

# A Decade of Growth: Space Education in Poland since Joining ESA

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## ABSTRACT

Since Poland's accession to the European Space Agency (ESA) in 2012, the country's space education landscape has undergone significant transformation. This e-poster highlights the current opportunities for space education in Poland, emphasizing university courses, international workshops, and training programs to students and professionals. Polish universities have established specialized programs to meet the growing demand for expertise in space-related fields. Leading institutions such as Warsaw University of Technology, Gdansk University of Technology, Wroclaw University of Science and Technology, and AGH University of Science and Technology offer courses in space engineering, satellite technologies, and aerospace engineering. In addition to academic programs, various international workshops and training programs facilitated by the ESA offer hands-on experience and advanced learning opportunities. ESA's Training and Learning Program, CubeSat Summer School, and the 'Fly Your Satellite!' initiatives provide invaluable practical training. ESA membership also grants access to scholarships at the International Space University. A program for young graduates, launched through cooperation between Polish and European agencies, as well as internships in the domestic space industry, further expand opportunities for professional development. This e-poster aims to provide a comprehensive overview of the current educational opportunities in Poland's space sector, highlighting the pathways available for students and professionals to engage with and contribute to this rapidly evolving field. It serves as a starting point of an evaluation and a discussion about country's space education system ten years after the establishment of the national space agency and amid growing interest in the area from both industry and government.

This conference proceeding highlighted Poland's evolving space education landscape since joining ESA, showcasing university programs, international training, and professional development opportunities in the country's growing space sector.

*Keywords:* Polish Space Agency, European Space Agency, space education

## **Una década de crecimiento: la educación espacial en Polonia desde su incorporación a la ESA**

### RESUMEN

Desde la adhesión de Polonia a la Agencia Espacial Europea (ESA) en 2012, el panorama de la educación espacial en el país ha experimentado una transformación significativa. Este póster electrónico destaca las oportunidades actuales de educación espacial en Polonia, con énfasis en cursos universitarios, talleres internacionales y programas de formación para estudiantes y profesionales. Las universidades polacas han establecido programas especializados para satisfacer la creciente demanda de expertos en campos relacionados con el espacio. Instituciones líderes como la Universidad Tecnológica de Varsovia, la Universidad Tecnológica de Gdansk, la Universidad de Ciencia y Tecnología de Breslavia y la Universidad de Ciencia y Tecnología AGH ofrecen cursos en ingeniería espacial, tecnologías satelitales e ingeniería aeroespacial. Además de los programas académicos, diversos talleres y programas de formación internacionales facilitados por la ESA ofrecen experiencia práctica y oportunidades de aprendizaje avanzado. El Programa de Formación y Aprendizaje de la ESA, la Escuela de Verano CubeSat y las iniciativas "¡Vuela tu Satélite!" ofrecen una valiosa formación práctica. Ser miembro de la ESA también da acceso a becas en la Universidad Internacional del Espacio. Un programa para jóvenes graduados, lanzado mediante la cooperación entre agencias polacas y europeas, así como prácticas en la industria espacial nacional, amplían las oportunidades de desarrollo profesional. Este póster electrónico busca ofrecer una visión general de las oportunidades educativas actuales en el sector espacial polaco, destacando las vías disponibles para que estudiantes y profesionales participen y contribuyan a este campo en rápida evolución. Sirve como punto de partida para una evaluación y un debate sobre el sistema de educación espacial del país diez años después de la creación de la agencia

espacial nacional y en un contexto de creciente interés en el área, tanto por parte de la industria como del gobierno.

Estas actas de la conferencia destacaron la evolución del panorama de la educación espacial en Polonia desde su incorporación a la ESA, mostrando programas universitarios, formación internacional y oportunidades de desarrollo profesional en el creciente sector espacial del país.

**Palabras clave:** Agencia Espacial Polaca, Agencia Espacial Europea, educación espacial

## 十年发展：波兰加入欧洲航天局以来的太空教育

### 摘要

自2012年波兰加入欧洲航天局(ESA)以来,该国的太空教育格局发生了重大转型。这张电子海报重点介绍了波兰目前的太空教育机会,强调了大学课程、国际研讨会、以及针对学生和专业人士的培训计划。波兰大学已经建立了专门的课程,以满足日益增长的、对太空相关领域专业知识的需求。华沙理工大学、格但斯克理工大学、弗罗茨瓦夫理工大学和AGH理工大学等领先机构提供空间工程、卫星技术和航空航天工程课程。除了学术课程外,ESA支持的各种国际研讨会和培训计划还提供实践经验和高级学习机会。ESA的培训和学习计划、CubeSat暑期学校和“放飞你的卫星!”(Fly Your Satellite!)倡议提供了宝贵的实践培训。ESA会员还可以获得国际空间大学的奖学金。波兰和欧洲机构合作推出的针对年轻毕业生的计划、以及一系列国内航天工业的实习进一步扩大了职业发展机会。这张电子海报旨在全面概述波兰航天领域目前的教育机会,重点介绍学生和专业人士参与和贡献这一快速发展领域的途径。它是对“国家航天局成立十年后该国的太空教育系统以及业界和政府对该领域日益增长的兴趣”进行评估和讨论的起点。

本次会议重点介绍了波兰加入欧空局以来不断发展的太空教育格局,展示了大学课程、国际培训、以及该国不断发展的太空领域的职业发展机会。

关键词:波兰航天局,欧洲航天局,太空教育

The Program of Activities for Space Technologies Development (Ministry of Economy [MoE], 2012) and the National Plan for Space Sector Development (MoE, 2014) laid the foundation for Poland's entry into the European Space Agency (ESA) in 2012 and the subsequent establishment of the Polish Space Agency (POLSA) in 2014. Both ESA membership and the national university initiatives aimed to develop space-related academic programs and facilitate opportunities for gaining knowledge through both domestic and international channels. The Polish Space Strategy (Council of Ministers, 2017) emphasizes this progress, stating: "The last few years, particularly since joining ESA in 2012, have been a period of dynamic growth in the Polish space sector." Education has played a vital role in this expansion, as previously only courses in Aerospace Engineering and Astronomy were available for students. This paper aims to highlight the changes in space education in Poland during the last decade and to present the evaluations of human resources conducted by the agencies.

## Methodology

This paper analyzes official Polish government documents (programs, plans, strategies) from 2012 onward, as well as reports issued by POLSA and ESA. Conference papers addressing advancements in space-related university courses were also reviewed. In addition, databases of Polish university courses and ESA training programs were examined.

## Results

### *New university courses*

Since 2014, the number of space-related university courses in Poland has grown significantly, with nine major institutions introducing specialized programs (Specht et al., 2018). In 2014, Warsaw University of Technology introduced a new specialization, *Cosmonautics*, as part of its Aerospace Engineering program. In 2015, the Military University of Technology in Warsaw launched undergraduate studies in *Space and Satellite Engineering*, targeting civilian students. Similarly, Lodz University of Technology introduced *Space Engineering* as an undergraduate program. POLSA's decision to locate its headquarters in Gdańsk fostered collaboration with local universities. In 2017, four institutions in Gdańsk and Gdynia launched the joint *Space and Satellite Technologies* program. This collaboration involved two faculties from Gdańsk University of Technology, Gdynia Maritime University, the Polish Naval Academy, and the University of Gdańsk (Chodnicki et al., 2018). In 2021, this program expanded through an agreement with the City University of Applied Sciences in Bremen, Germany, offering students the opportunity to earn dual degrees (Matevska et al., 2022). In 2020, Wroclaw University of Science and Technology introduced an undergraduate program in *Aerospace Engineering*, which is primarily focused on aeronautics but plans to offer a space-related master's degree in the future. For postgraduate studies, Warsaw School of Economics introduced

the *Managing Space in the New Economy* program in 2017, and Kozminski University launched an online course, *Entrepreneurship in the Space Sector*, in 2020. These programs are more business-oriented, designed to train future space industry managers.

### ***ESA and domestic programs***

ESA offers various training and learning programs through its academy, both on-site and online. Masters students can participate in internships, while graduates have access to the Young Graduate Trainee Program (YGT). The National Trainee Program, similar to YGT but co-funded by national agencies, began its first round for Polish citizens last year (Gapys, 2023). Except for Poland, four other ESA member countries are participating as well. ESA also provides access to its own scientific infrastructure (parabolic flight, drop tower, the Large Diametric Centrifuge) for students preparing theses and offers opportunities for CubeSat construction, rocket launches, and stratospheric balloon experiments. Moreover, the ESA membership grants Polish students access to scholarships at the International Space University.

Since 2016, the Polish space industry has organized an annual internship program for students in space-related fields. Additionally, POLSA annually awards monetary prizes for the best theses and dissertations. However, beyond this and the National Trainee Program, there is a noticeable lack of further initiatives from POLSA.

## **Evaluation of Human Resources in the Space Sector**

Two surveys targeting employers in the space sector were conducted by POLSA (Gruszecka et al., 2019) and ESA (Balcer et al., 2020). The surveys highlighted well-educated graduates in engineering, their strong mathematical and programming skills, as well as access to international internships and training opportunities, as key advantages. Conversely, the lack of experience in large-scale projects, difficulties in working with technical documentation, and limited understanding of the space environment were identified as significant challenges.

## **Conclusion**

Space education in Poland has experienced rapid development over the past decade. New university courses in space engineering have been established, and Poland's membership in the ESA has facilitated the transfer of knowledge from international specialists. Despite this progress, the limited number of domestic educational programs organized by POLSA remains evident. This study lacks quantitative data regarding the number of students enrolled in university courses, as well as the proportion of Polish citizens participating in ESA programs. Nevertheless, it serves as a foundation for further comparative analysis of current opportunities in Poland and those available in other ESA member countries.

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