESA_budget_2021.
23 More information about the event can be found here: https://www.spacesecurity.eu/.

For the Czech Republic, only a longer-term government concept of national space goals can advance concrete projects funded through public-private partnerships and translate into greater competitiveness of Czech firms in ESA and elsewhere.

GOVERNMENT SUPPORT FOR SPACE EDUCATION

As in other countries, the Czech space industry desperately needs qualified university graduates with space expertise.[24] In this regard, a positive development was the establishment of the Space Applications Master's Degree program at the Technical University of Brno in 2022.[25] To address this issue comprehensively, there should be a thorough review of other existing engineering graduate and post-graduate programs to bolster this trend. Students are often motivated to propose a product to complete the course successfully, but there is often an inadequate reflection on whether and how such a product can succeed commercially. By linking these often compulsory student projects with the activities and mentoring of private space companies and the possibility of financial compensation for the students themselves, the country can create a more inspiring, innovative, and attractive environment for graduate degree applicants and cultivate future Czech space engineers.

This latter model of student projects is common, for example, in the United States.[26] Accordingly, to create an educational dynamic that meaningfully supports the development of local experts, a collaboration between ministries, universities, and industry is essential in the period ahead. This can be done through means of reducing bureaucratic obstacles in universities and building a portal connecting students directly to the companies, such as through the Brno Space Cluster page.[27]

24 "Česko má vesmírný potenciál, ale schází šikovní absolventi a dodavatelé". 2020. *idnes.cz*. https://www.idnes.cz/ekonomika/domaci/kosmicke-cesko-kosmicky-prumysl-budoucnost-vesmirna-mise.A200805_154322_ekonomika_kou.

25 "Space Applications Master's Programme". 2022. *Brno Institute of Technology: Faculty of Electrical Engineering and Communication*. https://spaceapps.cz.

26 "Česko má vesmírný potenciál, ale schází šikovní absolventi a dodavatelé". 2020. *idnes.cz*. https://www.idnes.cz/ekonomika/domaci/kosmicke-cesko-kosmicky-prumysl-budoucnost-vesmirna-mise.A200805_154322_ekonomika_kou.

27 "Brno Space Cluster". 2022. Brno Space Cluster. https://brnospacecluster.cz.

CONCLUSION AND RECOMMENDATIONS

Given the velocity of events in the space sector, the Czech Republic would be wise to invest the time, money, and political capital in its space sector now. As a member of the EU, ESA, and NATO, all of which recognize the strategic nature of the space domain, the Czech government now has a unique opportunity to define its role in the future European and global space domain - both in the civil/commercial sphere and defense.

Accordingly, a comprehensive national space strategy offering policies that would truly strengthen the space portfolio and bolster support for its space industry is central to the Czech Republic positioning itself as an industry leader in the CEE region. It would have the added benefit of promoting its strategic, political, and economic interests in the broader European and global space domain.

According to this Perspective, it is recommended to:

— Recognize the highly significant role that the private sector can play in expanding government space capabilities and derived applications, including cost reductions (while retaining government control), greater innovation, and strengthened performance based on realistic market expectations.

— Introduce a comprehensive government strategy for the development of national space capabilities which clearly states where and how the private sector can contribute to maintaining, and further bolstering, the ramp-up of the Czech private space sector.

— Strengthen the position of the Czech Republic in space deliberations in European and allied fora, including determining priority space sub-sector and supporting relevant industry partners, particularly in the areas of research and development.

— Position the Czech Republic to contribute significantly to the dialogue on global space governance, as well as shape the discussions concerning the economic and financial aspects of space security.

— Capitalize on a Czech think tank hosting the world's most prominent space security conference series, with the full support of the Ministries of Transport, Foreign Affairs, and Defence.[28]

— Provide a new source of influence for the Czech Republic, as being the leading allied country in exposing -- and seeking to remedy -- the ongoing Chinese and Russian strategy to compromise the space sectors of scores of countries through the forging of vertically-integrated "international space partnerships" designed to foster undue dependencies.

28 "PSSI Space Security Conference series". 2022. *PSSI*. https://www.pssi.cz/projects/69-pssi-space-security-conference-series.