



Polish Space Sector

ENTITY
DIRECTORY
2022

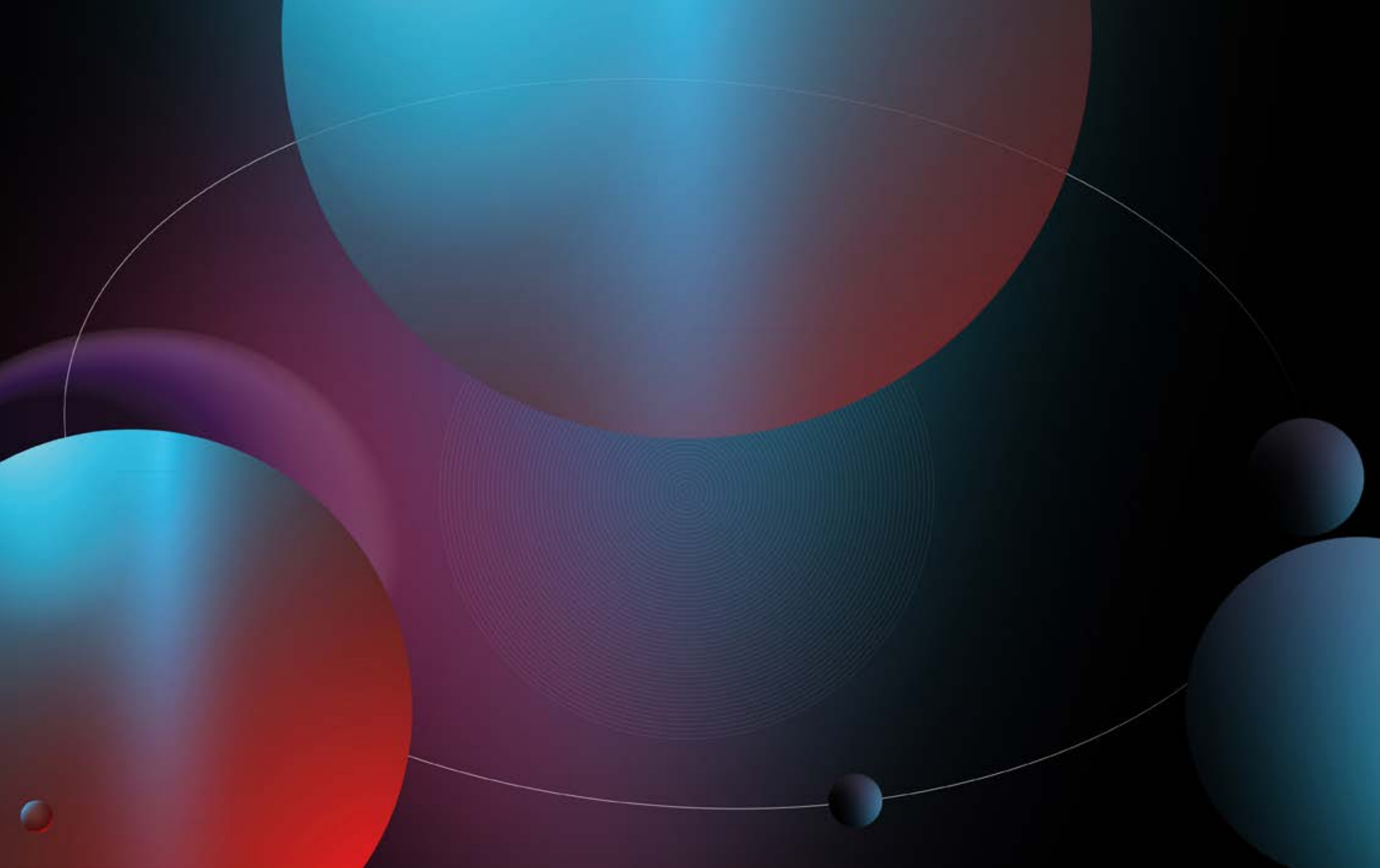
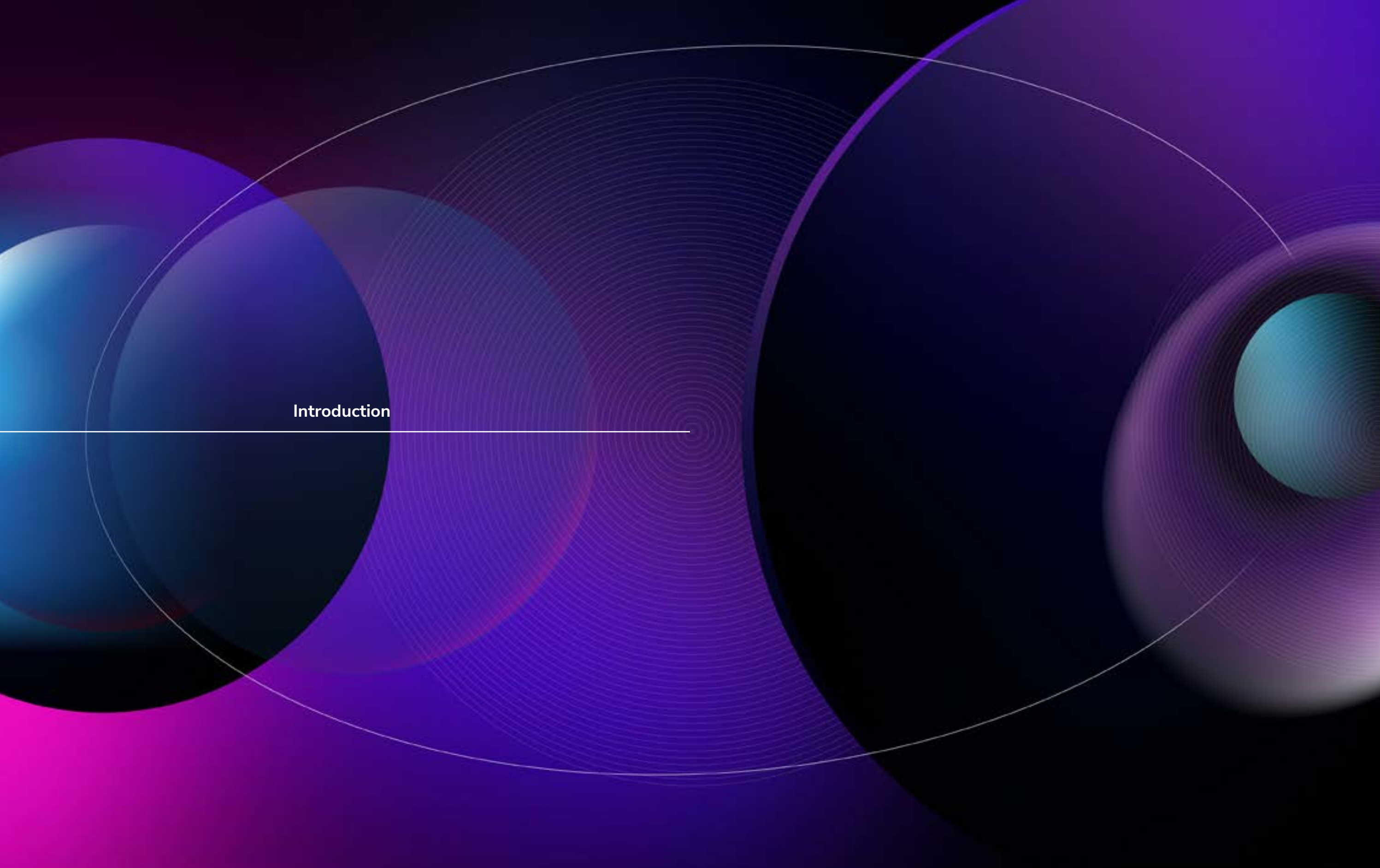


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Introduction

Directory of the space sector entities

Poland can look back on over 500 years of experience in space research and exploration. They were based on the revolutionary ideas of Nicolaus Copernicus and his followers, including Jan Heweliusz, great Polish astronomers from the 20th century and scientists working today. Over the years, scientists and engineers with Polish roots, working in the country and abroad, have created many valuable scientific concepts, inventions and devices that have become a permanent part of the history of the conquest of space.

Konstantin Ciolkowski and Ary Sternfeld created the theoretical foundations for the construction of multi-stage rockets and the calculation of spacecraft orbits. Mieczysław Bekker, Werner Kirchner, Eugeniusz Lachocki, Wojciech Rostański, Stanisław Stankiewicz and Kazimierz Piwoński worked on the American Apollo program. For over 40 years, the Space Research Center of the Polish Academy of Sciences has been implementing projects for on-board satellite devices and interplanetary space probes. The culmination of Poland's participation in the Soviet Inter-space program was the orbital flight of Mirosław Hermaszewski, and the descendants of Polish emigrants, Karol Bobko, Scott Parazynski, James Pawelczyk, George Zamka and Christopher Ferguson participated as astronauts in the American shuttle flight program. Over the last half century, Polish scientists and engineers have designed and constructed over eighty instruments used in space missions, such as Cassini-Huygens, Mars Express, Rosetta, Mars Curiosity Rover, Mars InSight, Venus Express, Herschel, Phobos-Grunt, BepiColombo, Solar Orbiter, or the planned Proba-3, Euclid, Juice, Arcus, Gamov, IMAP, Athena and others.

The domestic space sector currently gathers over 300 companies, employing nearly 12,000 people. Several dozens of them locate their business model entirely in the space sector, while for the rest it is part of their activity. These companies are particularly active in robotics and automation, mechatronics, on-board power supply systems, optical and communication systems for satellites, scientific sensors and soil penetrators for space probes, and software testing systems and subsystems of objects launched into orbit. For several years, work has also been underway on fully recoverable Polish sub-orbital missiles. They are intended to reach an altitude of over 100 km and take with them a load of several dozen kilograms, which would consist of various types of experiments, for which microgravity conditions are required.

The importance of the domestic space sector is constantly growing, because the exploitation of space is a development field based on the development of the latest technologies, setting ever new and ambitious goals. The growing importance of the space sector in the national economy also means a social return in the form of taxes paid to the state budget and building a positive image of the country. The cosmic industry, through its intensive development in the latest technologies, also inspires the young generation to self-improvement in the perspective of achieving the most ambitious goals.

Poland's accession to the European Space Agency (ESA) in 2012 became a catalyst for the development of the domestic space sector. As part of ESA programs, over the last 10 years Polish entities have obtained contracts for the amount of EUR 140 million under the European Space Agency. Thanks to membership in ESA, we have access to ground and space infrastructure, we cooperate with national agencies and the largest companies in the space sector, having the opportunity to develop native technologies and a significant share in the supply chain of international space projects. We also have the opportunity to develop human resources and participate in numerous educational programs.

The Polish Space Strategy adopted in 2017 – the basic document of Polish space policy – assumes the support for the Polish space sector in order to fully meet its expectations and needs and to be able to effectively compete on the European market. This goal is to be implemented, among others thanks to the introduction of the National Space Program, on which work is currently underway. The signing of the Artemis Accords agreement in 2021 also opens up prospects for our country to participate in the international exploration of the Moon and other bodies of the Solar System under the strategic leadership of the United States. This places Poland in the group of countries actively participating in the global market of space and satellite technologies, the use of which will determine future decades.

This catalog of Polish entities from the space sector is another study prepared by the Polish Space Agency. The publication contains information about the Polish space sector and its competences related to industry and science in the field of exploration and use of space. It is a useful and up-to-date source of information about the Polish space sector. We hope that our catalog will be helpful in making contacts that will result in new interesting projects.

prof. Grzegorz Wrochna
President of the Polish Space Agency





About the Polish space sector

The country in a nutshell

Poland is a Central European country with a population of 37.84 million in 2021. Poland's GDP increased by 5.7% in 2021. In 2020, the country invested 1.39% of its GDP in research and development. Poland joined the European Space Agency (ESA) in 2012.

Cosmic traditions

Poland's early space activities took place as part of the Soviet Union's Intercosmos program, which consolidated the countries of Eastern Europe and included them in the space activities of the USSR. Poland took part in the experimental satellite mission Copernicus-500 in 1973, and the first - and so far, only - Polish cosmonaut reached space in 1978.

After the end of the Cold War, Poland redirected its space cooperation to the west by signing the Agreement on cooperation with ESA in 1994, the ECS Agreement in 2007 and the PECS Charter in 2008. The country became a member of ESA in 2012 and in the same year launched its first native satellite, CubeSat PW-Sat 1, constructed by the Faculty of Power and Aeronautical Engineering of the Warszawa University of Technology in cooperation with the Space Research Center of the Polish Academy of Sciences.

Space management

The Polish Space Agency (POLSA) is responsible, inter alia, for supporting the Polish space industry, coordinating the participation of Polish industrial and scientific units in the ESA, EU, EUMETSAT, ESO and EDA programs, and promoting space research, space technology and satellite technology.

The agency operates under the supervision of the Ministry of Economic Development and Technology and reports to the POLSA Council, which includes representatives of several ministries, as well as representatives of space research and industry. In December 2021, the updated version of POLSA's statute entered into force, introducing a new organizational structure of the Agency, corresponding to the needs related to the implementation of the goals set by the Polish Space Strategy.

In May 2020, the position of the space plenipotentiary responsible for the departmental preparation and implementation of a comprehensive space strategy was created at the Ministry of National Defense. The plenipotentiary will represent the Ministry of National Defense at various international forums and will closely coordinate with POLSA the implementation of the Polish Space Strategy, especially in the field of security and defense.

The Space and Satellite Research Committee of the Polish Academy of Sciences, established in 1966, contributes to the development of the national space research policy. The Committee represents Poland together with the Ministry of Foreign Affairs and the Ministry of Economic Development and Technology in international forums: COPUOS (Committee on the Peaceful Uses of Outer Space) and COSPAR (Committee for Space Research).

National Space Strategy

In February 2017, the Polish government adopted the Polish Space Strategy, perceived as an important step in the modernization of the Polish economy, that emphasizes the importance of space for the global competitiveness and security of the nation now and in the future. The Polish Space Strategy covers the years 2017–2030.

The goal of the Polish Space Strategy until 2030 is to obtain a 3% market share by the Polish industry in Europe and the best possible use of satellite data for security and defense purposes, as well as to meet the domestic market's demand for related services. The strategy emphasizes that the creation of space infrastructure can significantly help to achieve these goals. In addition, increased capital investment in space assets, as well as optional ESA programs, should help Poland achieve its desired place in the European space sector, and thus constitute an important part of the national space strategy.

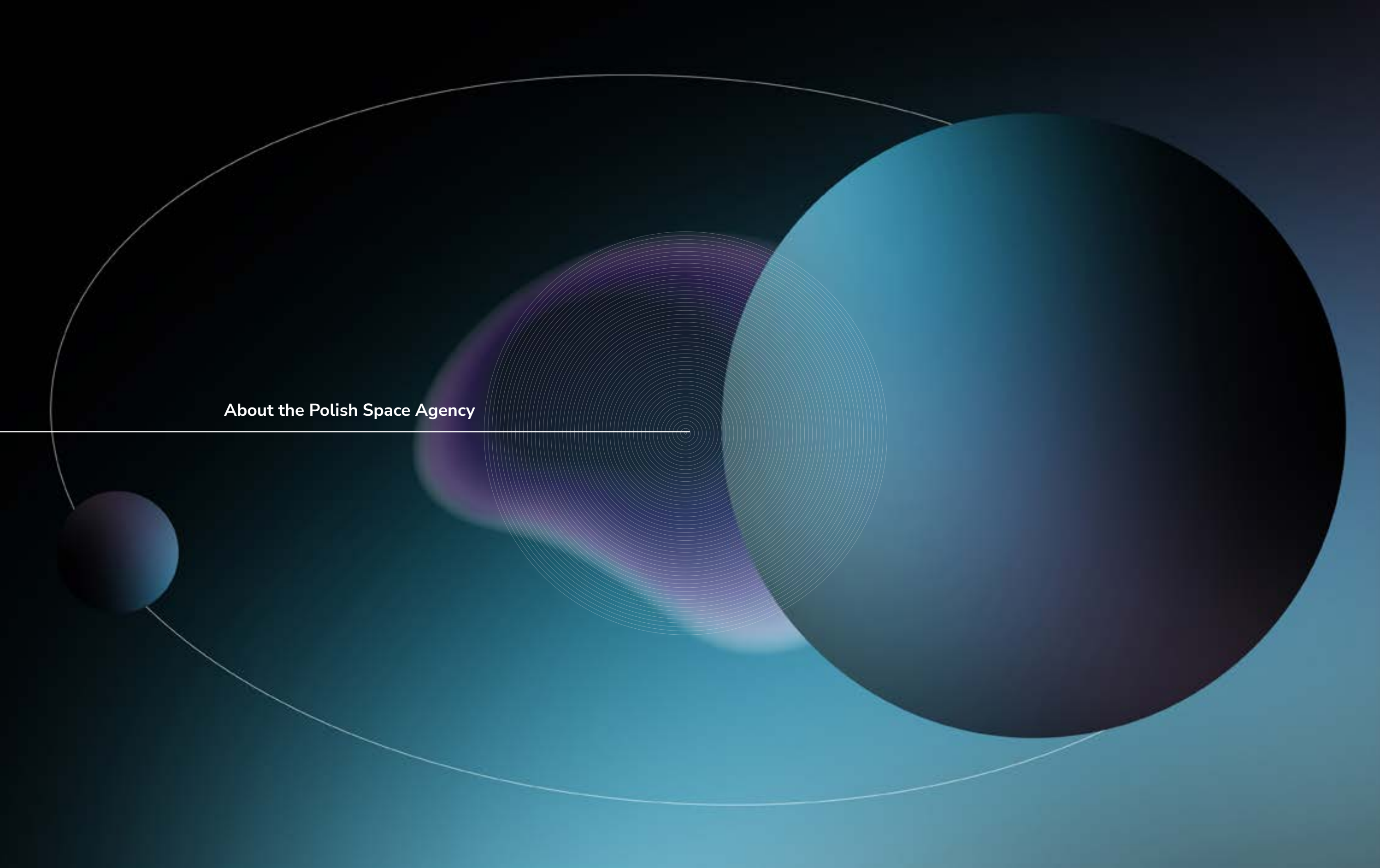
In addition to European cooperation with and through ESA, Poland has signed space cooperation agreements with China, Mexico, Brazil, Ukraine, Italy and France. In 2019, a joint declaration on space cooperation (in particular on space exploration) was signed with NASA, as well as an agreement with the US Strategic Command on space situational awareness (SSA) services and data. In 2020 POLSA became an associate member of the Committee for Earth Observation Satellites (CEOS) and in the same year Poland signed an agreement with NASA on cooperation in the helio-physical mission - Interstellar Mapping and Acceleration Probe (IMAP). In July 2021, POLSA published an analysis of the space sector in selected countries, indicating possible directions for international cooperation.

In October 2021, POLSA signed the Artemis Accords Agreement.

Outer space budget and the most important opportunities

Poland's total expenditure on space (including ESA and EUMETSAT) amounted to EUR 65.5 million in 2021. ESA contributions amounted to EUR 39.0 million in 2021, while EUR 12.4 million was allocated to EUMETSAT in 2021.

The European Space Education Resource Office (ESERO) is located in Warszawa, co-financed by ESA and the Copernicus Science Center - the largest science center in Poland (not related to the EU Copernicus program). ESA_Lab @ Gdańsk Technical University under the patronage of POLSA was inaugurated in November 2020, while another ESA_Lab @ Kozminski University was opened in February 2021.

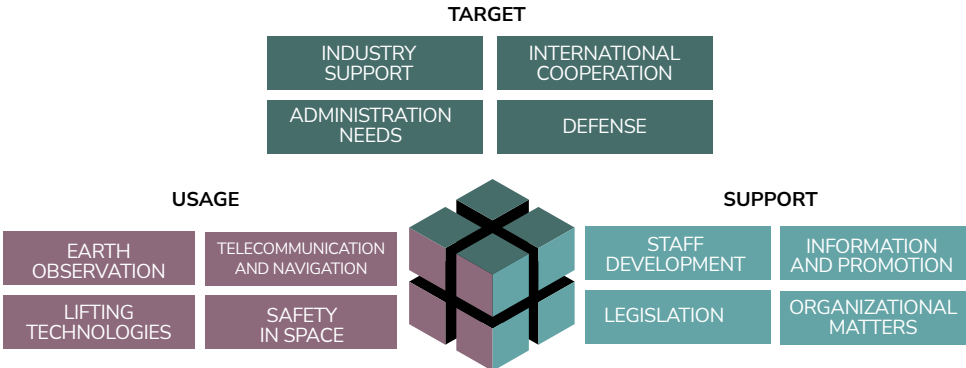


About the Polish Space Agency

Polish Space Agency

POLSA is an executive agency of the Ministry of Economic Development and Technology, established under the Act of September 26, 2014. Its task is to support the Polish space industry by implementing the priorities of the Polish Space Strategy.

- The tasks carried out by the Agency include:
- supporting the Polish space sector by connecting the world of science, business and administration,
 - supporting the introduction of regulations concerning the space sector in Poland,
 - supporting entrepreneurs in participating in international space missions and programs,
 - initiating agreements with entities from the space industry in Poland and abroad,
 - supporting state security and increasing defense capabilities through the use of satellite systems,
 - promoting the Polish space sector at home and abroad.



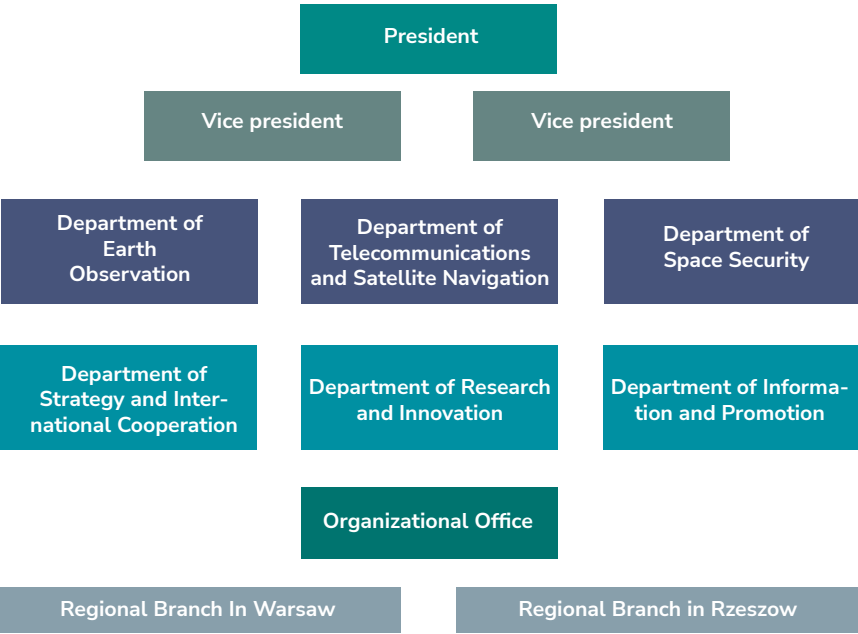
- The Polish Space Strategy adopted by the Council of Ministers in January 2017 sets goals for the Polish space sector until 2030:
- Polish economy and public institutions will have access to satellite infrastructure enabling them to meet their needs, especially in the field of security and defense.
 - Polish public administration will use satellite data for faster and more effective implementation of its tasks, and domestic enterprises will be able to fully meet the internal demand for this type of services and export them to other markets.
 - Polish economy and public institutions will have access to satellite infrastructure enabling them to meet their needs, especially in the field of security and defense.

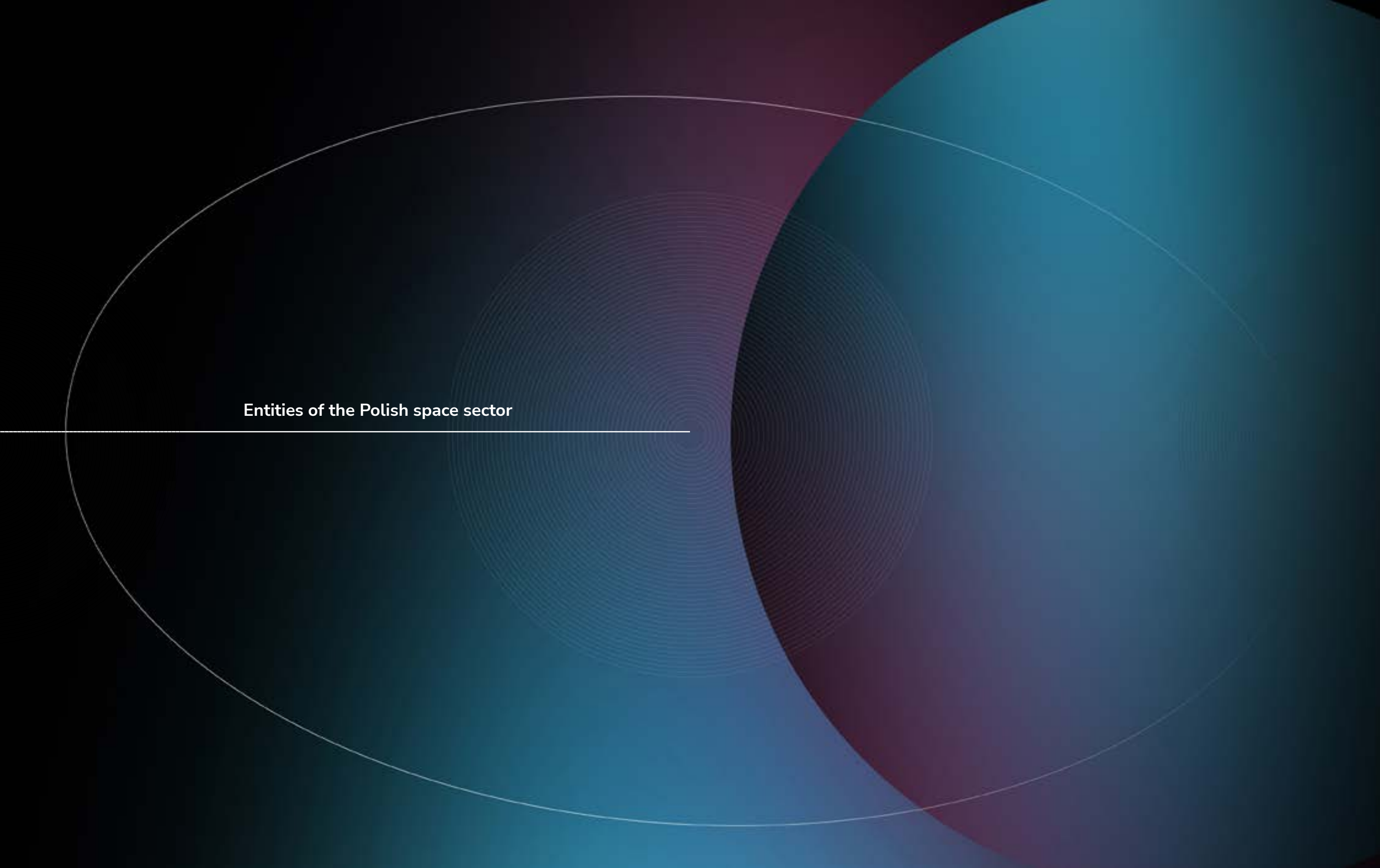
The Polish Space Agency cooperates with international agencies and state administration in the field of space research and use. One of the important tasks is also to support the Polish industry in order to increase its competitiveness on the European market and to obtain contracts by domestic companies with international organizations and institutions, especially the European Space Agency and the European Commission.

POLSA cooperates in the preparation and implementation of the National Space Program, which includes a number of instruments and mechanisms needed to engage Poland in ESA missions and programs, also serving the implementation of national goals in line with the Polish Space Strategy.

In accordance with the Polish Space Strategy, POLSA runs, among others, national space situational awareness system project. It also works for the development of satellite techniques (including navigation, observation and communication) in the economy, administration and everyday life – incl. in agriculture, forestry, land and sea transport, environmental monitoring, crisis management and weather forecasting. POLSA also conducts activities in the field of education and promotion.

Organizational structure of POLSA





Entities of the Polish space sector

6ROADS sp. z o.o.

6ROADS is a highly specialized company focused on providing SSA solutions, including SST and NEO. The infrastructural core of 6ROADS is a network of eight optical observatories located in various locations around the world. As a company, 6ROADS was established in 2016, however its experience dates back to 2003. Throughout the years of active contribution to the European SSA area, the company has constantly gained valuable experience, mostly from the projects conducted for the European Space Agency.

Main products and services:

- ▮ Observation of space objects.
- ▮ Activity within SST (Space Surveillance and Tracking).

The most important achievements in the space sector:

- ▮ Rantiga Observatory located in Tincana, Italy.

● Entity type: SME

● Main technological domains

○○○ Others (TD 26)

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Absiskey Polska sp. z o.o.

Entity type: SME

Absiskey Polska (formerly Kapitech) is a Polish company, founded in 2014, based in Warszawa, specializing in innovation management in the space business and consulting. Absiskey Polska’s mission is to increase the potential of their clients and partners by offering them strategies, tools and financing options (national and European) best suited to their research, development and innovation projects. The company provides a range of experts with 25 years of professional experience in various areas of the space sector.

The most important achievements in the space sector:

- Since January 2018, Absiskey Polska has been running SpaceHub, a permanent innovation place where monthly events aimed at popularizing the benefits of using Copernicus data and space technologies are organized.
- Absiskey Polska has been selected by the European Space Agency to act as ESA Space Solutions Network representatives in Poland as ESA Technology Broker and ESA Business Ambassador.

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Asseco Poland S.A.

Asseco Poland S.A. is the largest Polish software producer listed on the Warszawa Stock Exchange. For 30 years, it has been creating technologically advanced software for companies and organizations from sectors of key importance to the economy and for the Ministry of National Defense.

Main products and services:

- Mission monitoring and control.
- Use of terrestrial systems.

The most important achievements in the space sector:

- ESOC-LWMCS – a light web application designed to monitor and control cube-sat satellites. The application allows remote users to access the monitoring and control services of the satellite during the mission. The solution is fully compliant with the NMF (NanoSat MO Framework) architecture of the CCSDS standardization committee.
- EGNOS-SDATS (SBAS Data Analysis Tool Set) - the project developed a new toolkit for the rapid extraction and parsing of data obtained from RIMS and CFP for the detection of deviations and reporting of key parameters of the EGNOS system. The tool for qualifying the quality of service processing of the European EGNOS system has been improved, which has improved the availability and accuracy of GPS signals.
- SIMSAT (Software Infrastructure for Modeling Satellites) - a web-based graphical interface for satellite visualization during operations based on satellite architecture was developed to be used for simulation purposes. The component of the SIMSAT WebHMI interface guarantees direct communication between the core of the SIMSAT system and the web application.

Entity type: Large enterprise

Main technological domains

 Mission Operation and Ground Data Systems (TD 9)

 RF Subsystems, Payloads and Technologies (TD 6)

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Astri Polska sp. z o.o.



Astri Polska specializes in the following areas: 1) electronics - design and production of EGSE (Electrical Ground Support Equipment) devices, advanced equipment for testing satellite electronic systems and verification of radio communication compatibility between earth stations and satellites, and 2) satellite applications and services, including in the field of designing dedicated IT systems based on satellite technologies. The company is one of the Polish leaders in terms of involvement in the European Space Agency (ESA) programs. It also provides dedicated solutions commissioned by, among others: the European Commission (European Environment Agency, Horizon 2020), the World Bank or the National Center for Research and Development. Since its foundation in 2010, Astri Polska has been involved in over 50 projects.

Main products and services:

- EGSE (Electrical Ground Support Equipment) – integration and testing.
- RF Suitcase – integration and testing.
- Electrical, electronic and electromechanical components – wires and cables.
- Spacecraft data management.

The most important achievements in the space sector:

- GALILEO Transition Satellites (GTS) Platform Interface Simulator Assembly (PISA).
- MetOp-SG RF Suitcases - devices for the “S”, “X” and “Ka” bands test.
- JUICE Real Time Simulator Models Development - A test infrastructure for the JUICE explorer along with dedicated software to test and simulate the functioning of specific sub-systems of the explorer.

Entity type:
Large enterprise

Main technological domains

010101 Space System Software (TD 2)

System Design & Verification (TD 8)

Mission Operation and Ground Data System (TD 9)

Ground Station System and Networks (TD 12)

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Astronika sp. z o.o.



Astronika is a private company founded in 2013 by a unique group of engineers from the Space Research Center of the Polish Academy of Sciences (CBK PAN). We specialize in space instruments and mechanisms. In our portfolio, we have planetary missions to Mars - InSigth, and orbital missions, such as Juice. We also operate in the market of small and medium-sized satellites. We provide boom solutions on CubeSats, e.g., for the RadCube and HERA Juventas missions. We have our own machining workshop, ISO-8 clean room and a prototyping laboratory. We have a thermal-vacuum chamber and shock generation stand, as well as a bake-out for composite structures both in the scope of tests.

Main products and services:

- Antenna mechanisms (including electronic control system) used in satellites and space probes.
- Hold-release mechanisms.
- Implementation of SADM, SADE etc. standards.
- Elements used in chemical drives to distribute the flow, such as pipes, valves, actuators, filters, pressure transmitters, pressure regulators.

The most important achievements in the space sector:

- JUICE Mission LPPWI and RWI Instruments (TRL 8).
- InSight NASA mission – HP3 Instrument (TRL 9).
- RadMag Boom for RADCUBE mission (TRL 9).

Entity type: SME

Main technological domains

Automation, Telepresence & Robotics (TD 13)

Mechanisms (TD 15)

Structure (TD 20)

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aXpir

● Entity type: SME

● Main technological domains

 System Design & Verification (TD 8)

 Automation, Telepresence & Robotics (TD 13)

 Mechanisms (TD 15)

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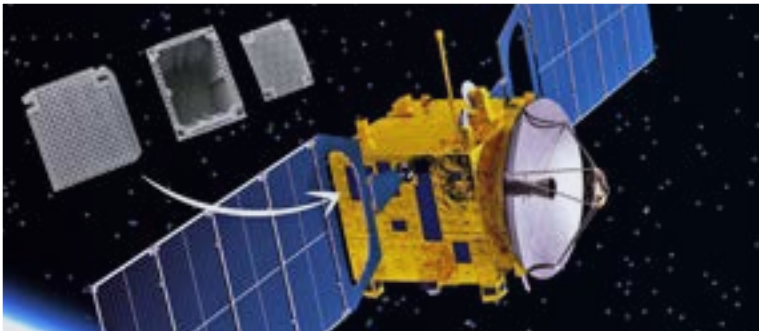
aXpir offers consulting services (engineering, project management, business development) in the space industry and hi-tech for a specified period or for a selected work package / project. The company also offers support in the recruitment process. The idea of aXpir is to support progress. We believe that combining the experiences of people who are open brings a lot of innovative ideas. In addition to improving hard skills, the company also focuses on soft skills and adapting to the partners' culture. The goal is to find people who will support the development of our partners in a long-term and effective way. The company also offers workshops and training for new employees (university graduates or those who are in the process of changing the industry).

Main products and services:

- ▶ Materials, mechanisms, parts and structures for satellites and space probes.
- ▶ Development of the space sector (ground segment).



Blue Dot Solutions sp. z o.o.



The company offers services related to technological expertise and defining products that use satellite data. Other services, include information and operating service related to the space sector and the development of entrepreneurial and design activities at an early stage. The company implements projects based on satellite navigation (including jamming, indoor positioning, etc.), Earth observation and integrated applications. It also develops modern materials with a porous structure and mechanics. In its projects, the company uses the expertise of a rich network of contacts in over 50 countries and the International Space University network. As part of the Space3ac accelerator mechanism, the company helped to obtain financing for R&D activities in the total amount of over PLN 23 million for over 100 small companies.

Main products and services:

- ▶ Satellites and probes – housings, components made of mesh structures.
- ▶ Design and verification of structures made of innovative materials (nanotubes, foams, self-regenerating materials).
- ▶ Ground segment data analysis.

The most important achievements in the space sector:

- ▶ Project „Development of a multifunctional housing for the needs of space and aviation electronics with particular emphasis on the so-called power electronics and power sources „, POIR.01.01.01-00-0581/17.
- ▶ Project “Fulfilling enhanced location accuracy in the mass-market through Initial Galileo Services”, H2020 Project 776436 (www.flamingognss.com).
- ▶ Project: „GroundEye - technological platform for monitoring mobile elements of ground infrastructure at airports”, RPPM.01.01.01-22-0099/16.

● Entity type: SME

● Main technological domains

 Flight Dynamics and GNSS (TD 10)

 Space Systems Electrical Power (TD 3)

 Thermal (TD 21)

 Structures (TD 20)

 Mechanisms (TD 15)

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Centrum Badań Kosmicznych Polskiej Akademii Nauk

(Space Research Center of the PAN)

● Entity type: Research and Development unit

● Main technological domains



On-board Data Subsystems (TD 1)



Space System Software (TD 2)



Space Systems Electrical Power (TD 3)



Space Systems Environments and Effects (TD 4)



Automation, Telepresence & Robotics (TD 13)

The Space Research Center of Polish Academy of Sciences is the only interdisciplinary research institute in Poland, whose entire substantive activity is related to the research of the outer space, the Solar System and the Earth bodies, while using space technologies and satellite techniques. It was established by the decision of the Presidium of the Polish Academy of Sciences on September 29, 1976, and began operating on April 1, 1977. Since 1991, it has been cooperating with the European Space Agency, and since Poland entered the ESA structures in 2012, it has been the main institution coordinating the activities of Polish companies from the space industry sector within ESA projects.

The Center cooperates with the world's largest institutions in the field of space exploration, it conducts its own experiments as part of NASA and ESA missions, collaborates with Centre National d'Études Spatiales, JPL and many others.

More than 70 research instruments sent into space on board of the satellites and interplanetary probes have been developed at the CBK PAN, incl. Solar Orbiter, Chang'E-4, InSight, Herschel, Koronas-Foton, Rosetta, Mars Express and Cassini-Huygens. The first Polish scientific satellites „Lem” and „Heweliusz” were also integrated and expanded here.

Currently, the institute's employees are involved in several ground-breaking space missions, including:

- ▶ ESA mission to the moons of Jupiter – JUICE.
- ▶ Two solar research projects: Solar Orbiter and PROBA-3.
- ▶ The Comet Interceptor mission that aims at „catching” and studying a comet from outside the solar system.
- ▶ Construction of the Ariel space observatory.
- ▶ NASA IMAP heliospheric mission.

Main products and services:

- ▶ Electronics in satellites and space probes.
- ▶ On-board data management for satellites and space probes.
- ▶ Satellite payloads.
- ▶ Radio and microwave communication.

The most important achievements in the space sector:

- ▶ Participation in the NASA IBEX and IMAP missions: the discovery of the IBEX Ribbon, i.e. the area of increased energy fluxes of hydrogen atoms, was a surprising result of the NASA Interstellar Boundary Explorer (IBEX) mission, in which a team of researchers from the CBK PAS participated. Thanks

to these scientific achievements, NASA decided to participate in the next interstellar mission, Interstellar Mapping and Acceleration Probe (IMAP), the launch of which is scheduled for 2024. The GLOWS instrument, the development and delivery of which is the responsibility of the CBK PAN, is the only non-American instrument in the IMAP mission. Its author - prof. Maciej Bzowski - holds the prestigious position of the main researcher (PI, Primary Investigator) of the instrument, and at the same time he is a co-researcher (Co-I, Co-Investigator) of the second instrument in the mission.

- ▶ The IBEX project was financed by the National Science Center, while IMAP is financed from an increased statutory subsidy granted for this purpose by the Ministry of Science and Higher Education.
- ▶ Involvement in ESA's first major flagship mission, Jupiter Icy Moon Explorer (JUICE), whose main scientific goal is to understand the complex system of interactions within the Jupiter system. The mission provides the opportunity to learn about the environment around Jupiter and its moons, to conduct advanced basic research and technological development. The JUICE mission will spend three years in the orbit of Jupiter, making precise observations of the largest planet in our solar system and its largest moons: Ganymede, Callisto and Europa. CBK PAN is responsible for the development and delivery of essential elements in two scientific instruments for this mission in cooperation with Polish industrial entities.
- ▶ Because of the involvement in JUICE, CBK PAN was invited to participate in the next ESA Comet Interceptor mission, in which a Polish scientist is responsible for the entire instrument (PI of the instrument).
- ▶ Development of the concept of an advanced, reconfigured on-board computer for future satellite missions, which involves a departure from the standard, very expensive and hard-to-reach element base in favor of using components commonly used in commercial electronic devices (the so-called COTS - Commercial Off-The-Shelf). The idea of a cheap device that can be produced in a short time, meeting the requirements of space missions, fits in with the assumptions of a new strategy for the development of the space market, the so-called New Space. The concept of the device was tested under the ESA project (technological level TRL 3, corresponding to the laboratory prototype), and is currently being developed under the Foundation for Polish Science program (technological level TRL 6, corresponding to the prototype tested in conditions corresponding to the space mission) and planned for the future for implementation (the highest technological level TRL9, meaning verification of the device's operation in a real space mission).
- ▶ Sources of financing: the HIPERO project from ESA / PLIS funds and its continuation under the FNP TeamTECH program.

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**Centrum Astronomiczne im. Mikołaja
Kopernika Polskiej Akademii Nauk (CAMK)**
(Nicolaus Copernicus Astronomical Center of the PAN)



Nicolaus Copernicus Astronomical Center Polish Academy of Sciences is a leading Polish research institute in the field of astronomy and astrophysics. It has existed in its present shape since 1978. Observational and theoretical research is carried out here in the field of stellar astrophysics, binary systems, circumstellar matter, dense matter, neutron stars, black holes, accretion processes, structure and evolution of active galaxies, cosmology, extrasolar planets, recording of gravitational waves.

Main products and services:
► BRITE ground station service and data analysis.

The most important achievements in the space sector:
► ATHENA.
► BRITE.
► INTEGRAL.

● Entity type: Research and Development unit

● Main technological domains

 Ground Station Systems and Networks (TD 12)

 Mission Operation and Ground Data Systems (TD 9)

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CIM-mes Projekt sp. z o.o.

CIM-mes Projekt is a design office operating on the market since 1987. It solves engineering problems using computer simulation methods. It provides design and analysis services for various devices - from computation for compliance with the standard to advanced FEM strength analysis and fluid mechanics / CFD multiphysics. It carries out projects for companies such as VALEO, AVIO and ArcelorMittal. It also takes care of the development of dedicated applications for engineering simulations. The company's experience allows to provide reliable analyzes. It also specializes in unusual tasks and engineering problems that require extensive knowledge in many fields of technology.

Main products and services:
► Computational Fluid Dynamics (CFD).
► Computational tools.
► Creating environment models.
► Structural Engineering – software.
► Heat engineering – software.
► System modeling and simulation.

The most important achievements in the space sector:
► Cooperation with AVIO in the field of strength analyzes of the M10, VEGA-E engine.
► Development of particulate pollution modeling software.

● Entity type: SME

● Main technological domains

010101
010101
010101 Space System Software (TD 2)

 Fluid Dynamics (TD 18)

 Propulsion (TD 19)

 Structures (TD 20)

 Thermal (TD 21)

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CloudFerro sp. z o.o.



CloudFerro provides innovative cloud computing services. It provides and supports cloud computing for demanding markets, incl. for the European space industry, climate research and science. It specializes in the storage and processing large data sets, including multi-terabyte repositories of Earth observation satellite data.

The company offers flexible solutions in the public, private and hybrid cloud model, based on open technologies, tailored to the user's needs and cost-effective. It provides many additional services and provides technical support, carried out by a local team of IT specialists with unique competences.

CloudFerro solutions are used by leading companies and scientific institutions in Europe from various market sectors, that process large data sets: European Space Agency (ESA), EUMETSAT, European Center for Medium-Range Weather Forecasts (ECMWF), Mercator Ocean International, German Aero-Space Agency (DLR), EGI and many more.

The most important achievements in the space sector:

- ▶ Building clouds and providing cloud services for two of the five European Copernicus DIAS (Data and Information Access Services) platforms: CREODIAS and WEKEO.
- ▶ Construction and operation of the national CODE-DE platform for Germany, combining access to Earth observation data with their flexible processing.
- ▶ Implementation and maintenance of the Copernicus CLIMATE DATA STORE hybrid cloud at the request of the European Center for Medium-Range Weather Forecasts.

● Entity type: SME

● Main technological domains

010101 Space System
010101 Software (TD 2)

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Creotech Instruments S.A.



Creotech Instruments is a leading Polish manufacturer of satellite systems and components as well as advanced electronics used, among others, in quantum computer control systems.

The company also operates in the field of unmanned aerial systems – it provides devices and software, e.g. to supervise the movement of drones.

The company has its own electronics assembly plant and small satellite integration facilities. Its portfolio includes 26 projects implemented for the space sector, 10 space missions involving Creotech Instruments subsystems, including 4 missions of the European Space Agency.

Main products and services:

- ▶ On-board software.
- ▶ On-board data management.
- ▶ Power monitoring and control.
- ▶ Satellite platform.
- ▶ Heat storage and reflection.

The most important achievements in the space sector:

- ▶ Participation in the ExoMars mission.
- ▶ Participation in the ASIM mission.
- ▶ Participation in the OP-SAT mission.

● Entity type: SME

● Main technological domains



System Design
& Verification (TD 8)



Materials and
Manufacturing
Processes (TD 24)



On-board Data
Subsystems (TD 1)



Space Systems
Electrical Power
(TD 3)



Structures (TD 20)

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Fundacja Partnerstwa Technologicznego TECHNOLOGY PARTNERS

(Technology Partnership Foundation)

TECHNOLOGY PARTNERS is a scientific and research organization founded in 2003. By the decision of the Polish Minister of Science, it was granted the status of the Center of Advanced Technologies. Its mission is to develop and support the cooperation of the Polish S&T sector with the international scientific community and industry, and to support the transfer of innovative technologies to SMEs. TECHNOLOGY PARTNERS specializes in research and innovation management and in the implementation of large multidisciplinary research projects. It conducts research as a general contractor of multidisciplinary projects and creates research teams that bring together the best specialists in the subject area of the project. The research areas in which it carries out its research include, among others, materials engineering, air and space transport, and the application of data obtained by satellite Earth observation.

Main products and services:

- ▶ Composite materials for lifting systems.
- ▶ Composite materials used in satellites and space probes.

The most important achievements in the space sector:

- ▶ Development of a technology for the production of nonwovens doped with carbon nanotubes enabling the design of mechanical, electrical and thermal properties of composite structures (GFRP, CFRP).
- ▶ Development of the production technology of ice-phobic and hydrophobic water-borne polyurethane coatings for use on various surfaces.
- ▶ Collaboration in the incubation and acceleration of young space sector companies, e.g., under the project H2020 Go2Space-HUBs – Generating new sOlutions 2 and from Space through effective local start-up HUBs (cordis.europa.eu/project/id/690819).

● Entity type: Foundation, Research and Development unit

● Main technological domains



Materials and Manufacturing Processes (TD 24)



Structures (TD 20)

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GIAP

GIAP sp. z o.o.

The GIAP company is a key supplier of solutions based on GIS-class software for public administration, institutions, business and selected sectors of the economy. The products offered by the company enable comprehensive analysis and management of terrestrial data, supporting companies and public institutions in obtaining comprehensive information about space.

By integrating spatial, satellite and aviation data, the GIAP software allows to create analysis that enable effective space management, investment planning and environmental protection.

Thanks to the experience and knowledge gained, a wide portfolio of products and services as well as the company's flexible policy, GIAP solutions constitute a key pillar in activities for the digital transformation of local governments and the transformation of analogue processes into digital ones. Cooperation with GIAP opens the way for clients and partners to a competitive, technological and strategic advantage.

In the GIAP systems that the company creates and delivers, various types of data are used and integrated, creating comprehensive and integrated GIS systems. The company schedules, combines and organizes spatial data from many sources - terrestrial, satellite, aerial and photogrammetric data, and thanks to the interpretation of information about the indicated area is consistent.

The portfolio of GIAP includes over 300 implementations in Poland in the field of delivery and implementation of dedicated Spatial Information Systems for public administration, institutions, business and selected sectors of the economy. The output data for our implementations are satellite, aviation and photogrammetric data, on the basis of which system users perform various types of comparative analysis of the area, spatial statistics and inventory of space (e.g., inventory of squares, parks and green areas in the city).

GIAP provides dedicated map portals and 3D data portals for investors and interested parties.

With the use of online tools offered by the company, each user can easily visualize the planned investment in relation to the terrain conditions and the level of urbanization and can analyze the shading of the area. The input data for three-dimensional studies are digital elevation models (DEMs).

Main products and services:

- ▶ GIS software.
- ▶ Terrestrial data management.
- ▶ Dedicated map portals, 3D data portals.

● Entity type: SME

● Main technological domains

010101
010101
010101

Space System Software (TD 2)



System Design & Verification (TD 8)



Mission Operation and Ground Data Systems (TD 9)

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● Entity type:
Large enterprise

● Main technological domains

 On Board Data Subsystems (TD 1)

 Space System Software (TD 2)

 Mission Operation and Ground Data systems (TD 9)

 Flight Dynamics and GNSS (TD 10)

 Space Debris (TD 11)

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GMV Innovating Solutions sp. z o.o.



GMV Innovating Solutions sp. z o.o. was established in 2008 as the Polish branch of the international GMV group. The company implements in Poland a whole range of products and services that is offered by the GMV group and carries out its own projects in the following sectors: space, transport, defense and security. GMV offers comprehensive IT solutions built on the basis of close cooperation with customers and users. One of the main recipients of the services and products of the Polish branch of GMV is the European Space Agency (ESA). The company also cooperates with the largest companies in the European space sector and entities of the Polish space sector. The Polish branch consists of 80% of engineers of various specializations (IT, mechanics, telecommunications) and has its own technical and service facilities.

Main products and services:

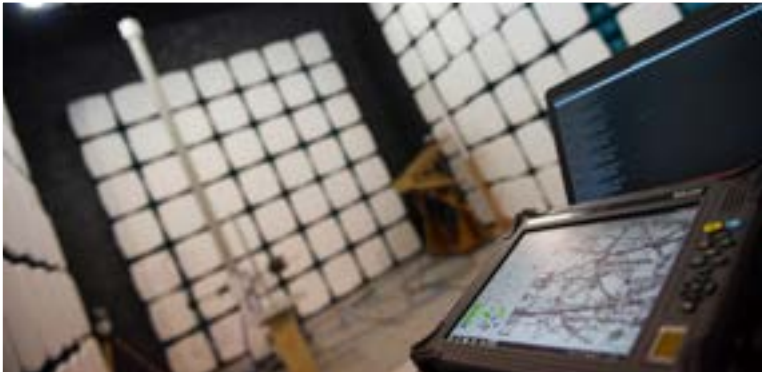
- Mission control.
- Software for terrestrial systems – AOCS, GNC.
- Terrestrial communication – monitoring and control
- GNSS receivers.
- Satellite operation.

The most important achievements in the space sector:

- On-board software – delivery of on-board software for the OPS-SAT satellite, ADCS system, FDIR (OPS-SAT Phase B2 / C / D / E1). Satellite placed in orbit in 2019.
- SW GNSS receivers – programmable GNSS receivers for small rockets and small satellites. Test flights will be performed on the MIURA-1 rocket and on board the GOMX-5 satellite as part of the ESA mission.
- Satellite data processing – development of data processing algorithms, data quality control, data orchestration for missions such as: SWARM, EarthCARE, ALEOS, BIOMASS.



Hertz Systems sp. z o.o.



Hertz Systems has been operating with passion for technology for over 30 years. It offers comprehensive solutions – from design to production, assembly, integration, testing and training. It provides hardware and software solutions for the military, government and European institutions, and the private sector. Hertz Systems is active in the military market, for over a decade it has been providing the Polish Armed Forces with a satellite navigation receiver integrated with a cryptographic module. The company is the only Polish producer of this type of receivers. The company carries out space projects related to GNSS systems for the downstream segment and sensors for space applications. It is also working on the development of the PRS service of the European GALILEO system, actively striving to produce PRS receivers in Poland.

Main products and services:

- GPS receivers integrated with the SAASM cryptographic module.
- GNSS receivers.
- Jastrzab system – detection and neutralization of drones.
- TEMPEST equipment.

The most important achievements in the space sector:

- As the only Polish entity, it participated in a project related to the development of the Galileo PRS receiver.
- Membership in the Consortium building the Space Technology Park, which will be located in the western part of Poland (near Zielona Góra, the company's headquarters). Many specialized laboratories will be created in the park.
- Development of dual GPS / Galileo receivers for terrestrial applications to improve user safety.
- SIMSAT (Software Infrastructure for Modeling Satellites) – a web-based graphical interface for satellite visualization during operations based on the satellite architecture to be used for simulation purposes was developed. The component of the SIMSAT WebHMI interface provides direct communication between the core of the SIMSAT system and the web application.

● Entity type: SME

● Main technological domains

 Space Systems Software (TD 2)

 RF Subsystems, Payloads and Technologies (TD 6)

 System Design & Verification (TD 8)

 Flight Dynamics and GNSS (TD 10)

 Ground Station System and Networks (TD 12)

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ICEYE

Iceye Polska sp. z o.o.



ICEYE is a world leader in the use of SAR (Synthetic Aperture Radar) radar technology in microsatellites. The company supports making better decisions by providing access to up-to-date and reliable satellite imagery for any place on Earth, regardless of the time of day and weather conditions.

Main products and services:

- ▮ Construction of the space segment – microsatellites.
- ▮ Mission operation and management.
- ▮ Ground station control.
- ▮ SAR radio and radar instruments.
- ▮ Data management systems onboard the satellite.

The most important achievements in the space sector:

- ▮ The world's first successfully orbited microsatellite equipped with synthetic aperture radar.
- ▮ The world's largest commercial SAR satellite constellation (14 missions).
- ▮ The only global tool for flood impact analysis.

● Entity type: SME

● Main technological domains

 System Design & Verification (TD 8)

 Mission Operation and Ground Data Systems (TD 9)

 RF Subsystems, Payloads and Technologies (TD 6)

 On-board Data Subsystems (TD 1)

010101 Space System
010101 Software (TD 2)
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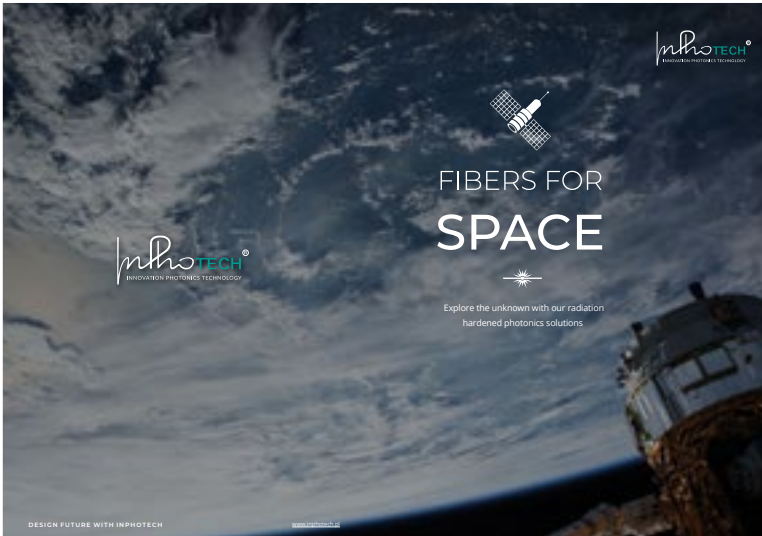
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InPhoTECH[®]
INNOVATION PHOTONICS TECHNOLOGY

InPhoTech sp. z o.o.



InPhoTech is a Polish company of advanced technologies that creates modern solutions for the industry based on fiber optic photonics, defined as the technology of the 21st century. InPhoTech addresses its solutions to such sectors as: railroad, gas industry and telecommunications.

The company knows the potential of optical fibers and knows how to use it, developing completely new solutions that are designed for use in demanding conditions on land, underground and in space. It creates intelligent structures that - integrated with the fiber optic sensor – enable real-time monitoring of many parameters throughout the structure. Thanks to modern solutions, the company provides customers with a sense of security, increased efficiency and competitiveness, while limiting the negative impact of their activities on the natural environment.

Main products and services:

- ▮ Sensors used in satellites and space probes.
- ▮ Manufacture of parts for satellites and space probes.

The most important achievements in the space sector:

- ▮ Radiation hardened multicore optical fiber amplifier.
- ▮ Finesse project - ESA Contract No. 4000123665/18/NL/BJ.
- ▮ Development of a flyer with special fibers for space usage.

● Entity type: SME

● Main technological domains

 Optics (TD 16)

 Optoelectronics (TD 17)

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Instytut Agrofizyki im. Bohdana Dobrzańskiego Polskiej Akademii Nauk

(Bohdan Dobrzański Institute of Agrophysics
of the Polish Academy of Sciences)

Bohdan Dobrzański Institute of Agrophysics (IA PAN) is a research unit of the Polish Academy of Sciences in the group of institutes of the Second Department of Biological and Agricultural Sciences. Interdisciplinary basic research conducted at the Institute of Agrophysics is aimed at understanding the processes of mass and energy transport in the soil - plant - atmosphere system and factors related to soil quality, the quality of agricultural plant raw materials and processing for nutritional and energy purposes. The conducted research uses the knowledge of physics, physicochemistry and biology to solve current agricultural problems. Application research is focused on the development and improvement of methods and devices for the assessment and monitoring of soil, agricultural plant raw materials and gas emissions, as well as food production technologies and biomass processing for energy purposes or the production of new biomaterials and bioproducts.

Main products and services:

- User operations in the ground segment – tool management, data analysis etc.

The most important achievements in the space sector:

- Implementation of the SWEX / R project „Soil, Water and Energy Exchange - Research”, financed under the ESA - PECS program (European Cooperating State Agreement between the Government of the Republic of Poland and the European Space Agency), theme package No. 98084; coordinator from the Space Research Center of the Polish Academy of Sciences: Dr. Wojciech Marczewski, representative of the Institute of Agrophysics of the Polish Academy of Sciences: prof. dr hab. Bogusław Usowicz.
- Implementation of the project „ELBARA_PD (Penetration Depth)”, No. 4000107897/13 / NL / KML (AO 1-7021) financed under the ESA - PECS program (European Cooperating State Agreement between the Government of the Republic of Poland and the European Space Agency); head: Dr. Mateusz Łukowski.
- Implementation of the project „Technical Support for the Fabrication and Deployment of the Radiometer ELBARA-III in Bubnow, Poland”, no. 4000113360/15 / NL / FF / gp, financed by the European Space Agency; head: Dr. Mateusz Łukowski.

- Entity type: Research and Development unit

- Main technological domains



Thermal
(TD 21)

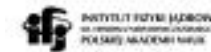


Environmental
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Support (ECLS) and
In Situ Resource
Utilisation (ISRU)
(TD 22)

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Instytut Fizyki Jądrowej im. Henryka Niewodniczańskiego Polskiej Akademii Nauk

(Henryk Niewodniczański. Institute of Nuclear Physics
of the Polish Academy of Sciences)

Henryk Niewodniczański Institute of Nuclear Physics of the Polish Academy of Sciences conducts basic and applied research in the field of physics and related sciences. With the use of the latest technological and IT achievements, IFJ PAN studies the structure of matter and the properties of fundamental interactions from the cosmic scale to elementary particles. Research results are published annually in over 600 articles in peer-reviewed scientific journals and in over 100 other types of publications: monographs, conference reports and reports. Every year, the Institute organizes or co-organizes many international and national scientific conferences, seminars and other scientific meetings.

Main products and services:

- Building Blocks (BB) sensors used in satellites and space probes.
- Electrical, electronic and electromechanical components.

The most important achievements in the space sector:

- The European Space Agency (ESA) Experiment Matroshka 2a and 2b project: Measuring Radiation Hazards in Space - the experiment was based on long term (2004–2009) measurements of cosmic radiation doses in anthropomorphic models of the human body at the International Space Station in Earth orbit. The results of the measurements allowed for a realistic assessment of astronauts' exposure to radiation. Very unique research is the result and continuation of the Matroshka project. This research is one of the main tasks of the first flight of the new American Orion manned spacecraft to the orbit of the Moon (mission Artemis-1) planned for the end of 2021: „MARE - the Matroshka AstroRad Radiation Experiment”.
- The „DOSIS 3D” experiment (from 2012 to the present). Participation in the experiment is financed by the NCN HARMONIA project „Spatial distribution of cosmic radiation dose on the International Space Station - DOSIS 3D” in 2013–2016. The project involves measurements with thermoluminescent and trace detectors in the Columbus module of the International Space Station to determine the cosmic ray field and its variability over time.
- Radiation of space electronics elements - for the purposes of the project, two stations at the AIC-144 cyclotron were adapted at the IFJ PAN. The first irradiation of the elements of the Polish artificial satellite „Heweliusz” was carried out in 2012. In the following years, irradiation was carried out using a proton beam for commercial companies at a dedicated stand, as part of the radiation resistance tests of electronic systems designed for space applications.

- Entity type: Research and Development unit

- Main technological domains



Space Systems
Environments and
Effects (TD 4)



Electrical, Electronic
and Electro-
mechanical (EEE)
Components and
Quality (TD 23)

- Contact information

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Instytut Fizyki Plazmy i Laserowej Mikrosyntezy im. Sylwestra Kaliskiego

(Sylwester Kaliski Institute
of Plasma Physics and Laser Microfusion)

Works carried out at IFPiLM include, among others, use of controlled nuclear fusion to generate electricity. The research program (in cooperation with leading centers from abroad) concerns, among others, manufacturing methods, physical properties and processes related to inertia held laser plasma and fusion plasma confined in magnetic traps. An important direction developed at IFPiLM, based on the experience gained by IPPT PAN in cooperation with the French CNRS, is research on plasma satellite propulsion. Prototypes of these drives (Hall motors and PPT pulse plasma motors) constructed at IFPiLM are tested in the Laboratory of Plasma Satellite Drives, created in recent years from scratch, and have been tested at the ESA Propulsion Laboratory of the European Space Agency.

Main products and services:

- ▶ Mission control and use of ground system.

The most important achievements in the space sector:

- ▶ KLIMT – Krypton Large IMpulse Thruster, ESA Contract No.4000107746/13/NL/KLM.
- ▶ HIKHET – High Voltage Krypton Hall Effect Thruster, ESA Contract No. 4000122415/17/NL/GE.
- ▶ LμPPT Innovative Liquid Micro Pulsed Plasma Thruster system for nanosatellites, EC / FP7 contract No. 283279.

- Entity type: Research and Development unit

- Main technological domains



Propulsion
(TD 19)

- Contact information

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Instytut Geodezji i Kartografii

(Institute of Geodesy and Cartography)



The main task of the Institute is to conduct research and application works in the field of geodesy and cartography and related disciplines for the purposes of science, geodetic and cartographic practice for the purposes of government and local government administration, state security, as well as for the needs of geodetic and cartographic contracting units. An important part of the Institute's activity is also conducting research and application work in the field of basic geodetic measurements, as well as on the use of aerial and satellite remote sensing in agriculture, environmental protection, spatial management and public statistics. The unit cooperates with many national, foreign and international institutions and organizations in the implementation of research and development works.

Main products and services:

- ▶ User operations in the terrestrial segment – data analysis.
- ▶ Drought models.

The most important achievements in the space sector:

- ▶ ESA EOStat: Agriculture Poland: Services for Earth Observation-based statistical information for agriculture.
- ▶ ESA Drought: Service 4 Drought Monitoring applying Satellite Data (DISS agricultural drought identification indicator).
- ▶ ESA SAT4EST: Earth observation based service supporting local administration in non-state forest management.

- Entity type: Research and Development unit

- Main technological domains

010101 Space System
010101 Software (TD 2)

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Instytut Obserwatorium Astronomiczne, Wydział Fizyki, Uniwersytet im. Adama Mickiewicza

(Astronomical Observatory Institute, Faculty of Physics,
Adam Mickiewicz University)

Astronomical Observatory Institute (IOA) of Adam Mickiewicz University is a leading center in Poland in the field of research on the movement of artificial satellites, space debris and asteroids approaching the Earth, and therefore has been participating in space security programs (SSA) for many years, implementing various research and development projects.

The Astronomical Observatory has been participating in international research on the movement of artificial satellites almost from the very beginning of the space age. The currently used telescopes in the SSA program are PST1 at the Astrogeodynamic Observatory of the Polish Academy of Sciences in Borowiec, RBT / PST2 in Arizona, and the latest instrumental achievement is the worldwide unique set of five PST3 satellite telescopes built in 2020.

Main products and services:

- Software for optical solutions in telecommunications.
- Systems Engineering – software.

The most important achievements in the space sector:

- Design, construction and exploitation of the PST3 satellite telescope set. Creation of a dedicated management planning and data analysis system.
- Participation in an international project: FP7 CLEANSPACE “Small debris removal by laser illumination and complementary technologies”.
- LESA project leader: NEO & SST Observation Assistant Service (NOAS).

● Entity type: University

● Main technological domains



Flight Dynamics and
GNSS (TD 10)



Space Debris
(TD 11)



Ground Station
Systems and
Networks (TD 12)



Life & Physical
Sciences (TD 14)

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Instytut Oceanologii Polskiej Akademii Nauk

(Institute of Oceanology of the Polish Academy of Sciences)



Institute of Oceanology of the Polish Academy of Sciences (IO PAN) was established in 1983. Today, it is a leading oceanographic institution in Poland, also having an established position in European and global marine research. The mission of the Institute is to conduct basic research of the marine environment and broaden the knowledge of the phenomena and processes taking place in it. The Institute of Oceanology conducts research mainly in the Baltic Sea and in the European Arctic. The Institute also conducts research and applications related to various aspects of satellite remote sensing of the properties of the oceans and the air-sea interface. It has extensive experience in the processing and use of satellite data in research and monitoring of the marine environment.

Main products and services:

- Processing and analysis of EO satellite data.
- In situ radiometric measurements for satellite data calibration.

The most important achievements in the space sector:

- Creation and operational maintenance of the SatBałtyk System - enabling routine monitoring of the environmental parameters of the Baltic Sea on the basis of satellite data and dedicated hydrodynamic models (IO PAN is the consortium leader and the main operator of the system).
- Participation in the development of a virtual platform enabling the search and handling of various EO data for selected areas and related model data sets and in-situ measurements in a selected area – Ocean Virtual Laboratory Project.

● Entity type: Research and Development unit

● Main technological domains

010101 Space System
010101 Software (TD 2)
010101

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ITTI sp. z o.o.



ITTI is an IT (SME) company that provides software for companies and institutions from Poland and other countries. The company has been operating since 1996; Currently, its team consists of about 85 people.

The main goal of ITTI is the development and delivery of innovative applications and dedicated software that is tailored to the customer's needs (including software for R&D projects, systems supporting production processes or managing the work of warehouses, and systems supporting space missions).

In the space area, the company focuses on software supporting the terrestrial segment, space situational awareness and on-board communication networks.

- Main products and services:**
- On-board data management for satellites and space probes.
 - Development and construction of the space segment (as part of the work carried out in the ground segment).
 - Support for ground segment missions.

- The most important achievements in the space sector:**
- Participation in the construction and modernization of EGS-CC (European Ground Systems Common Core) components for the operational supervision of future space missions.
 - Building a national, Polish center of expertise and development of SST Core Software for the needs of a national recipient.
 - Building a universal, multi-protocol SPACEMAN tool for the detection, configuration and management of on-board communication networks; development of the NDCP v2 network protocol for the management of SpaceFibre and mixed SpaceWire / SpaceFibre networks.

Entity type: SME

Main technological domains

On Board Data Processing (TD 1)

Space System Software (TD 2)

System Design & Verification (TD 8)

Mission Operation and Ground Data Systems (TD 9)

Space Debris (TD 11)

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Jakusz SpaceTech sp. z o.o.

Jakusz SpaceTech has been a valued producer of „green” rocket fuel - HTP (hydrogen peroxide with a concentration of up to 98%) for several years. It conducts research on it in cooperation with the European Space Agency (ESA). The company is also working on other rocket fuels, such as DMAZ and ionic liquids.

The Jakusz SpaceTech research laboratory was established in 2015 as part of a team of chemical specialists and it focused its activities on space technologies, mainly in the field of fuel production and technological research projects. A team of specialists comes from the Jakusz company, which was established in 1985 and is a leader in security and defense systems.

- Main products and services:**
- Production and sale of HTP, DMAZ rocket fuel and ionic liquids and for re-entry systems.
 - Performing chemical tests and analysis.
- The most important achievements in the space sector:**
- Development of a catalytic medium for a thruster with a power of 1N (ESA project),
 - Safety research and validation of the highly concentrated hydrogen peroxide process (ESA project).
 - Optimization of passivation parameters of selected aluminum alloys (ESA project).
 - Testing the compatibility of highly concentrated hydrogen peroxide (HTP) with materials used in the space sector (ESA project).

Entity type: SME

Main technological domains

Propulsion (TD 19)

Materials and Manufacturing Processes (TD 24)

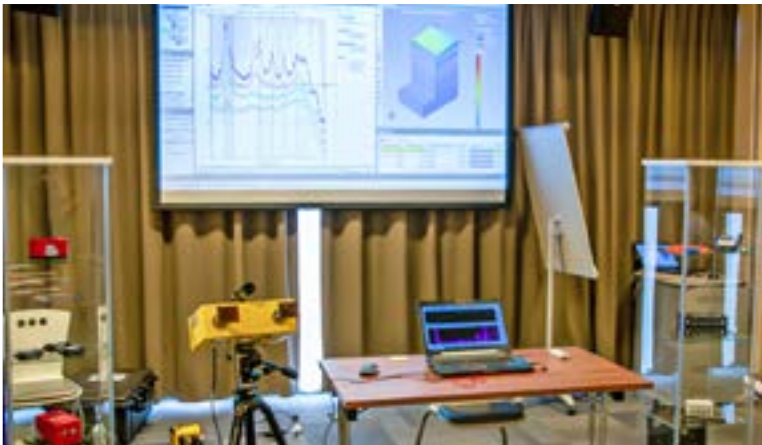
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KOMES sp. z o.o.



The idea of the KOMES company is to undertake and solve non-standard projects. The offer includes mainly simulation tests (CAE), fiber-optic and strain gauge measurements, vibration tests at the expert level. The company verifies the security and functionality of the solutions set up by customers. It solves complex engineering problems thanks to the practical application and implementation of the latest achievements of technical knowledge. Since 2011, KOMES has completed approx. 850 projects. The management system operating in the company meets the requirements of ISO 9001 - it is the first certificate awarded in Poland by DNV GL, covering numerical calculations and strain gauge tests.

Main products and services:

- ▶ Designing mechanisms and structures.
- ▶ Designing structures supporting the integration and satellite testing.
- ▶ Design of adapters, lifting, turning, and supporting devices.
- ▶ Execution and production of structures and mechanisms.
- ▶ Testing, consulting in the field of physical and virtual tests.

The most important achievements in the space sector:

- ▶ Participation and support in the PW-Sat2 satellite construction project.

● Entity type: SME

● Main technological domains

 Mechanisms (TD 15)

 Structures (TD 20)

 Thermal (TD 21)

 Materials and Manufacturing Processes (TD 24)

 Quality, Dependability and Safety (TD 25)

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KPGeo sp. z o.o.



KPGeo is a company specializing in cartography and photogrammetric geodesy, providing its clients with the highest quality geospatial services and products. Its offices are located in Krakow, Poland and in Kansas City, USA. KPGeo combines the best of two worlds: American perfectionism, work organization and innovative technologies with high-quality production in Poland, performed by well-educated and trained professionals ready to face the challenges of the most complex and technically sophisticated projects. KPGeo is ISO 9001: 2015 and AQAP 2110: 2016 certified. It is a company that provides comprehensive services in the field of maps and geospatial measurements.

The most important achievements in the space sector:

- ▶ Land Use Land Cover Map for Philippines.
- ▶ Mapping of ETOD and AMDB aerodromes from satellite data.
- ▶ Development of technology for creating 3D models from monoscopic satellite images.

● Entity type: SME

● Main technological domains

010101 Space System
010101 Software (TD 2)

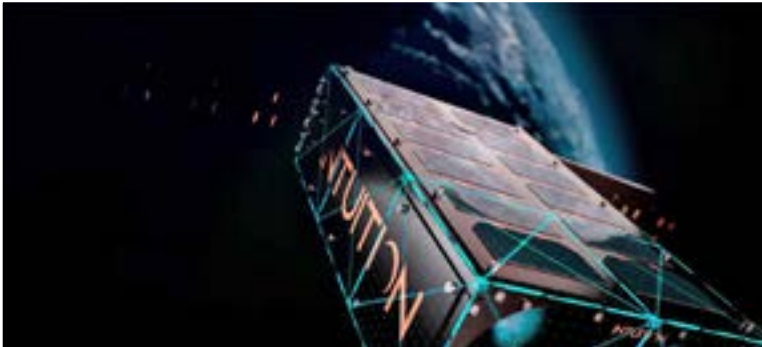
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KP Labs sp. z o.o.



● Entity type: SME

● Main technological domains

010101 Space System
010101 Software (TD 2)
010101

On-board Data
Subsystems (TD 1)

Mission Operation
and Ground Data
Systems (TD 3)

KP Labs – Earth Observation satellite is a new space company whose mission is to accelerate space exploration through the development of autonomous spacecraft and robotic technologies. The experience includes development of on-board software, hyperspectral imaging devices, artificial intelligence algorithms and high-performance computers. Its flagship project is the Intuition-1 mission, the launch of which is planned for the turn of 2022 and 2023. The goal is to launch a satellite for Earth observation into a low orbit, which, thanks to artificial intelligence solutions and a dedicated on-board computer, will automate and accelerate the process of acquiring and processing photos already on board the satellite. From 2019, the company has the status of a R&D Center, and in 2022 it plans to open a Research and Development Center.

Main products and services:

- ▶ On-board software for spacecrafts.
- ▶ Designing highly efficient on-board computers.
- ▶ Design of hyperspectral imaging devices.
- ▶ On-board data management.
- ▶ Artificial intelligence solutions.



The most important achievements in the space sector:

- ▶ Construction of the Intuition-1 Earth observation satellite, which will be placed in orbit in Q4 2022 – Q1 2023. The project is implemented under the Smart Growth Operational Program (POIR) 2014–2020, and its value exceeds PLN 19 million.
- ▶ Development of a set of innovative products called Smart Mission Ecosystem, consisting of algorithms, software and satellite hardware, that will reduce the time and operational costs of the mission.
- ▶ Building its own, modern Research and Development Center with an area of over 2,300 m². Thanks to its infrastructure and research facilities, the center will enable the construction, testing and integration of the satellite's volatile components, as well as the complete control of the mission from the ground station. The value of the investment is over PLN 15 million.

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N7 Space sp. z o.o.

● Entity type: SME

● Main technological domains

010101 Space System Software (TD 2)

System Design & Verification (TD 8)

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N7 Space is a company specializing in the production of software for the space industry. It has experience in the implementation of on-board software for on-board computers used in satellite projects, compliant with the B-criticality of the ECSS standards.

Main products and services:

- On-board software (LEON3, ARM).
- Infrastructure and software validation environment.
- Model-based systems engineering (MBSE).
- Defining software tests using script interpreters.
- Database software.
- Ground support software for space missions.
- Implementation of Independent Software Verification & Validation (ISVV) processes.

The most important achievements in the space sector:

- Implementation of on-board software for PROBA3 (ESA) missions.
- Project implementation (ESA): ECSS-E-ST-50-15C Protocol On-Board SW Implementation.
- Project Implementation (ESA): Model checking for formal verification of space systems.



Narodowe Centrum Badań Jądrowych
(National Center for Nuclear Research)



The National Center for Nuclear Research is one of the largest scientific institutes in our country, which has, among others, the only nuclear research reactor Maria in Poland. It employs over 1,100 physicists, chemists, IT specialists, engineers and support staff. The research staff of NCBJ consists of over 200 people with a PhD, including approx. 80 professors and habilitated PhD. The Institute has the highest A + category awarded as a result of the evaluation of Polish scientific units and is a partner of the Joint Research Center, which is the research and scientific base of the European Commission.

The most important achievements in the space sector:

- Research and publication: J. Jagielski, A. Piatkowska, A. Merstallinger, Z. Librant, P. Aubert, R. Groetzschel, T. Suszko, „Friction properties of implanted alumina for vacuum applications”, Vacuum 81 (2007) 1357 –1362.

● Entity type: Research and Development unit

● Main technological domains

Materials and Manufacturing Processes (TD 24)

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PCO S.A.

● Entity type:
Large enterprise

● Main technological
domains



Optics
(TD 16)

PCO S.A. is a company with 45 years of experience. It is the largest Polish manufacturer of optoelectronic products with the use of night vision, thermal imaging and laser technology. All products are the result of the company's own research and development activities.

PCO S.A. produces a wide range of optoelectronic observation and targeting devices using laser, night vision and thermal imaging technology for the military and other uniformed services.

Main products and services:

- ▶ Production of optoelectronic devices:
 - ▶ night vision goggles and monoculars,
 - ▶ aviation goggles,
 - ▶ day-night sights,
 - ▶ collimator sights,
 - ▶ thermal imaging sights,
 - ▶ night vision sights.
- ▶ Research and development in the field of optoelectronics for the needs of the army and services.

The most important achievements in the space sector:

- ▶ PROBA-3 – PCO coronagraph was responsible for the design and manufacture of the mechanical part: the Coronagraph Optical Box (COB) housing.
- ▶ CIROP (ESA-PLIIS) – feasibility study of the possibility of observation in the infrared (IR) band in order to optimize the work and data transfer for the main observation system.
- ▶ HESS (High Energy Stereoscopic System) Telescope – in the framework of cooperation, PCO was responsible for the production of mechanical parts and the assembly of hydraulic actuators to control the mirrors.

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PIAP Space sp. z o.o.

PIAP Space is a company operating in the space and satellite engineering sector. The company specializes in areas such as robotics, automation and mechanics. PIAP Space develops technologies and products in the field of satellite integration and testing devices (MGSE), active space debris removal, manipulators and grippers, servicing of satellites in orbit, human-robot interaction, vision systems and mechanisms.

Main products and services:

- ▶ Solutions and products for orbital robotics, incl. grippers, force and moment sensors, robotic arms.
- ▶ Field tests as well as assembly and integration of subsystems of mobile robots.
- ▶ Mechanical Ground Support Equipment (MGSE).

The most important achievements in the space sector:

- ▶ TITAN project.
- ▶ EROSS / EROSS + project.
- ▶ PRO-ACT project.

● Entity type:
Large enterprise

● Main technological
domains



System Design
& Verification (TD 8)



Space Debris
(TD 11)



Automation,
Telepresence
& Robotics (TD 13)



Mechanisms
(TD 15)

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Planet Partners sp. z o.o.

Planet Partners is a consulting company specializing in communication consulting, campaign implementation and crisis management. It supports entities operating in the B2B area, entities from innovative sectors of the economy (including the high technology sector) and the public sector in achieving business goals through effective communication with the environment. It prepares communication strategies, cares for good customer relations with the environment and reacts in crisis situations. It provides comprehensive service thanks to cooperation with experienced marketing partners. Planet Partners is a part of the international GlobalCOM PR network. It provides its clients with a network of branches located in 60 countries. Thanks to this, it can effectively support any brand in terms of communication – not only in Poland, but also abroad.

The most important achievements in the space sector:

- ▶ Creating and promoting the brand of the international project European Rover Challenge.
- ▶ The only communication agency in Poland specializing in servicing the space sector.
- ▶ Initiator of the creation of an international PR network specialized in providing services to entities from the space sector around the world.

● Entity type: SME

● Main technological domains

○○○ Others
(TD 26)

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Politechnika Śląska

(Silesian University of Technology)

The Silesian Technical University is the oldest public technical university in Upper Silesia and one of the largest in the country. As the only university in the region, it is included in the prestigious group of laureates of the Ministry of Education and Science competition „Initiative of Excellence - Research University”. Currently, 15 units offer over 60 fields of study and approx. 200 specializations, covering the entire scope of engineering activities. Scientific research is conducted in all disciplines in the field of engineering and technical sciences, as well as in the field of: chemical sciences, earth and environmental sciences, as well as management and quality. Based on in-depth analyzes of the achievements of employees, international cooperation, technology transfer and infrastructure, six priority research areas have been distinguished.

The most important achievements in the space sector:

- ▶ Preparation of image processing techniques to obtain precise results of photometric measurements in the mission of the First Polish Scientific Satellites BRITE-PL.
- ▶ Preparation of the optics design and telescope adjustment procedure for hyperspectral observations as part of the NCBiR project.

● Entity type: University

● Main technological domains



Materials and
Manufacturing
Processes (TD 24)



Space System Control
(TD 5)

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Polskie Zakłady Lotnicze sp. z o.o.

● Entity type:
Large enterprise

● Main technological
domains



Materials and
Manufacturing
Processes (TD 24)



Structures (TD 20)

PZL Mielec is one of the largest aircraft manufacturers in Poland and the largest Lockheed Martin production plant outside the US. It has a fully functional airframe factory, final assembly production lines, an aircraft assembly facility, and an aircraft operations center.

PZL Mielec's capabilities include:

- design and production of equipment,
- production of sheet metal elements made of aluminum alloys,
- production of machined aluminum and steel elements,
- assembly of complex aircraft structures,
- conceptual and executive design of aircraft structures,
- conducting fatigue and material tests.

Since 2020, PZL Mielec has been implementing projects and activities for the Polish and European space industry.

Main products and services:

- ▶ Metallic materials.
- ▶ Composite materials (glass, carbon and aramid fibers).
- ▶ Fuel drive components (tanks).
- ▶ Fasteners (nuts, bolts, etc.), springs, spacers, bearing parts, gears.

The most important achievements in the space sector:

- ▶ Analysis of Block Structures type connections for Lockheed Martin Space.
- ▶ Development of innovative snap-fit T-rap connections for space application for Lockheed Martin Space.
- ▶ Participation in realisation of the project for ESA: „<40l monopropellant demisable tank” (ESA Contract No. 4000129800/2020/NL/CBi).

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ProGea 4D sp. z o.o.

The ProGea 4D company was established as a result of the development of the trusted and recognized ProGea Consulting company operating since 1991. ProGea 4D provides high-level geoinformatics services thanks to a qualified staff consisting of specialists with extensive professional experience in the field of geoinformatics, remote sensing, photogrammetry, natural environment and landscape architecture. The company has experience in the implementation of various environmental and research and development projects related to the use of satellite data, performed both for the needs of private companies or local government institutions, and authorities established to protect nature. It is also a long-term distributor of satellite data from companies such as: Planet Labs, European Space Imaging (MAXAR), HEAD, Capella Space, SI Imagine Services.

The most important achievements in the space sector:

- ▶ LIFE URBANGREEN project „Innovative technological platform improving the management of green areas in order to better adapt to climate change”, co-financed by the EU and the National Fund for Environmental Protection and Water Management, implemented in 2018-2021 in cooperation with R3GIS (project coordinator), ZZM in Krakow, Anthea Rimini and the University in Milan. The main goal of the project was to provide an innovative geoinformation platform GreenSpaces, which enables more efficient management of urban green areas, which allows cities to better respond to climate change, and its expansion. ProGea 4D has performed, among others, analysis of the change in urban green areas based on the object classification of high-resolution WorldView satellite data and it also developed a methodology for monitoring the health of trees using PlanetScope satellite data.
- ▶ Research and scientific project „The use of remote sensing to manage the State Treasury's Agricultural Property Stock – pilot stage” commissioned by the National Center for Agricultural Support. The ProGea 4D company participated in the implementation of scientific research and development works using satellite remote sensing in the monitoring of agricultural drought and the detection and monitoring of drenching and dreaming of crops based on the synergy of satellite, meteorological and thermal data.
- ▶ AGROEYE – Remote Sensing Monitoring of Agricultural Space. Project implemented as part of the competition launched by ESA: „2nd CALL FOR OUTLINE PROPOSALS UNDER THE POLISH INDUSTRY INCENTIVE SCHEME”. The company's role was to program the OpenSource application to support the control of Good Agricultural Culture standards, as well as to conduct automatic land cover and use classification (LULC).

● Entity type: SME

● Main technological
domains

010101 Space System
010101 Software (TD 2)
010101

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● Entity type: SME

● Main technological domains

 Propulsion (TD 19)

 Space System Control (TD 5)

 Materials and Manufacturing Processes (TD 24)

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Progresja Space sp. z o.o.



Progresja Space is a company in the space sector, which bases its activity on the sale of products for the small satellites market. The scope of its activities currently includes two types of satellite modules: drive modules and orientation control modules (AOCS). The company's business strategy involves long-term development based on innovative ideas and technologies – as a result of internal R&D works and cooperation with leading research units in Poland.

Main products and services:

- ▶ BLINK – nano-satellite cold-gas drive.
- ▶ FLARE – nano-satellite resisto-jet drive.
- ▶ FLASH – nano-satellite Pulse Plasma Thruster drive.
- ▶ MRW – a family of flywheels for Nano- and microsatellites.



QWED sp. z o.o.



The QWED company was founded in 1997 to develop and commercialize the QuickWave EM electromagnetic simulator by the company's founders. To date, over 200 software licenses have been implemented in academic, scientific and industrial institutions. Since 2000, QWED has also specialized in precise microwave measurements of materials. The company's mission is to promote computer modeling in science and industry, but also to implement modeling-based measurement methods. Research for the benefit of the space sector plays an important role. The QWED team, led by dr inż. M. Celuch, consists of four PhDs of technical sciences and two IEEE Fellows (W. Gwarek, J. Krupka).

Main products and services:

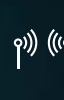
- ▶ QuickWave simulation software.
- ▶ Microwave material measuring devices.
- ▶ Consulting and designing microwave devices.

The most important achievements in the space sector:

- ▶ Implementation of the QuickWave series software license in institutions and companies from the space sector, e.g., National Radio Astronomy Observatory (USA), Jet Propulsion Laboratory (USA), Lyrebird Antenna Research (Australia).
- ▶ Implementation of devices for precise measurements of electromagnetic properties of materials in institutions and companies in the space sector.
- ▶ Implementation of commercial projects for the design of dual-reflector antennas and power systems in the SATCOM sector.

● Entity type: SME

● Main technological domains

 RF Subsystems, Payloads and Technologies (TD 6)

 Electromagnetic Technologies and Techniques (TD 7)

 Optoelectronics (TD 17)

 Thermal (TD 21)

 Materials and Manufacturing Processes (TD 24)

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● Entity type: SME

● Main technological domains

 On-board Data Subsystems (TD 1)

 RF Subsystems, Payloads and Technologies (TD 6)

 Flight Dynamics and GNSS (TD 10)

 Space System Software (TD 2)

 Ground Station Systems and Networks (TD 12)

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RECTANGLE sp. z o.o.

RECTANGLE sp. z o.o. is a technology company created to develop innovative products and solutions for transport, telecommunications, public security and defense, crisis management and the critical infrastructure sector.

The Research and Development Department of the company is a team of around dozen highly specialized engineers with experience in the implementation of both domestic and international R&D projects.

Main products and services:

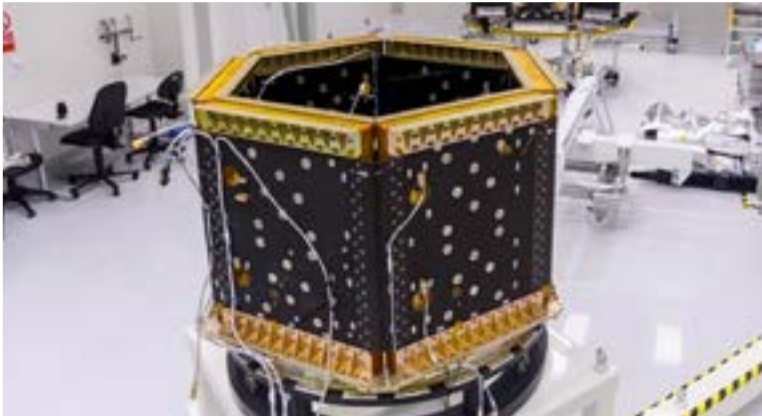
- ▶ Radio navigation systems and inertial navigation systems.
- ▶ Active location systems based on radar, optics or sound.
- ▶ On-board command and control systems.
- ▶ Designing solutions based on FPGA and Systems-on-a-Chip technology.
- ▶ Telecommunications systems.
- ▶ Designing electronic devices and systems.
- ▶ Developing specialized algorithms and dedicated software.

The most important achievements in the space sector:

- ▶ A Robust Interference DETection Algorithm for the hybrid GNSS/INS receivers – RIDETA (kontrakt z ESA realizowany w ramach PLIIS).
- ▶ The hardware and software front-end of the GNSS receiver immunizing the navigation system against attacks with disruptive signals (project co-financed by the National Center for Research and Development under the program „Fast path – space technologies”).



SAB Aerospace sp. z o.o.



SAB Aerospace sp. z o.o. is part of the SAB group, an SME in the development of space subsystems and products for satellites and lifting systems. The organization of the company is based on a cluster of small and medium-sized enterprises located in various centers in Central Europe. The company has specific competencies in project management, system engineering, quality control, design and integration of mechanical and thermal systems. The SAB strategy is to act as a small system integrator in Poland, its implementation is already in the implementation phase. The headquarters of the company is located in Warszawa, and the engineering office and AIT are located in Zielona Góra.

The most important achievements in the space sector:

- ▶ Involvement in the PLATO Project (ESA’s scientific mission).
- ▶ Set up of a consortium to develop an ISRU O2 production load.
- ▶ Collaboration in the development of IOSHEXA (In-Orbit Servicing HEXAgonal module of the SSMS Dispenser) for the VEGA missile system.

● Entity type: SME

● Main technological domains

 Structures (TD 20)

 Thermal (TD 21)

 System Design & Verification (TD 8)

 Environmental Control & Life Support (ECLS) and In Situ Resource Utilisation (ISRU) (TD 22)

 Space Debris (TD 11)

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SatAgro sp. z o.o.



SatAgro specializes in tool development and satellite data services for the agricultural sector. The main product of the company – the SatAgro website (app.satagro.pl) - is the most dynamically developing enterprise in Poland in the field of precision agriculture. The company acts as a link between the dynamically developing sector of satellite observation and a large group of agricultural enterprises. Its services allow access to products based on NASA, ESA satellite observations and a wide group of private operators combined with data from meteorological stations and weather models. SatAgro also conducts research projects and consultations in the field of crop harvest monitoring, crop identification, yield forecasting and loss estimation.

Main products and services:

- ▶ SatAgro service - app.satagro.pl.
- ▶ The use of satellite data for the agricultural sector.
- ▶ Tools and services in precision agriculture.
- ▶ Conducting research and consultations in the field of monitoring the harvest of crops, identifying crops, forecasting yields, estimating losses and more.

The most important achievements in the space sector:

- ▶ Serwis SatAgro.
- ▶ Projekt ESA EO4SD – Earth Observation for Eastern Partnership.
- ▶ Projekt ESA ACCESS4FI – Automated Crop Classification and yield Estimation online Services for Food Industry.

● Entity type: SME

● Main technological domains

010101 Space System
010101 Software (TD 2)

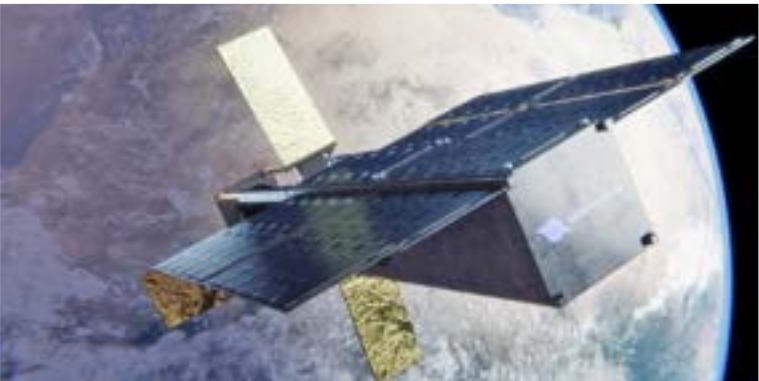
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SatRevolution S.A.



SatRevolution was established in 2016 with the aim of developing the real-time Earth observation constellation. The company was the first in Poland to place its satellites: Światowid (2019), KRAKsat (2019), and AMICal Sat (2020) Earth's orbit. NASA's State of the Art Small Spacecraft Technology report lists SatRevolution as one of only 12 companies in the world that comprehensively design, manufacture and place observational nanosatellites collecting optical data in orbits. Currently SatRevolution is implementing the next stages of building a functional, commercial constellation of 1,500 observation satellites (REC) by 2028.

Main products and services:

- ▶ Design and production of observation nanosatellites.
- ▶ Placing nanosatellites in orbit.
- ▶ Production of satellite platforms.
- ▶ System testing.
- ▶ Earth observation images – their analysis and processing, related services.
- ▶ Production of commercial components.

The most important achievements in the space sector:

- ▶ Designing, testing and developing our own satellite nanoplatform in orbit, which can be used in future projects for private purposes for the company and for commercial clients, including the creation of our own optical system for satellites.
- ▶ Building the first Polish Earth observation satellite (Światowid), which was successfully placed in low Earth orbit. As a result, the first optical data was generated.
- ▶ Creating an actual product for Smart City projects, which was contracted by several local governments – providing data that allows to optimize the costs of tax collection procedures. In long-term, it is going to increase the efficiency of public administration and building foundations for a cooperation platform between the public sector and space industry enterprises in Poland.

● Entity type: SME

● Main technological domains

On-board Data
Subsystems (TD 1)

010101 Space System
010101 Software (TD 2)

Space Systems
Electrical Power (TD 3)

System Design
& Verification (TD 8)

Optics (TD 16)

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Scanway sp. z o.o.



Scanway is a commercial supplier of optical instruments for the space industry. It creates observation systems for micro- and nanosatellites. The company's specialists are the authors of 3D laser system for orientation in space of drilled particles (DREAM experiment) or satellite Earth observation system (ScanSAT); they are currently working on the design and development of the optical part for the EagleEye microsatellite and on the PIAST - Polish Imaging SaTellite project. Scanway's software and optical devices worked in space. The company is carrying out orders and projects that will fly into orbit on board at least three satellites over four years.

Main products and services:

- ▶ Manufacture of optical instruments for outer space applications.
- ▶ Design and production of optical parts for satellites.
- ▶ Laser system for orientation in space.
- ▶ ScanSAT – Satellite Earth Observation System.

The most important achievements in the space sector:

- ▶ Designing and launching a measuring chamber in the DREAM project.
- ▶ Design of an imaging instrument for the ScanSAT project.
- ▶ Designing an imaging instrument for the EagleEye project.

● Entity type: SME

● Main technological domains



Optics
(TD 16)



On-board Data
Subsystems
(TD 1)



Optoelectronics
(TD 17)



Automation,
Telepresence
& Robotics (TD 13)

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Semicon sp. z o.o.



For over 30 years, Semicon sp. z o.o. has been distributing electronic components, materials, tools for electronics, apparatus and measuring accessories. It provides comprehensive contract manufacturing services for electronic devices (EMS). It specializes in assembling complex projects on rigid and flexible PCBs. It provides Chip-On-Board assembly, cable harnesses and BGA reballing services. It produces laser cut SMT stencils. It offers templates in the VectorGuard® standard, templates with nano-coatings and graduated ones. It converts industrial single- and double-sided adhesive tapes, cuts Die cut and Kiss cut. It is also the largest producer of laser modules in Poland. Its services' recipients are in various industries, such as medical, automotive, space, aviation service, science and military.

Main products and services:

- ▶ Electronic Manufacturing Services (EMS).
- ▶ Installation of projects on rigid and flexible PCB.
- ▶ Chip-On-Board Assembly.
- ▶ Installation of cable harnesses.
- ▶ BGA Reballing.
- ▶ Production of laser cut SMT stencils.
- ▶ Converting industrial single- and double-sided adhesive tapes.
- ▶ Die cut and Kiss cut patterns.
- ▶ Production of laser modules.

● Entity type: SME

● Main technological domains:



Materials and
Manufacturing
Processes (TD 24)



Optoelectronics
(TD 17)

● Contact information

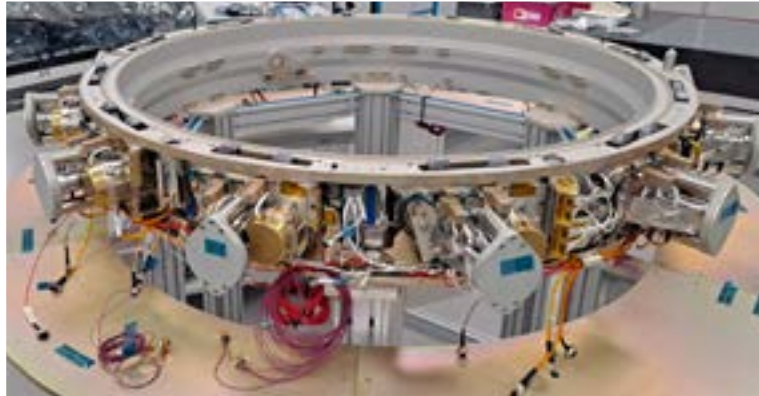
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SENER Polska sp. z o.o.

(SENER sp. z o.o.)



SENER Polska was launched in 2006, and since 2012 it has been focusing on creating innovative solutions in the field of space engineering for the most important projects of ESA, NASA and ESO. SENER Polska specializes in two areas of mechanical engineering: unfolding and holding mechanisms (necessary for the transport of space vehicles in rocket holds and the subsequent deployment of solar panels, antennas and measuring instruments) and satellite assembly devices (used, among others, for precise satellite movement for technician access and transport to test chambers and holds). Only a few companies in Europe design this type of device.

Main products and services:

- Design and production of mechanisms: unfolding and holding, positioning.
- Custom made space engineering solutions.
- Mechanical Ground Support Equipment (MGSE).

The most important achievements in the space sector:

- Umbilical Release Mechanism - ExoMars 2022 (target TRL 9).
- Multiple systems for International Berthing and Docking Mechanism - Hard Capture System (IBDM - HCS) (target TRL 9).
- Complete sets of MGSEs for missions such as: EUCLID, Extremely Large Telescope (ELT) Mirrors 2 and 3, PLATO, ELECTRA Biomass.

- Entity type:
Large enterprise

- Main technological domains



Mechanisms
(TD 15)



System Design
& Verification (TD 8)

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Sieć Badawcza Łukasiewicz – Instytut Lotnictwa

(Łukasiewicz Research Network – Institute of Aviation)



The Łukasiewicz Research Network – Institute of Aviation is one of the most modern research institutions in Europe, with traditions dating back to 1926. The Institute closely cooperates with global leaders in the aviation industry, such as GE, Airbus, Leonardo, Lockheed Martin or Ariane Group, as well as with institutions from the aviation and space industry, including the European Space Agency. The strategic research areas of the Institute are aviation, space and unmanned technologies. Research and services for the domestic and foreign industry in the field of material, composite, incremental, remote sensing and many other technologies are also carried out here. In the field of space technologies, the institute specializes in satellite propulsion, rocket systems, avionics, environmental research and satellite remote sensing.

The most important achievements in the space sector:

- ILR-33 AMBER 2K Suborbital rocket.
- Hydrogen peroxide with a concentration above 98%.

- Entity type: Research
and Development unit

- Main technological domains



Space Debris
(TD 11)



Propulsion
(TD 19)



Structures
(TD 20)



Thermal
(TD 21)

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Space Kinetics sp. z o.o.

Space Kinetics is a consulting company specializing in Global Navigation Satellite Systems (GNSS). Its main specialization is precise determination of GNSS and LEO satellite orbits, scientific applications of GNSS and high accuracy real-time positioning services. Space Kinetics develops state-of-the-art GNSS data processing and analysis algorithms.

Main products and services:

- ▶ Accurate determination of orbits.
- ▶ Satellite Precise Point Positioning.
- ▶ Positioning for the commercial market.
- ▶ GNSS in space applications.
- ▶ Time synchronization with GNSS.
- ▶ GNSS data monitoring.
- ▶ GPS Products.

The most important achievements in the space sector:

- ▶ Real-time Precise Point Positioning on-board LEO satellites.
- ▶ Multi-constellation multi-frequency GNSS precise orbit determination and point positioning.
- ▶ Development of machine-learning algorithms for orbital dynamics.

● Entity type: SME

● Main technological domains



Flight Dynamics and GNSS (TD 10)



RF Subsystems, Payloads and Technologies (TD 6)



Space System Software (TD 2)



On-board Data Subsystems (TD 1)

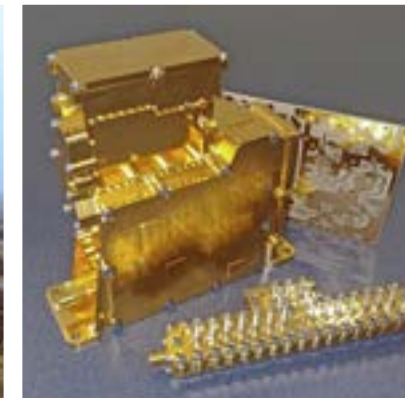
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SpaceForest sp. z o.o.



SpaceForest designs and commercializes innovative solutions. It specializes in microwave technology, artificial intelligence, advanced electronics and rocket technologies.

SpaceForest's mission is to provide customers with the highest quality products and to constantly improve the scope and quality of services offered, while taking care of the natural environment and broadly understood social interest.

Main products and services:

- ▶ Design and manufacture of electronic equipment for satellite telecommunications applications.
- ▶ Development of technology of universal research rockets for scientific experiments, including sub-orbital ones.
- ▶ Development of advanced software for manual and automatic tuning of microwave filters and optimization of other industrial processes.

The most important achievements in the space sector:

- ▶ PESA Projects – Development and qualification of Ultra Low Noise Frequency Generators (PLDRO) and Development and Qu+C405alification of Dual Redundant Medium Power Signal Source (MLO) (TRL 7 completed).
- ▶ ESA project – Solid State Power Amplifier for X-band (first project completed with TRL5, planned completion of TRL7 in 2022).
- ▶ Project „Controllable and recoverable sub-orbital rocket with an SF1000 hybrid engine based on ecological propellants” project, co-financed by the National Center for Research and Development (NCBiR), involves the construction of a commercial launchable suborbital rocket able to carry up to 50 kg at a height of min. 100 km. Successful test flight at the altitude of 10 km and recovery.

● Entity type: SME

● Main technological domains



RF Subsystems, Payloads and Technologies (TD 6)



Electromagnetic Technologies and Techniques (TD 7)



Ground Station Systems and Networks (TD 12)



Propulsion (TD 19)



Materials and Manufacturing Processes (TD 24)

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Spacive sp. z o.o.

● Entity type: SME

● Main technological domains

- Thermal (TD 21)
- Mechanisms (TD 15)
- Materials and Manufacturing Processes (TD 24)



Spacive sp. z o.o. is a spin-off company founded in 2014 by a group of managers and engineers from the Space Research Center of the Polish Academy of Sciences. The company specializes in thermal control systems, mechanism design and carrying out structural and thermal analysis of satellites and its components. It designs and manufactures MLI thermal insulation. It conducts R&D research on components for the construction of thermal control systems.

Main products and services:

- Design and production of MLI thermal insulation.
- Conducting thermal-vacuum tests.
- Performing structural and thermal analyzes of satellites and their components.
- Design of thermal control systems for satellites and space probes.
- Constructing mechanisms and structures for space applications.

The most important achievements in the space sector:

- Solar Orbiter – STIX – Spacive engineers prepared a thermal control system.
- PLISS – implementation of two ESA projects regarding the development and qualification of MLI technologies.

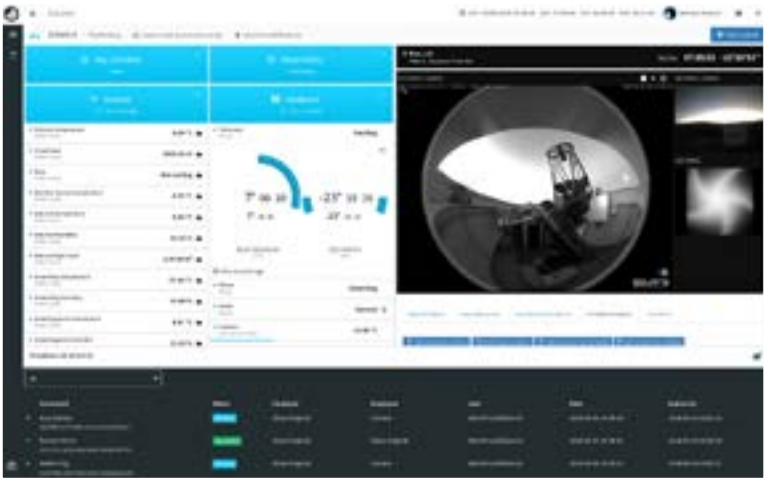
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Sybilla Technologies sp. z o.o.



Sybilla Technologies sp. z o.o. specializes in the construction and programming of ground observation stations. It operates fourteen telescopes on five continents. The observatories conduct research in the field of Space Surveillance and Tracking (SST) and Near-Earth Objects (NEO), as well as commercial and educational observations. The company designs, supplies and integrates observation systems based on its own solutions and the achievements of third companies. The company's experts develop and maintain software solutions for autonomous and robotic telescope networks including planning, scientific data evaluation and analysis processes. Sybilla Technologies employs active scientists in the field of precise photometric and astrometric measurements and space control.

Main products and services:

- Monitoring and control of ground systems.
- Mission control – engineering support.

The most important achievements in the space sector:

- ABOT – software for managing robotic sensors that observe space.
- WebPlan – software for managing and planning a network of space observation sensors and maintaining a catalog of objects.
- LightStream – software for processing optical space observation data from CCD and CMOS cameras (NCBiR project).

● Entity type: SME

● Main technological domains

- Space Debris (TD 11)
- Ground Station System and Networks (TD 12)
- Automation, Telepresence & Robotics (TD 13)
- Life & Physical Sciences (TD 14)

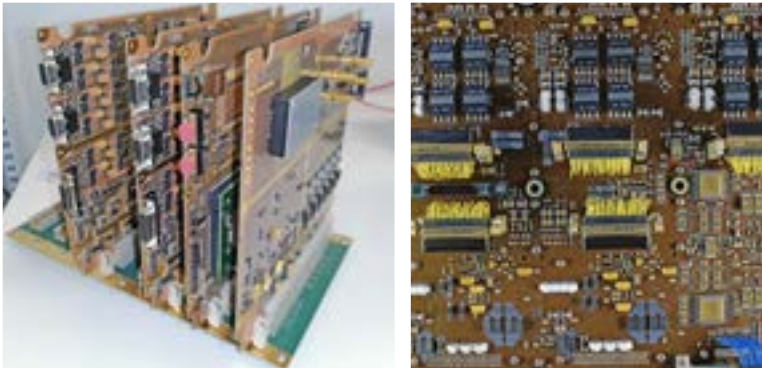
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SYDERAL Polska sp. z o.o.



SYDERAL Polska sp. z o.o. specializes in providing solutions in the field of electronics and software for the space industry. The company was founded in 2016 and currently employs 20 highly qualified specialists. The seat of SYDERAL is located in the Gdańsk Science and Technology Park.

The dynamic development of SYDERAL Polska was possible thanks to the company's involvement in the flight projects of the European Space Agency, including control electronics for the antenna directional mechanism for the EUCLID mission and the FLORIS management unit. In the framework of the project co-financed by the National Center for Research and Development, the company develops technologies for the satellite distribution of the quantum key.

The company's mission is to participate in the development of the Polish space sector and to take a key place on the European and global market in the areas related to quantum communication, control electronics and Flash mass memories. SYDERAL Polska is in the process of co-creating a local ecosystem (Tri-City area) that will enable comprehensive implementation of projects for the supply of control electronics for space missions, including development, production and testing of satellite components.

Main products and services:

- Technologies used in electronic control system.
- On-board data processing systems – data storage and processing.
- Technologies used in the production of optical equipment.

The most important achievements in the space sector:

- Joining Airbus DS Core Consortium on ARIEL mission as supplier of MGA PME.
- Nomination for the Economic Award of the President of the Republic of Poland in 2021.
- Development of quantum key distribution technology – creation of an engineering model in the SECSEQS project.

Entity type: SME

Main technological domains

On-board Data Subsystems (TD 1)

Space System Software (TD 2)

Mechanisms (TD 15)

Optoelectronics (TD 17)

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Śląskie Centrum Naukowo-Technologicznego Przemysłu Lotniczego sp. z o.o.

(Silesian Science and Technology Centre of Aviation Industry sp. z o.o.)

The company operates in the field of development and production of modern composite structures intended mainly for the aviation and space industry. Currently, it is the only Polish qualified manufacturer of space structures. The company consists of two basic organizational units: a composite structures plant (responsible for the production of composites and production equipment) and materials testing laboratory (conducting mechanical and non-destructive tests).

Silesian Science and Technology Centre of Aviation Industry also acts as an innovation center – it substantively supports other enterprises and research units in the implementation of modern composites for various industrial fields.

Main products and services:

- Manufacturing of composite structures used in the construction of spacecraft.
- Design and production of prototypes.
- Testing of materials and structures:
 - resistance tests,
 - thermal imaging,
 - environmental,
 - resonant fatigue tests.

The most important achievements in the space sector:

- Successive validation of own competences and technological infrastructure in order to gain a significant position on the European market of suppliers of primary and secondary structures for the construction of spacecraft.
- Execution of „flight” contracts in terms of production of structural panels for the construction of telecommunications satellites for a leading European prime space company.
- Participation in the Polish industrial consortium that aims at developing and creating a development model of the ATHENA space telescope module.

Entity type: Large enterprise

Main technological domains

Structures (TD 20)

Materials and Manufacturing Processes (TD 24)

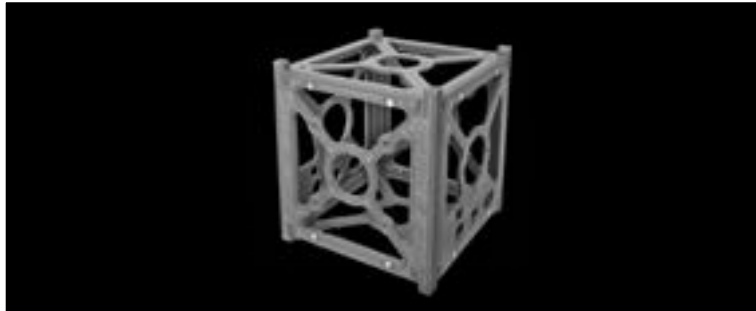
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TechOcean sp. z o.o.



TechOcean creates innovative devices using technologies such as Bluetooth, IoT, RFID, Machine Learning and image analysis. It deals with the design and implementation of products on the market. It has competences in the field of rapid prototyping, electronics design, industrial design, mechatronics, machine building and software development. In addition to providing services in the field of implementing demanding projects for innovative companies, TechOcean also focuses on the development of its own products, such as VisionQb in the field of optimization of production lines for industry, as well as 3D Zodiac filaments designed to work in space.

Main products and services:

- ▶ Design and production of devices for electronic machines.
- ▶ Design and construction of prototypes.
- ▶ Consulting and design services in the field of:
 - ▶ mechatronic structures,
 - ▶ robotics and automation,
 - ▶ software,
 - ▶ industrial design,
 - ▶ 3D printing.

The most important achievements in the space sector:

- ▶ 3D Zodiac.

● Entity type: SME

● Main technological domains



Materials and Manufacturing Processes (TD 24)



Automation, Telepresence & Robotics (TD 13)



Structures (TD 20)

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Thales Alenia Space Polska sp. z o.o.



Thales Alenia Space has been designing, integrating and managing innovative space systems for over 40 years. Thales Alenia Space is a joint venture between French Thales (67%) and Italian Leonardo (33%). It employs over 8,000 people in nine countries. In 2016, it generated approximately EUR 2.5 billion in revenue. In addition, Thales Alenia Space and Telespazio form the Space Alliance, which offers a full range of services and solutions for satellite systems.

It inaugurated its activity in Poland in 2015. The Polish company has experience in implementing telecommunications and navigation projects, Earth observation, planetary exploration, environmental protection and research related to orbital infrastructure. Thales Alenia Space Polska implements projects for the European Space Agency and cooperates with scientific and research centers, as well as with the Polish industry.

Main products and services:

- ▶ Designing satellites.
- ▶ Orbital infrastructure – slabs, panels, load-bearing walls.

The most important achievements in the space sector:

- ▶ ATHENA SIB Program.
- ▶ MMPF Phase 1 Program.
- ▶ ESA selection to COPERNICUS CHIME, iHAB programs.

● Entity type: Large enterprise

● Main technological domains



Structures (TD 20)

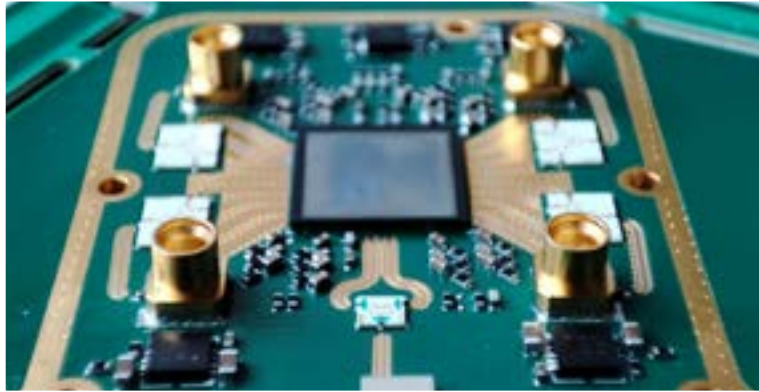
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Thorium Space sp. z o.o.



Thorium Space creates a new generation of small LEO / MEO / GEO HTS satellite platforms and RF payloads, in particular Multi Beam K / Ka and E-Band communication transporters. It redefines the future of satellite communications by exceeding its capabilities. The company works on four projects: 1) flat antenna active for the Ka-Band, 2) AESA Multi Beam E-Band transponder, 3) Polish 5G base station in the millimeter band, 4) SUBCOM – satellite remote sensing and communication system for suborbital research missiles. The company consists of an interdisciplinary team of space technology engineers and specialists in related fields.

Main products and services:

- ▶ Ka-band transponder and antenna.
- ▶ E-band transponder and antenna.

The most important achievements in the space sector:

- ▶ Technology of a fully digital control over Ka and E bands.
- ▶ Satellite system of remote sensing and communication of suborbital research missiles.
- ▶ The award for a transponder and Ka band antenna as one of the 5 Top Space Tech Global Manufacturing Solutions 2021 according to startus-insights.com. The title of one of the 10 most innovative space technology start-ups in 2021 according to startus-insights.com.

● Entity type: SME

● Main technological domains

 RF Subsystems, Payloads and Technologies (TD 6)

 On-board Data Subsystems (TD 1)

 Electromagnetic Technologies and Techniques (TD 7)

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TTcomm S.A.



TTcomm is one of the largest satellite service providers in Central and Eastern Europe. It has the necessary certificates to operate on the global and domestic market, including the authorization to cooperate with the Armed Forces of the Republic of Poland and the North Atlantic Alliance. Since 1997, it has been providing global telecommunications solutions for government and military institutions, telecoms, telecommunications operators, national and international corporations as well as radio and television broadcasters. Since 2007, TTcomm has been included in the list of entrepreneurs of special economic and defense importance. The company disposes of a teleport with a park of antennas operating in the C, X and Ku bands. Cooperating with the largest operators and suppliers of satellite equipment, TTcomm successfully implements projects for the construction and implementation of extensive VSAT networks, comprehensive telecommunications solutions for turnkey clients and solutions for foreign military missions.

Main products and services:

- ▶ Teleport antenna park, antennas with a diameter of 3.7 to 9.3 m in the C, X, Ku bands.
- ▶ KaSAT broadband satellite communications system for offshore platforms.
- ▶ Satellite platform iDirect, DVB-S / S2 & DVB multiplexing.

The most important achievements in the space sector:

- ▶ Launching the first commercial Teleport in Poland providing telecommunications services in the C, Ku, X band.
- ▶ Providing satellite services as part of military expeditionary missions since 2003.
- ▶ Providing satellite services for the research station of the Institute of Geophysics of the Polish Academy of Sciences in Spitsbergen (Polish Polar Station Hornsund).

● Entity type: SME

● Main technological domains

 Ground Station Systems and Networks (TD 12)

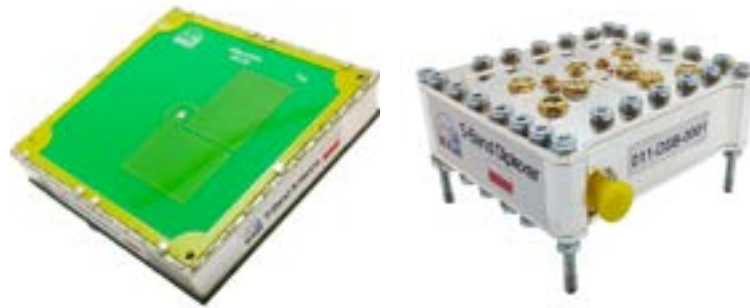
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WiRan sp. z o.o.



WiRan is a manufacturer of volatile radiocommunication devices (TRL 9). It is also a comprehensive supplier of solutions related to all wireless communication technologies (RF – Radio Frequency), operating since 2002, with experience in the space, military, railway and IoT markets. Its Design Office and ELAB Measurement Laboratory implement designs of electronic devices from concept to working prototype along with dedicated tests to ensure the required product quality. The engineers of the company support clients with their experience also in the field of solving problems of electromagnetic compatibility (EMC). For the last four years, WiRan has been executing contracts with ESA for the implementation of radio communication modules in the S and X bands.

Main products and services:

- ▶ Microwave communication.
- ▶ RF signal distribution systems.
- ▶ Antennas used in the terrestrial segment.
- ▶ Designing electronic devices.
- ▶ Final Assembly, Integration and Test (AIT).
- ▶ Support in solving problems of Electromagnetic Compatibility (EMC)

The most important achievements in the space sector:

- ▶ Flight HW TRL 9 S band diplexer, antenna and splitter for nanosatellites.
- ▶ Flight HW TRL7 X band diplexer, antenna and splitter for nanosatellites.
- ▶ Flight HW TRL 9 L band splitter for navigation.

● Entity type: SME

● Main technological domains

 RF Subsystems, Payloads and Technologies (TD 6)

 Electromagnetic Technologies and Techniques (TD 7)

 System Design & Verification (TD 8)

 Ground Station Systems and Networks (TD 12)

 Electrical, Electronic and Electro-Mechanical (EEE) Components and Quality (TD 23)

● Contact information

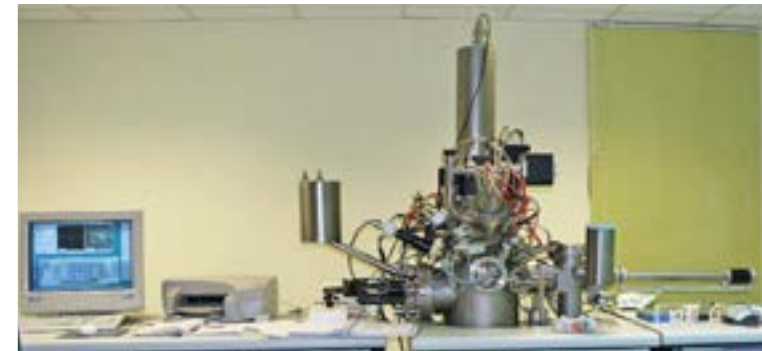
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Wydział Chemiczny Politechniki Łódzkiej

(Faculty of Chemistry, Lodz University of Technology)



The faculty is known in Poland and abroad as a strong research and teaching center (category A). It employs 428 people, and 258 of them are research and development staff. Over 100 PhD students carry out their research here. The faculty is equipped with the most modern equipment that enables leading research at the highest level in the directions indicated in the Regional Innovation Strategy of the Lodzkie Voivodship LORIS 2030 and in technologies of key importance for the development of the region and the country, including nanotechnology and functional materials, special polymeric and hybrid materials and biomass conversion. Apart from the traditional ones, the department conducts interdisciplinary research in cooperation with other units (65 projects for nearly PLN 11 million in 2020).

Main products and services:

- ▶ Composite materials (polymer fibers) for lifting systems, satellites and space probes.

The most important achievements in the space sector:

- ▶ Research and edition of the publication: D.M. Bieliński, U. Ostaszewska, J. Jagielski, "Application of ion bombardment to modify tribological properties of elastomers", Polimery (Warszawa) 2014, 59 (5), 54–57.
- ▶ Research and edition of the publication: J. Jagielski, U. Ostaszewska, D.M. Bieliński, D. Grambole, I. Jóźwik, "Hydrogen Release From Irradiated Elastomers Measured by Nuclear Reaction Analysis", Nuclear Instruments and Methods in Physics Research 2016, B 371, 216–219.
- ▶ Research and edition of the publication: K.S. Bandzierz, L.A.E.M. Reuvekamp, G. Przybytniak, D.M. Bieliński, "Effect of electron beam irradiation on structure and properties of styrene-butadiene rubber", Rad. Phys. Chem. 2018, 149, 14–25.

● Entity type: University

● Main technological domains

 Mechanisms (TD 15)

 Structures (TD 20)

 Environmental Control & Life Support (ECLS) and In Situ Resource Utilisation (ISRU) (TD 22)

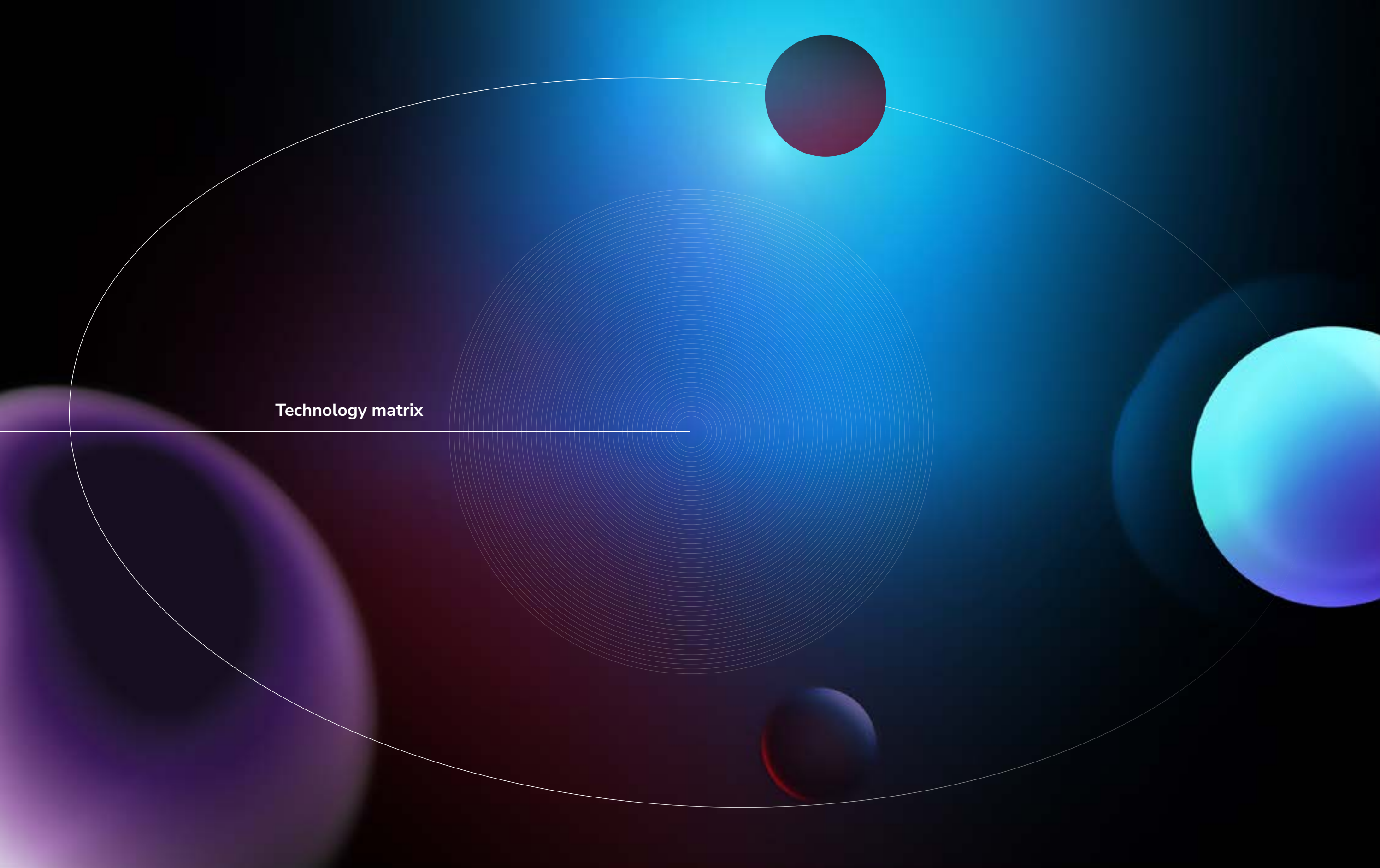
 Materials and Manufacturing Processes (TD 24)

● Contact information

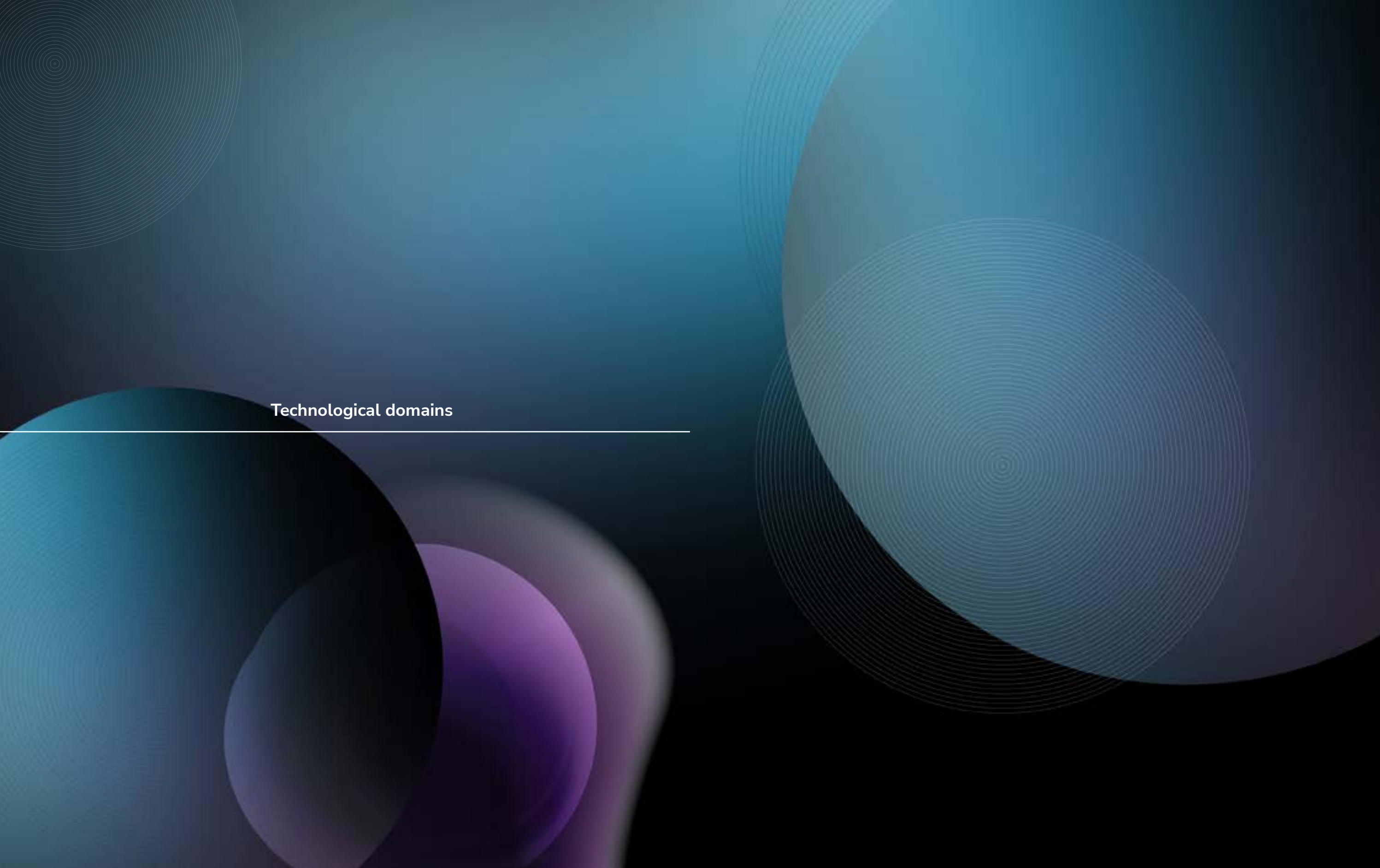
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Technology matrix

The image features a dark blue to black gradient background. A large, thin white circle is centered on the left side. A horizontal white line extends from the center of this circle towards the right, ending at the center of a series of concentric white circles. These concentric circles are centered on the right side of the image. There are three large, semi-transparent spheres: a dark blue one at the top center, a bright cyan one on the right side, and a smaller dark blue one at the bottom center. The overall aesthetic is futuristic and technological.

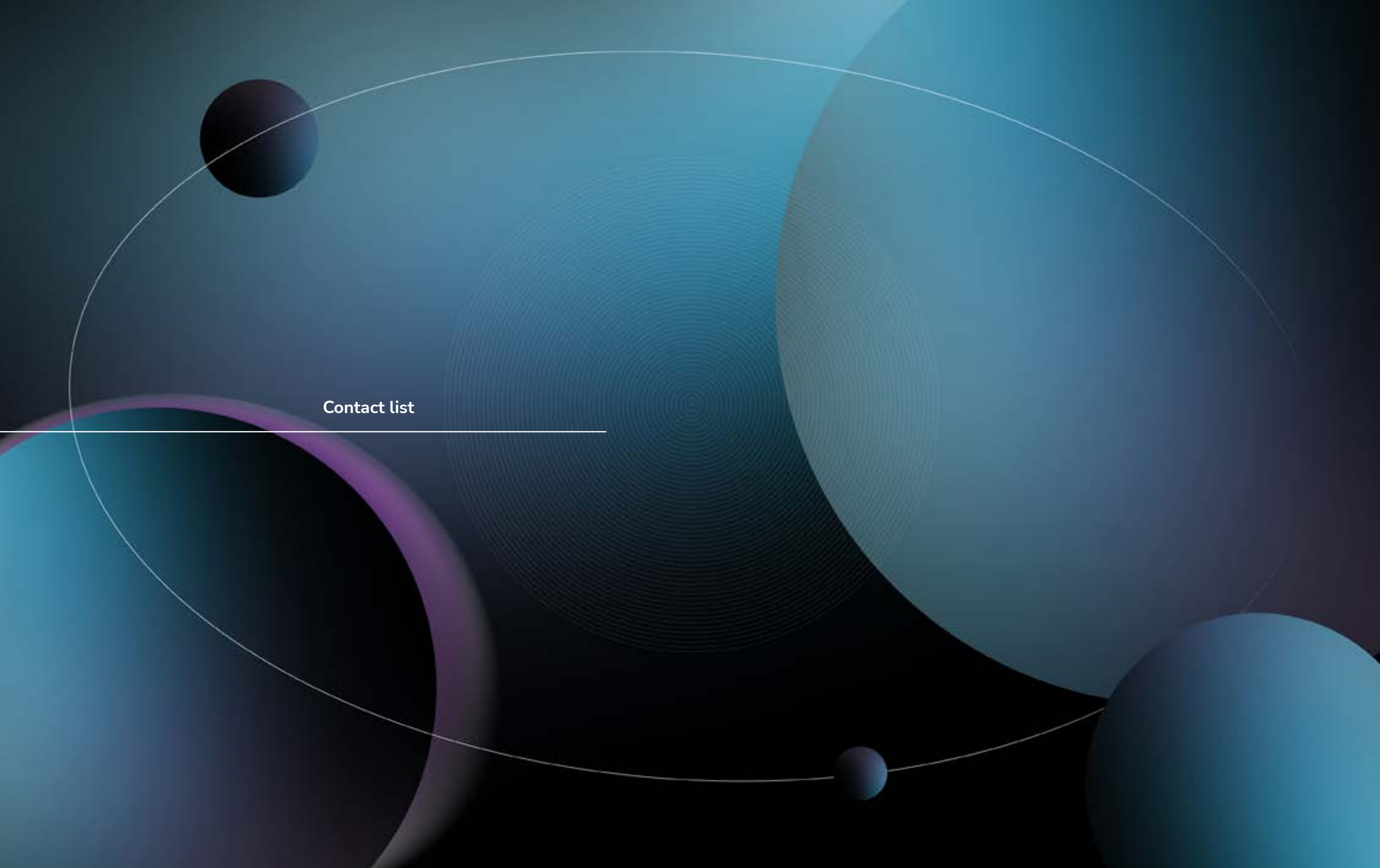
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Technological domains

	TD 1 On-board Data Subsystems
010101 010101 010101	TD 2 Space System Software
	TD 3 Space Systems Electrical Power
	TD 4 Space Systems Environments and Effects
	TD 5 Space System Control
	TD 6 RF Subsystems, Payloads and Technologies
	TD 7 Electromagnetic Technologies and Techniques
	TD 8 System Design & Verification
	TD 9 Mission Operation and Ground Data Systems
	TD 10 Flight Dynamics and GNSS
	TD 11 Space Debris
	TD 12 Ground Station Systems and Networks
	TD 13 Automation, Telepresence & Robotics

	TD 14 Life & Physical Sciences
	TD 15 Mechanisms
	TD 16 Optics
	TD 17 Optoelectronics
	TD 18 Fluid Dynamics
	TD 19 Propulsion
	TD 20 Structures
	TD 21 Thermal
	TD 22 Environmental Control & Life Support (ECLS) and In Situ Resource Utilisation (ISRU)
	TD 23 Electrical, Electronic and Electro-mechanical (EEE) Components and Quality
	TD 24 Materials and Manufacturing Processes
	TD 25 Quality, Dependability and Safety
	TD 26 Others



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The background of the entire page is a dark blue gradient. It features several large, faint, concentric circles in a lighter blue shade. Three dark blue spheres are positioned at different points along these circles, creating a sense of depth and movement. The overall aesthetic is modern and scientific.

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