SPACE TECHNOLOGY TRANSFER

Poland and Europe 2025

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Image source: ESA

Space technology transfer is the process of implementing technologies and innovations originally developed for the space sector in applications across other industries.

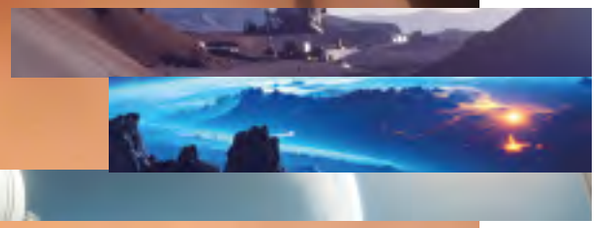

Image source: ESA

The Space Technology Transfer – Poland and Europe 2025 catalogue has been prepared as a practical response to the growing importance of space technologies in building companies' competitive advantage and creating innovations whose impact extends beyond a single sector. Its purpose is to demonstrate how solutions developed for the exploration and use of outer space can tangibly support product development on Earth. At the same time, the catalogue highlights the reverse trend – the increasing application of industrial technologies and scientific solutions in space missions. This two-way exchange of knowledge and technology can today be regarded as one of the key pillars driving the dynamics of the space market.

The publication presents a selection of inspiring examples of successful technology transfers carried out by Polish and European enterprises, illustrating how competencies and experience from different market areas can be effectively combined. The catalogue aims to encourage readers to view space technologies as an opportunity to expand business activities, develop specialisations, and – for some organisations – take a first step toward a market of growing global significance.

The technology transfer process is inherently linked to issues of intellectual property (IP), legal and formal aspects, and "freedom to operate" analyses. While these considerations are crucial to practical implementation, they are not the focus of this publication. The catalogue is intended as an inspirational and showcase-oriented resource – its goal is to present the potential of space technologies and examples of their application, rather than to provide a comprehensive discussion of commercialisation processes or full implementation pathways.

Numerous analyses confirm that outer space is becoming one of the engines of a new wave of innovation. It is estimated that every EUR 1 invested in the space sector generates between EUR 3 and EUR 6 in value for the economy. For example, according to the report "Socio-economic impact assessments of ESA programmes" (25 June 2019), each euro allocated to the ESA Future EO programme translates into an average of EUR 3.8 in value generated in the economies of ESA Member States between 2013 and 2023. Similarly, the analysis "Evaluating the benefits of the UK's investments in the European Space Agency" indicates that every pound invested in ESA programmes yields approximately GBP 7.49 in benefits for the UK economy.

This impact is not only the result of funding invested in research and development; it also stems from the creation of new products, services, companies, and jobs. With the advancement of deep tech, digital technologies, automation, and advanced analytics, the space sector has become a source of innovation impulses permeating nearly every area of the economy – from industry and medicine to transport, energy, and public services.

The catalogue aims not only to provide information on available solutions, but also to support the establishment of connections between entrepreneurs, researchers, public institutions, and organisations that foster innovation. It is an invitation to cooperation and the exchange of experience – the foundations upon which projects with commercial and developmental potential are built.

By presenting concrete examples of space technology applications across various sectors, the catalogue underscores that innovations originating from space are not reserved exclusively for the largest global corporations or specialised agencies. Medium-sized enterprises, startups, research institutions, and public administration bodies can also benefit from them by seeking solutions that increase efficiency, enable business diversification, or open access to new markets.

Today, technology transfer is not merely a pathway for the commercialisation of research results – it is a means of building future competencies, strengthening international cooperation, and participating in the creation of solutions that will shape economic development in the years to come.

Author: Paweł Kwiatkowski,
ESA Technology Broker

Technologies developed for the exploration of outer space have, for decades, served as a significant driver of progress across numerous fields of science and the economy. The complex challenges associated with operating devices and systems in extraterrestrial environments – such as extreme temperatures and steep thermal gradients, microgravity, radiation, and limited energy resources – necessitate the creation of solutions characterised by exceptional reliability, efficiency, and resistance to environmental factors. Technologies developed in response to these specific conditions constitute a valuable body of technological knowledge.

The publication presented here contributes to the discussion on the conditions required for effective transfer of space technologies to terrestrial applications, highlighting both the potential of space-derived solutions and the mechanisms of their commercialisation within academic and business environments. At the Polish Space Agency, we firmly believe that cooperation between the scientific community, industry, and public institutions is an essential prerequisite for effective technology transfer and for the development of academic entrepreneurship.

Space technology transfer should be treated as an economic challenge and a core mission of space agencies and institutions responsible for managing national space sectors, rather than as a by-product of scientific activity or the search for new industrial solutions and improvements. The role of public institutions should be to support innovative – and even visionary – ideas, as only public funding can ensure and safeguard the development of niche competencies: first within scientific research and development, and subsequently through the application of specific solutions for economic purposes.

It is crucial to establish fundamental conditions that enable the effective implementation and management of space technology transfer. These include continuous, long-term, and stable funding for space research and industrial activities to generate a broad pipeline of ideas and solutions; the creation of favourable economic conditions and a formal and legal ecosystem that provides access to investment capital; and public financing for the protection of intellectual property rights in the space sector, including the maintenance of exclusive rights.

This publication offers an opportunity to reflect on the institutional mechanisms, economic factors, and legal frameworks that influence the adaptation of technological solutions for the needs of society and the economy. The cases presented demonstrate that solutions developed for scientific experiments, orbital missions, or interplanetary exploration can effectively support the advancement of medicine, energy, telecommunications, transport, precision agriculture, and environmental monitoring. The analysis also aims to show how space technologies contribute to improving quality of life, increasing the efficiency of industrial processes, and enhancing our understanding of global phenomena occurring on Earth. The case studies presented include both examples of adapting advanced materials and systems, as well as the application of innovative manufacturing methods.

This publication is addressed to representatives of the space sector seeking deeper reflection on mechanisms for leveraging space technologies within the economy, as well as to those shaping industrial policy in Poland. Its overarching objective is to lay the groundwork for discussion on how the potential of space technologies can be effectively transformed into products and services that contribute to sustainable socio-economic development.

dr Marta Wachowicz
President of
the Polish Space Agency (POLSA).

Graphic generated using AI

The space sector is not only about space exploration but has, for decades, also been a powerful vehicle for knowledge and technology transfer.

Since Poland joined the European Space Agency (ESA), we have observed a dynamic increase in the involvement of Polish companies in this field. We have entered the New Space era, which has opened opportunities for young and ambitious startups developing breakthrough technological solutions and testing them in space. Already at the planning stage, many of these companies adopt a dual-use approach, thereby increasing their commercialisation potential and their ability to reach a broad range of customers.

The importance of space technologies is growing at an unprecedented pace, driven by global digitalisation. From systems providing internet connectivity to solutions for planetary monitoring, every project implemented for the space sector generates potential innovations that can be applied across numerous industries.

ESA's new Strategy 2040 challenges companies and research institutions to anticipate future technological needs and begin addressing them today.

Estimates indicate that the global space economy will reach a value close to EUR 1 trillion by 2040. This is why it is so important for Europe – and Poland in particular – to ensure that domestic space companies become leaders in innovation and sustainable development, and that companies themselves recognise the immense innovation potential arising from space-related challenges.

Technology transfer between the space sector and terrestrial industries has long been a key driver of innovation. Solutions developed for space exploration find applications in medicine, transport, energy, agriculture, and defence. Conversely, technologies developed in traditional industrial sectors increasingly support space missions and projects. It is precisely this two-way flow – "space for Earth and Earth for space" – that creates opportunities for cooperation, including for companies that do not traditionally identify themselves as part of the space sector.

The concept of dual-use is gaining particular importance today, demonstrating that technologies developed for space applications can also be successfully applied in both civilian and military domains. This approach strengthens cross-sector synergies and contributes to the creation of a resilient and innovative technological ecosystem. Importantly, it opens new opportunities for entities operating across various segments of the economy – from technology companies and research institutions to startups – to actively participate in technology transfer processes. Poland and Europe possess significant potential in this area.

It is worth emphasising that the space sector is not a closed industry reserved for a select few, but rather an open arena for cooperation with entities from across the economy. Recognising this fact can become a powerful development impulse for many enterprises.

This catalogue showcases the potential and diversity of solutions that may serve as inspiration for future technology transfer initiatives.

Jarosław Chojnacki
ESA Technology Broker
Kraków Technology Park

Paweł Kwiatkowski
ESA Technology Broker
ABGi Poland sp. z o.o. [Ltd.]

Space technologies rarely remain confined to outer space. Their greatest potential is revealed when they begin to operate on Earth – in sectors seemingly far removed, such as energy, medicine, or logistics. Solutions developed for the extreme conditions of orbital environments inspire innovations that become part of everyday life: from precision sensors and advanced materials to data management systems. The transfer of space technologies to other sectors is not a linear process; rather, it is a circulation in which experiences from different areas of industry intersect, strengthening competitiveness and opening up new development pathways. It is precisely this exchange that constitutes the true strength of the space economy.

Paweł Pacek
Director, Department of
New Technologies
Industrial Development Agency
(ARP S.A.)

Space has always inspired humanity and expanded our understanding of how the universe functions, while space exploration offers truly unique opportunities for the creation of new technologies. The space environment and its limited resources pose technological challenges that cannot be encountered on Earth. The need to overcome these challenges drives the development of new technologies, and their transfer enables the large-scale implementation of their outcomes.

One of the objectives of ESA BIC Poland (the European Space Agency Business Incubation Centre in Poland) is to support commercial projects based on technology transfer from or to the space sector. Technology transfer is not an easy process; therefore, initiatives undertaken by ESA – such as the ESA Technology Broker network and the ESA BIC incubation centres – provide invaluable support and, in some cases, represent the only chance for success.

Michał Chwieduk
Head of ESA BIC Poland
Industrial Development Agency
(ARP S.A.)

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Technologies developed within the space sector are increasingly finding applications on Earth, creating tangible business and social value. At KP Labs, we develop super-resolution reconstruction (SRR) algorithms that make it possible to enhance the resolution and level of detail of satellite imagery. Thanks to these solutions, standard Earth observation data gain a new quality, becoming valuable tools for precision agriculture, urban planning, environmental monitoring, and the protection of critical infrastructure.

This clearly demonstrates that investments in space are not limited to exploration alone, but also serve as a powerful driver of innovation that supports economic growth and improves quality of life. By building strong competencies in artificial intelligence and data processing, Poland has the opportunity to strengthen its position within the global technology ecosystem and to deliver solutions that address the key challenges of the modern world.

Michał Zachara
Vice President of the Management Board,
KP Labs sp. z o.o. [Ltd.]

To understand how space technologies influence the creation of new companies whose products are not physically present in orbit, it is enough to take a closer look at today's GEOINT market.

This market can be divided into several segments: entities that collect GEOINT data (satellite and sensor providers), companies that process data (detection models, target recognition), and those focused on data integration and interpretation.

The position of companies operating exclusively in data processing is becoming increasingly complex. They often appear to be forced either to cooperate with potential competitors or to function permanently as junior partners. To counter this, some of these firms attempt to expand into additional use cases or to evolve into full-scale threat intelligence companies, such as Anomali Six.

At the same time, new companies specializing in data integration are emerging to address the growing challenge of effectively analysing GEOINT data. The architecture of legacy tools, such as Esri, is outdated and unable to operate efficiently at scale given the rapid growth in data volumes in recent years. As a result, demand is increasing for unified platforms that enable fast and efficient GEOINT data analysis.

This is why Expeditions invested in Larx, a company founded by Tad Mielnicki (founder of Second Front Systems and Overwatch), Colter Carambio (former IQT employee), and Adam Smith (with 16 years of experience at SOCOM).

Andrzej Rościszewski
Investment Associate, Expeditions Fund

INSTITUTIONAL SUPPORT FOR SPACE TECHNOLOGY TRANSFER IN EUROPE AND WORLDWIDE

Technology transfer in the space sector requires not only innovative solutions and entrepreneurial courage, but also robust institutional support. Public institutions and specialized agencies create the organizational and financial conditions that enable the implementation of research and development outcomes across various sectors of the economy, providing infrastructure, funding, advisory services, and promoting mechanisms for cooperation. In Europe and globally, a range of practices has been developed that serve as inspiration for building effective innovation ecosystems.

One of the key instruments are publicly funded programmes, including initiatives co-financed by national and international institutions supporting research and innovation. These programmes enable universities and enterprises to conduct joint research while distributing risk among multiple stakeholders. At the European level, the Horizon Europe framework programme and the European Innovation Council (EIC) play a central role.

Horizon Europe is the largest research and innovation programme of the European Union, financing projects with high implementation potential and fostering cooperation between science, industry, and public administration. The programme promotes open access to research results, develops international collaboration infrastructure, and enables startups and SMEs to participate in initiatives of strategic importance to the economy. The **EIC**, in turn, supports both early-stage, high-risk research (EIC Pathfinder) and commercialization processes (EIC Accelerator), financing projects with strong innovation potential.

A particularly important role in this system is played by the **European Space Agency (ESA)**, which goes beyond scientific research to systematically support the commercialization and adaptation of space technologies for terrestrial applications. ESA supports startups and mature companies alike and facilitates access to research infrastructure. Its initiatives include the incubation of young companies – most notably through the **ESA Business Incubation Centres (ESA BIC)** network – as well as industry support programmes and market-oriented funding instruments such as **ESA Spark Funding**.

The scale of these activities is significant. The ESA BIC network comprises 29 incubation centres across Europe, which to date have supported more than 1,600 startups, generating thousands of jobs in the space and related technology sectors. Approximately 200 new companies join the programme each year, some of which achieve success beyond the space sector. It is estimated that ESA's incubation activities have contributed to the creation or maintenance of over 2,500 jobs in Europe.

In parallel, the **Technology Transfer Programme Office (TTPO)** operates in cooperation with the network of **ESA Technology Brokers**, supporting the application of space technologies in other sectors of the economy. To date, more than 450 applications of such solutions have been recorded, including new materials, technologies for precision agriculture, and systems supporting the energy sector.

ESA offers programmes such as **PhiLab, BIC, Spark Funding, and Business Applications,** which support technological innovation and the commercialization of solutions. Horizon Europe, as the EU's flagship research and innovation programme, finances international projects with high R&D and deployment potential. In Poland, entrepreneurs can also benefit from national instruments, including programmes of the **National Centre for Research and Development (NCBR)** focused on R&D, as well as support from the **Polish Agency for Enterprise Development (PARP)**, primarily addressed to SMEs in areas such as innovation, internationalization, digitalization, and the green transition. This creates a wide range of funding opportunities – from grants and co-financing to advisory services and acceleration – tailored to the company's stage of development and the nature of the project.

ESA PHI-LAB

a Polish ESA innovation hub with a focus on space robotics and artificial intelligence. It offers access to state-of-the-art laboratories, simulators, business and technology experts, intellectual property, and seed funding support.

ESA BIC

the ESA Business Incubation Centre provides incubation for space-related startups, offering advisory services, mentoring, and business support to facilitate market entry and the development of innovative solutions.

ESA BROKER & SPARK FUNDING

finances the development and market deployment of solutions used in the space sector (e.g., sensors, materials, electronic components, software) for applications in other industries such as transport, energy, and healthcare. The programme targets SMEs, startups, and larger companies with proprietary product lines, supporting innovation.

ESA BUSINESS APPLICATIONS AND SPACE SOLUTIONS (BASS)

focuses on the commercialization of space technologies and the implementation of projects using satellite data, navigation, and satellite telecommunications, supporting practical market applications.

HORYZONT EUROPA (UE)

research and innovation programme, financing ambitious R&D projects with global implementation potential and supporting a wide range of entities, from research institutions and companies of all sizes to public administrations and non-governmental organizations.

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In many European countries, space technology transfer is supported by national space agencies. For example, **DLR (Deutsches Zentrum für Luft- und Raumfahrt)** in Germany runs extensive programmes for industry–science collaboration. The **UK Space Agency** supports space technology transfer through cooperation with the **ESA Technology Broker UK** network, while **ESA BIC UK** in Harwell facilitates the commercialization of space technologies, supporting companies implementing them in robotics, automation, and materials engineering.

In France, **CNES (Centre National d'Études Spatiales)** develops "innovation laboratories" and initiates projects applying space technologies in the energy, transport, and medical sectors. In Italy, **ASI (Agenzia Spaziale Italiana)** runs a broad industry cooperation programme, supporting the creation of academic spin-offs and financing R&D projects involving SMEs. In partnership with ESA and a network of national technology centres, ASI supports the transfer of space technologies – such as materials, mechatronics, and communications – to sectors including automotive, energy, logistics, and industrial automation.

Beyond Europe, inspiring support models also exist. In the United States, federal programmes such as **SBIR (Small Business Innovation Research)** and **STTR (Small Business Technology Transfer)** play a key role by supporting collaboration between small businesses and research institutions. **NASA** operates a comprehensive Technology Transfer Program, making its research results available to enterprises. In addition, U.S. investment funds co-financed by government agencies create a strong ecosystem for technological entrepreneurship.

In Canada, the **Canadian Space Agency (CSA)** supports innovation through grants and cooperation with universities, focusing on space-derived technologies in robotics, medicine, and communications – many of which have found applications in healthcare and automation.

In Asia, a comprehensive approach is exemplified by **Japan's Space Strategy Fund (SSF)**, financed by **JAXA** and the Japanese government, which supports international research cooperation and the commercialization of space technologies. The Japanese **Ministry of Education, Culture, Sports, Science and Technology** (MEXT) and the **Ministry of Economy, Trade and Industry** (METI) offer grants for R&D projects and initiatives with high economic potential, generating hundreds of jobs and contributing to productivity growth in non-space sectors.

In India, the **Technology Adoption Fund (TAF)** launched by **IN-SPACe (Indian National Space Promotion and Authorization Centre)** supports the implementation and adaptation of space technologies in the private sector, covering up to 60% of investment costs for startups. Current efforts focus on deploying advanced technologies developed by **ISRO (Indian Space Research Organisation)** in the automotive sector, including imaging sensors, temperature and pressure sensors, gyroscopes, accelerometers, acoustic and vibration sensors, specialized coatings and adhesives, anti-vibration and noise-damping technologies, insulation solutions, and safety systems. Additionally, in 2024 India established a fund of INR 10 billion (approx. USD 119 million) to support space technology companies, alongside an intensive 21-month **PIE (Pre-Incubation Entrepreneurship Development Program)** promoting science–business collaboration in developing space-related innovations.

Global experience demonstrates that success in space technology transfer depends on strong synergy between science, industry, and public administration. Effective models – such as those implemented by ESA, NASA, and JAXA – are based on long-term funding, open access to research results, and active support for technological entrepreneurship. Institutional support also strengthens economic competitiveness, creates jobs, and stimulates technological development beyond the space industry itself.

Author: Paweł Kwiatkowski,
ESA Technology Broker

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EXAMPLES OF SPACE TECHNOLOGY TRANSFER

Polish space technologies still represent a relatively small segment of the market, and as a result, the technology transfer process is only beginning to gain momentum. Solutions developed by Polish companies and research institutions are typically characterized by very narrow, precisely defined applications, closely tailored to the requirements of specific space missions. This strong focus on meeting the constraints of the space environment – often without parallel planning for potential applications in other sectors – means that the subsequent transfer of such technologies can be a significant challenge.

Under these conditions, the selection of examples presented in this publication focuses primarily on technologies that have been successfully transferred to non-space applications and have delivered measurable commercial benefits. The experiences of the entities that have achieved this demonstrate that success often depended on recognizing the value of a technology in areas where it was not immediately obvious to other market participants, and on developing solutions that had not previously been available. These examples convincingly illustrate the value of research conducted for space purposes and highlight how many modern technologies owe their existence to the process of transferring space-developed solutions to applications on Earth.

The dynamic development of the space sector observed in other countries, combined with the growing interest in space technologies in Poland, allows for an optimistic outlook that the coming years will see a significant increase in the number of domestic space solutions and related technology transfer projects into other areas of the economy.

The technology transfer cases presented in this publication were selected from a broad pool of completed projects based on their relevance, level of innovation, and market significance. All described transfers originate from the past five years and were identified by both companies and technology brokers operating in Poland and across other European countries. The primary emphasis was placed on solutions developed by companies and research entities that have found effective applications outside the space sector and demonstrate strong implementation potential. An additional selection criterion was the ability of the technology to generate tangible commercial benefits, as well as its unique character, confirming the high value of space technology transfer processes.

Author: Jarosław Chojnacki,
ESA Technology Broker

SMART BED-OCCUPANT SENSOR – BOSFAL

SUPPLIER TECHNOLOGY DESCRIPTION:

The Fibre Optic Sensor (FOS) system, originally developed for the Canadarm2 robotic arm aboard the International Space Station (ISS), provided high precision and reliability under conditions of vacuum, radiation, and extreme temperatures. The system is based on optical cavity sensors embedded in polymer foam, enabling the detection of minimal movements and pressure changes with millimetre-level accuracy. It operates in a temperature range from −80°C to +200°C, responds in less than 1 ms, contains no metal components, and is immune to electromagnetic interference. The system can be configured into sensor matrices, allowing detailed multi-point monitoring simultaneously.

RECIPIENT TECHNOLOGY DESCRIPTION:

The FOS technology was adapted for healthcare applications. The BOSFAL Smart Bed-Occupant sensor enables continuous monitoring of bedridden patients in hospitals, nursing homes, and home care settings, supporting pressure ulcer prevention and improving the efficiency of medical care. The sensing mat records pressure distribution and movement with millimetre accuracy and transmits data in real time via an IoT platform compliant with GDPR and IT security requirements.

The system enables rapid staff response, reduces administrative workload, lowers treatment costs, and integrates seamlessly with healthcare IT systems. Key advantages include hygiene and safety of use (waterproof design, absence of electric fields and metals), high measurement precision, system scalability, and cost-effective deployment and operation.

TECHNOLOGY TRANSFER DESCRIPTION:

The technology transfer was initiated by KINOTEX SENSOR GmbH under the ESA Technology Transfer Programme in response to challenges facing modern healthcare, including the growing number of bedridden patients, shortages of medical staff, and the high costs of institutional care. Pressure ulcer prevention remains a costly and time-consuming process, and existing monitoring systems lacked sufficient reliability and automation.

Through the ESA network, the FOS technology from the ISS was identified as an ideal solution for continuous (24/7) patient monitoring due to its robustness, precision, and immunity to electromagnetic interference.

The transfer process included: adapting the FOS design to medical-sector requirements (hygiene, safety, integration into care workflows), developing the BOSFAL Smart Bed-Occupant sensor prototype, integrating the system with a GDPR- and IT-compliant IoT platform, and conducting pilot tests in nursing homes.

For BLACKPIN.IOT UG, the project resulted in the creation of a unique medical IoT solution combining fibre optic sensors, artificial intelligence (AI), and mobile communication. Additional benefits include new opportunities for healthcare digitalisation, reduced costs and documentation burden, support for home care development, and a strengthened market position at the intersection of space technologies, medicine, and secure communications.

Source: Promotional materials of BLACKPIN IOT UG

Supplier: **BLACKPIN GmbH**

Space Technology Category: **Sensors and Measurement Techniques**

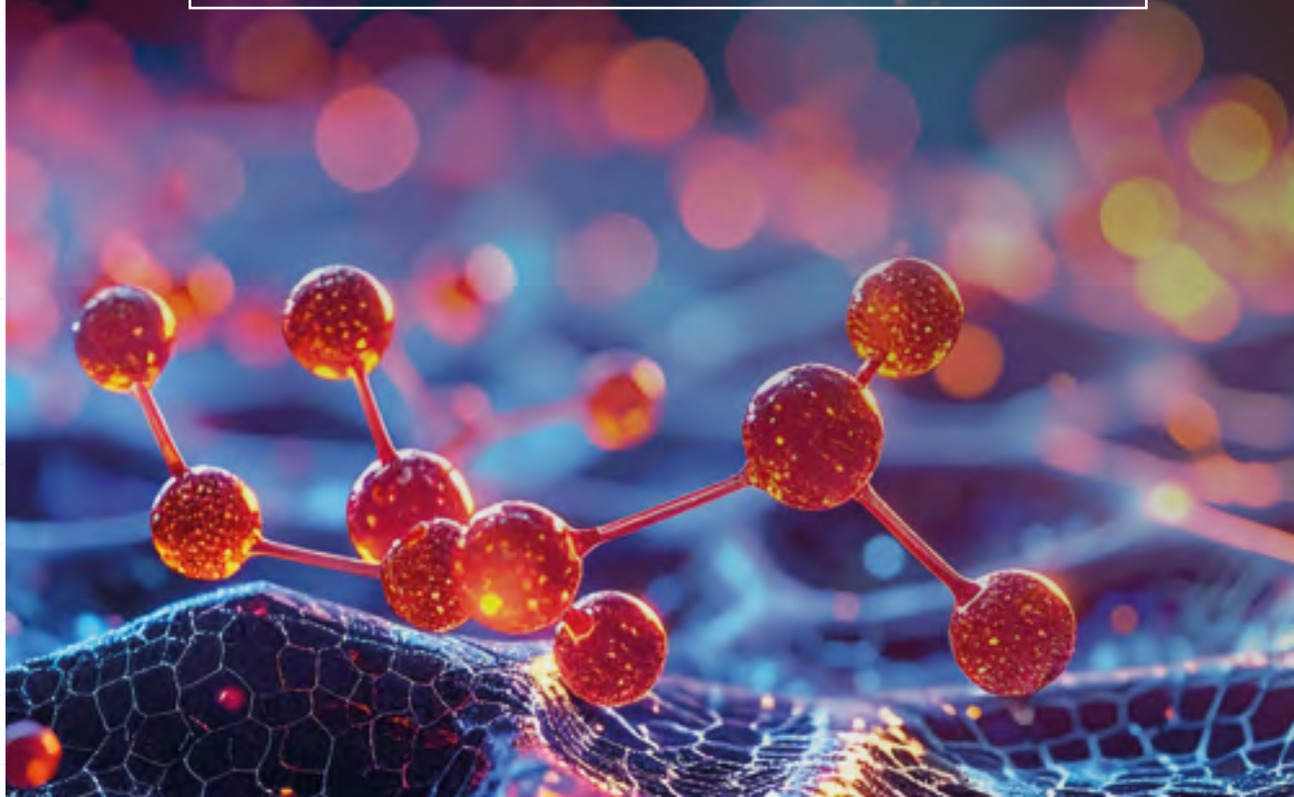
Recipient: **KINOTEX SENSOR GmbH**

Organisation Type: **SME**

Target Industries: **Healthcare and related sectors**

Technology Readiness Level (TRL): **TRL8**

Year of implementation: **2025**



Graphic generated using AI

Image source: promotional materials of MIRORES Mining Data Services sp. z o.o.

MIRORES EARTH

SUPPLIER TECHNOLOGY DESCRIPTION:

MIRORES is a far-infrared (FIR) spectrometer with an extended measurement range reaching into the mid-infrared (MIR), developed by MIRORES Mining Data Services sp. z o.o. [Ltd.] in cooperation with the Institute of Geological Sciences and the Space Research Centre of the Polish Academy of Sciences. The instrument was originally designed for the ESA High-resolution Lunar Mineralogy Mapper mission and the Polish Lunar Mission.

The spectrometer is used for mineralogical analysis of the surfaces of the Moon and other celestial bodies – such as Mars and asteroids – by recording their absorption and/or emission spectra in the far-infrared range.

MIRORES enables the detection of sulphide and oxide minerals that cannot be identified using conventional near-infrared methods, significantly expanding the capabilities of spectroscopic exploration of the Moon and asteroids.

RECIPIENT TECHNOLOGY DESCRIPTION:

MIRORES Earth is a far-infrared spectrometer designed for drone-based, laboratory, and field applications. It enables the detection of copper ores (including pyrite and chalcopyrite) as well as iron–titanium ores (such as ilmenite), which are invisible in the near- and mid-infrared ranges. This solution opens new opportunities for geological prospecting in hard-to-access areas.

The instrument operates in both vertical and horizontal geometries, supporting open-pit mining operations and field surveys alike, and provides data with a spatial resolution of 5–10 cm in demanding environmental conditions, including tundra, mountainous, and desert regions.

MIRORES Earth is a compact adaptation (13 × 13 × 21 cm) of a larger space-grade spectrometer (32 × 32 × 40 cm) developed for the ESA High-resolution Lunar Mineralogy Mapper mission and the Polish Lunar Mission.

TECHNOLOGY TRANSFER DESCRIPTION:

The terrestrial application of MIRORES resulted from the need to develop more sensitive mineral detection methods, particularly in response to the growing demand for critical metals such as cobalt, nickel, and copper, which are essential for the transition towards a low-emission economy.

Traditional techniques based on near-infrared spectroscopy and X-ray radiation are unable to identify many ore minerals, including sulphides and most oxides, whereas MIRORES allows for the registration of their unambiguous absorption signatures.

The establishment of the MIRORES Mining Data Services (MDS) spin-off enabled the commercialisation of the technology. The company received support from ESA BIC (for the development of a geological data analysis platform) and the ESRIC SSP programme, and also won an ESA Technology Transfer award. Through the ESA Spark Funding Poland programme, a compact version of the spectrometer suitable for drone or laboratory deployment was developed.

The adaptation process included optimising the optical layout for shorter optical paths (1–30 m) and integrating the instrument with mobile platforms, demonstrating that space-heritage instruments can operate effectively in challenging terrestrial field conditions.

The technology is currently used in applications such as precision mineral sorting and recycling, as well as in autonomous mining robots that analyse ore composition in real time. MIRORES has also attracted interest in the context of future asteroid missions, as MIRORES Mining Data Services remains active in the space sector as a subcontractor for the second development phase of the ESA High-resolution Lunar Mineralogy Mapper (HRLMM) mission, responsible for delivering one of the two main payloads.

International commercialisation is supported by a Luxembourg-based consulting company cooperating with the South American mining sector. The MIRORES Earth case clearly demonstrates how a spectrometer of space origin can effectively strengthen both scientific research and industrial capabilities on Earth.

Source: Promotional materials of MIRORES Mining Data Services sp. z o.o. [Ltd.]

Supplier: **MIRORES Mining Data Services sp. z o.o. [Ltd.]**

Space Technology Category: **Sensors and Measurement Techniques**

Recipient: **MIRORES Mining Data Services sp. z o.o. [Ltd.]**

Organisation Type: **SME**

Target Industries: **Geology and mineral engineering**

Technology Readiness Level (TRL): **TRL7**

Year of implementation: **2025**

MAGNETOMETER

Image source: promotional materials of RB Defence sp. z o.o.

Supplier:
KMSENSE Aerospace Solutions B.V.

Space Technology Category:
Sensors and Measurement Techniques

Recipient:
RB Defence sp. z o.o. [Ltd.]

Organisation Type: **SME**

Target Industries: **sektor obronny, kosmiczny, lotniczy, IT**

Technology Readiness Level (TRL): **TRL 7**

Year of implementation: **2025**

SUPPLIER TECHNOLOGY DESCRIPTION:

KM Sense K-PUS Nano is a family of high-precision and high-performance digital magnetic compass (DMC) sensors from the K-PUS series. The device measures roll, pitch, and yaw angles, with results transmitted via a bidirectional electrical interface.

The sensor integrates core measurement components: a 3-axis accelerometer, a 3-axis gyroscope, and a 3-axis magnetometer. Magnetometers from the K-PUS series were deployed onboard the HelloSpace satellites Hello Test 1 and Hello Test 2 as part of their orbital demonstration missions. The satellites were launched during the SpaceX Transporter-9 mission.

RECIPIENT TECHNOLOGY DESCRIPTION:

Quantum Perimeter is an advanced perimeter protection system designed to detect anomalies in the Earth's magnetic field using space-grade magnetometers developed by KM Sense. The system passively records magnetic disturbances caused by vehicles, moving machinery, or other ferromagnetic objects, enabling early detection of potential threats.

Unlike camera-based solutions, Quantum Perimeter does not require a direct line of sight, allowing it to operate reliably in darkness, adverse weather conditions, and environments where visibility is obstructed by vegetation or infrastructure.

As the system emits no signals, it is inherently resistant to cyberattacks, jamming, and other forms of electronic interference. Particular emphasis has been placed on minimising false alarms through rigorous testing and the application of advanced anomaly-detection algorithms. As a result, Quantum Perimeter is a compelling solution for high-security applications where rapid response and detection accuracy are critical.

TECHNOLOGY TRANSFER DESCRIPTION:

The transfer of space-grade magnetometer technology to the Quantum Perimeter system, implemented under the ESA Spark Funding Poland programme, involved adapting advanced sensors originally used in satellite missions for terrestrial perimeter security applications. This need was driven by the growing number of intrusion and sabotage incidents at strategic sites – including critical infrastructure, industrial facilities, and logistics hubs – where traditional detection systems often prove ineffective or vulnerable to interference.

The deployment of space technologies enabled exceptional detection precision and sensitivity. Space-grade magnetometers are capable of identifying even minimal magnetic field disturbances generated by ferromagnetic objects such as vehicles or equipment entering protected areas. The solution demonstrates high resistance to electromagnetic interference and jamming attempts, ensuring continuous operation in demanding environmental conditions.

The transfer process also included adapting electronics and software for operation across diverse environments – from industrial zones to environmentally protected areas. The resulting technology features low maintenance requirements and high energy efficiency, reducing operating costs while increasing system reliability.

As a result of the implementation, the recipient expanded its product portfolio with an innovative solution distinguished by detection accuracy, robustness, and flexible integration with existing security infrastructure, such as CCTV systems and access control. The project enabled the acquisition of new customers in high-security sectors, supported international expansion, and increased revenues and market presence.

Source: Promotional materials of RB Defence sp. z o.o. [Ltd.]

Image source: promotional materials of RB Defence sp. z o.o.

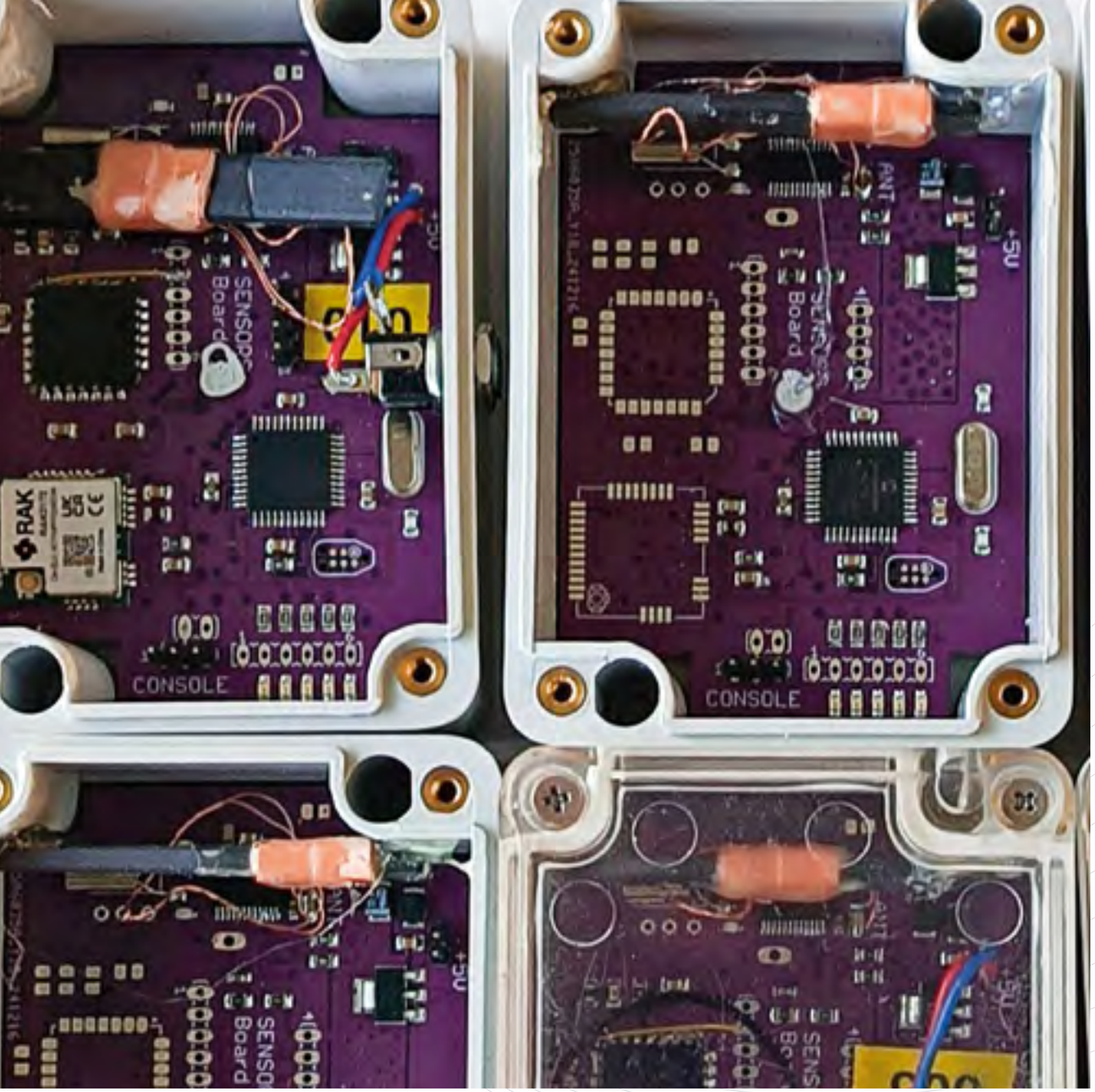


Image source: promotional materials of Blue Dot Solutions sp. z o.o.

PLUTONIC DOSIMETER

SUPPLIER TECHNOLOGY DESCRIPTION:

RadNano 2K is an advanced, miniaturised dosimeter developed by 27G Technology Ltd., designed for precise measurement of ionising radiation doses. The device monitors the impact of radiation on electronics and materials, enabling the assessment of system resilience in harsh environments such as outer space, research laboratories, and industrial settings.

The dosimeter features extremely compact dimensions, a mass below 1 g, and exceptionally low power consumption, allowing integration with microsatellites and devices with limited energy resources. The technology has reached Technology Readiness Level (TRL) 9 and has been validated in space missions, representing a state-of-the-art solution for radiation safety monitoring in extreme environmental conditions.

RECIPIENT TECHNOLOGY DESCRIPTION:

The PLUTONIC device, developed by Blue Dot Solutions sp. z o.o. [Ltd.], is a time synchronisation module operating independently of satellite navigation systems (GNSS). It utilises a terrestrial radio signal broadcast by Polish Radio at a frequency of 225 kHz.

Within the project, the device was expanded to include an electronic module integrated with the RadNano 2K dosimeter from 27G Technology Ltd. The objective of this integration was to demonstrate that combining an independent time synchronisation system with a high-precision radiation sensor enables advanced measurements in conditions where such capabilities were previously limited or unavailable.

TECHNOLOGY TRANSFER DESCRIPTION:

Under the ESA Spark Funding Poland programme, an integrated solution – PLUTONIC Dosimeter – was developed, combining time synchronisation technology with precise radiation measurement. The RadNano 2K dosimeter by 27G Technology Ltd., the smallest integrated electronic dosimeter currently available on the market, was selected due to its compact design, low power consumption, and compatibility with standard digital interfaces used in terrestrial electronics.

Tests conducted at the Institute of Nuclear Physics using a Cobalt-60 radiation source confirmed the device's effectiveness in detecting various levels of gamma radiation. The integration of the components enabled the development of miniaturised, cost-effective radiation monitoring devices, as well as the conceptualisation of a distributed sensor network operating across the entire country.

Such a system could serve as the foundation for a national early warning system in crisis situations and provide an independent source of data on radiation levels.

Source: Promotional materials of Blue Dot Solutions sp. z o.o. [Ltd.] and 27G Technology Ltd.

Supplier: **27G TECHNOLOGY LTD.**

Space Technology Category: **Sensors and Measurement Techniques**

Recipient: **Blue Dot Solutions sp. z o.o.**

Organisation Type: **SME**

Target Industries: **Automotive, IoT, aerospace, maritime sector, consumer electronics, data centre infrastructure**

Technology Readiness Level (TRL): **TRL 7**

Year of implementation: **2025**

MXENE WRISTBAND

Image source: promotional materials of AGH University of Science and Technology in Kraków

SUPPLIER TECHNOLOGY DESCRIPTION:

MXenes are a family of two-dimensional nanomaterials composed of metal carbides, nitrides, or carbonitrides. These materials were utilised in the MXene in LEO project, funded by the Ministry of Development and Technology, the Polish Space Agency, and the European Space Agency, and implemented as part of the IGNIS / Axiom-4 mission.

As part of the experiment conducted aboard the International Space Station (ISS), the stability of MXene nanomaterials was tested under low Earth orbit conditions, within crewed habitat environments. In parallel, a wristband made of biocompatible bacterial cellulose was developed and equipped with sensors based on MXene nanomaterials. The purpose of the wristband was to monitor astronauts' biometric data – specifically heart rate and wrist movement for gesture and limb motion detection – under microgravity conditions. The experiment also included verification of the stability of MXene nanomaterials under exposure to cosmic radiation.

RECIPIENT TECHNOLOGY DESCRIPTION:

Wearable devices based on MXene materials were subsequently developed and applied in cardiac monitoring tests at the Upper Silesian Medical Centre Hospital in Katowice. Biomedical applications of this technology have now commenced in a hospital environment as part of preclinical studies.

TECHNOLOGY TRANSFER DESCRIPTION:

Devices combining multifunctional nanomaterials with biocompatible, renewable materials represent an innovative approach to human health monitoring. This technology enables the replacement of costly manufacturing processes and reduces reliance on petrochemical-based raw materials in favour of materials of biological origin.

Source: Promotional materials of AGH University of Science and Technology in Kraków

Supplier: **AGH University of Science and Technology (Stanisław Staszic) in Kraków**

Space Technology Category: **Materials and Manufacturing Processes**

Recipient: **AGH University of Science and Technology (Stanisław Staszic) in Kraków**

Organisation Type: **University / Higher Education Institution**

Target Industries: **Biomedicine, healthcare**

Technology Readiness Level (TRL): **TRL 9**

Year of implementation: **2025**

Image source: promotional materials of Creotech Instruments S.A.

CAMERA FOR SPACE DEBRIS OBSERVATION

SUPPLIER TECHNOLOGY DESCRIPTION:

The Creosky 6000 camera was developed for observations of Near-Earth Objects (NEO) and Space Surveillance and Tracking (SST) within the EU-SST programmes implemented by the European Commission (EC) and the S2P programmes conducted by the European Space Agency (ESA). The solution addresses the need for acquisition and processing of data from high-speed sCMOS sensors (over 20 frames per second, 6k × 6k pixel resolution, 70 MB per frame), which significantly exceed the capabilities of traditional CCD arrays (2–3 frames per second). In multi-sensor systems, this results in a substantial increase in data processing and storage requirements.

The camera enables preliminary data reduction directly within the device, including image stacking and rejection of empty frames. Thanks to the use of FPGA systems, it supports real-time processing and offers high configurational flexibility. The device is equipped with an application processor, PTPv2 time synchronisation and a GPS receiver (PPS), enabling standalone operation, precise time synchronisation and control of external devices. As part of the project, vacuum technologies, cooling systems, high-speed data transmission and real-time imaging were also developed, resulting in a complete platform for advanced space observation.

RECIPIENT TECHNOLOGY DESCRIPTION:

In quantum computers and optical clocks, general-purpose devices (such as standard scientific cameras or commercial DAQ systems) are commonly used, which limit data acquisition speed and require external signal processing. This results in a low effective readout rate of atomic states (typically 2–10 Hz) with coherence times measured in tens of microseconds. Collaboration with the Max Planck Institute of Quantum Optics (Germany) and the Institute of Physics (Croatia) demonstrated the need to develop cameras capable of readout rates in the range of 2–10 kHz for weak optical signals (~10 photons / 10 µs) and operation in real time.

Creotech Instruments S.A. developed a prototype camera based on the Creosky 6000 platform, which confirmed the effectiveness and stability of the proposed solution. The company plans to increase the technology readiness level (TRL) to 9 and introduce the solution to the quantum technologies market.

TECHNOLOGY TRANSFER DESCRIPTION:

The technology transfer was carried out within the NImSoQ project (New Imaging and Control Solutions for Quantum Processors and Metrology), implemented under the QuantERA programme – a European Commission initiative supporting fundamental and applied research in quantum technologies. The project aimed to develop a camera capable of overcoming technological barriers in quantum computers and optical clocks based on trapped atoms.

In cooperation with the Max Planck Institute of Quantum Optics (Germany) and the Institute of Physics (Croatia), the technological requirements necessary for the project were defined. Creotech Instruments S.A. developed camera prototypes dedicated to quantum applications, which were subsequently subjected to functional testing. The results confirmed that the solution met the defined requirements and eliminated limitations inherent in general-purpose devices. The company plans to raise the technology readiness level (TRL) to 9 and commercialise the developed solution.

The transfer also enabled identification of further improvements for the original Creosky technology applications and introduced new tools and techniques from the field of quantum technologies into the design process, strengthening the company's development potential and increasing its capacity to create innovative products in the future.

Source: Promotional materials of Creotech Instruments S.A.

Supplier:
Creotech Instruments S.A.

Space Technology Category:
Sensors and Measurement Techniques

Recipient: **Max Planck Institute of Quantum Optics**

Organisation Type: **SME**

Target Industries:
Telecommunications and connectivity, cybersecurity and cryptography, data processing and artificial intelligence, electronics industry and system components

Technology Readiness Level (TRL):
TRL 9

Year of implementation: **2025**

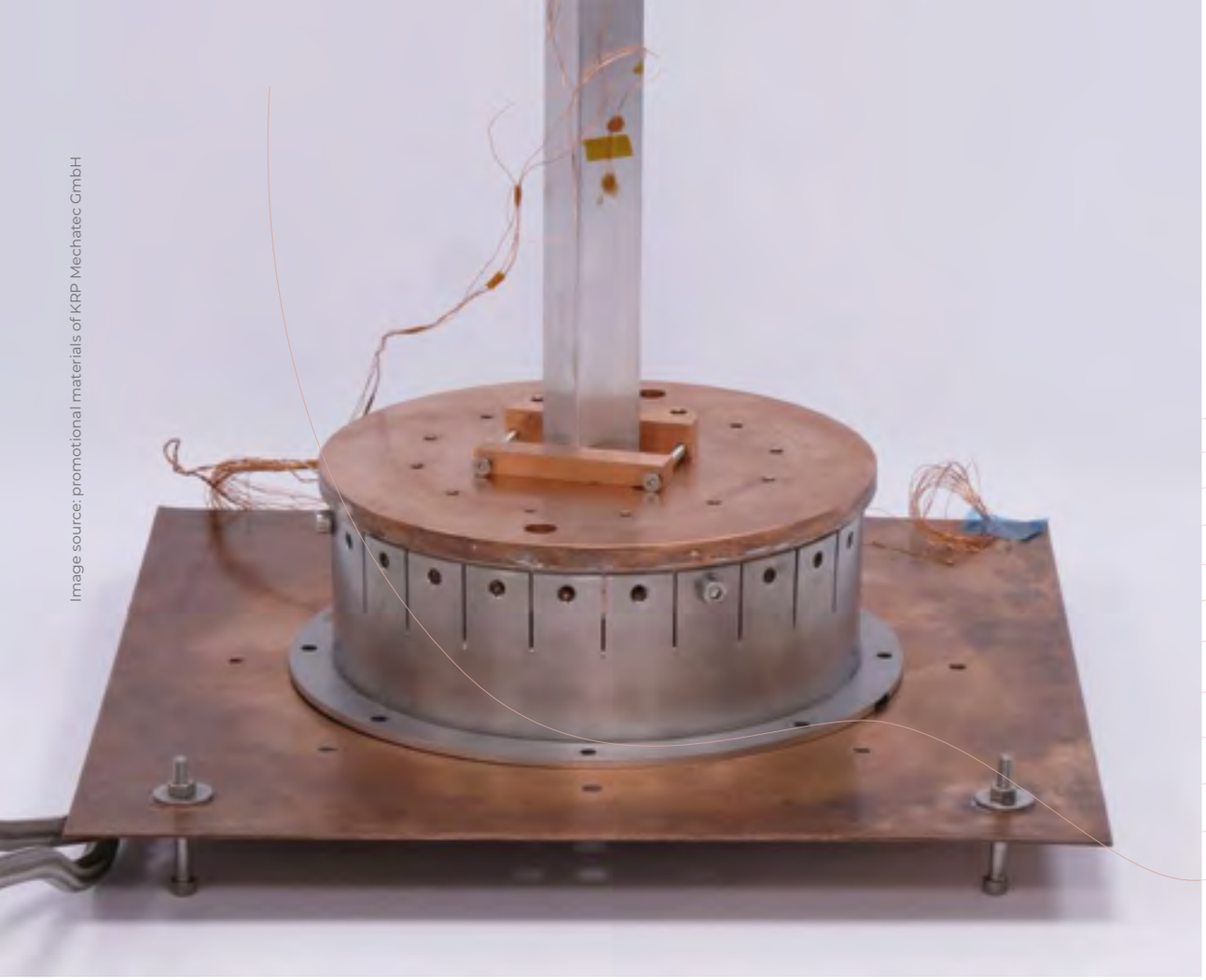


Image source: promotional materials of KRP Mechatec GmbH

CRYOGENIC THERMAL CONDUCTIVITY TEST RIG

SUPPLIER TECHNOLOGY DESCRIPTION:

KRP Mechatec GmbH developed a research test rig for measuring thermal conductivity under cryogenic conditions – the Cryogenic Thermal Conductivity Test Rig (KRP). The system is designed to determine longitudinal thermal conductivity values over a temperature range from −263°C to +100°C.

The test rig can be adapted to a wide variety of materials and sample geometries (up to 270 mm in length and 80 mm in diameter), enabling testing of both highly thermally conductive materials and thermal insulation materials.

The technology was originally developed for the space industry, in particular for testing materials used in systems operating at extremely low temperatures. KRP Mechatec GmbH's expertise in the design of test facilities enabled the company to develop and manufacture the entire system in-house, achieving high measurement precision and reliable operation down to −263°C.

RECIPIENT TECHNOLOGY DESCRIPTION:

Cryogenic material testing technology is also applicable beyond the space sector, particularly in the energy and transport industries, where liquefied gases are widely used.

In these sectors, thermal conductivity measurements are critical for the design of energy storage systems, as the thermal conductivity of a material $W/(m \cdot K)$ can vary by several orders of magnitude between room temperature and −263°C.

Thanks to the technology developed by KRP Mechatec GmbH, it is possible to precisely determine the thermal properties of materials used in cryogenic storage and transportation systems, supporting safer and more efficient system design.

TECHNOLOGY TRANSFER DESCRIPTION:

The technology transfer was based on a one-dimensional heat flow measurement method published by NASA. KRP Mechatec GmbH identified the need for accurate thermal conductivity data of materials at cryogenic temperatures to improve thermal simulations for spacecraft and other cryogenic systems.

Leveraging its experience in test rig design, the company developed and built its own measurement system, adapting NASA's concept to larger samples and achieving improved measurement accuracy. Implementation of the solution enabled precise measurements at temperatures down to 10 K, expanding KRP Mechatec GmbH's service portfolio and strengthening European expertise in cryogenic material characterisation.

The system opened new business opportunities in the space, energy, transport and cryogenic sectors, where accurate thermal conductivity data are essential. The technology is promoted through scientific publications, the company's website and presentations at industry trade fairs.

Ongoing improvements aim to further increase measurement accuracy and extend the temperature range, while the system's flexible design allows testing of sample geometries and configurations tailored to customer needs.

Source: Promotional materials of KRP Mechatec GmbH

Supplier: **NASA**

Space Technology Category: **Sensors and Measurement Techniques**

Recipient: **KRP Mechatec GmbH**

Organisation Type: **SME**

Target Industries: **Energy sector**

Technology Readiness Level (TRL): **TRL 9**

Year of implementation: **2025**

SOFTWARE FOR SIMULATION AND DESIGN OF OPTICAL FIBRES

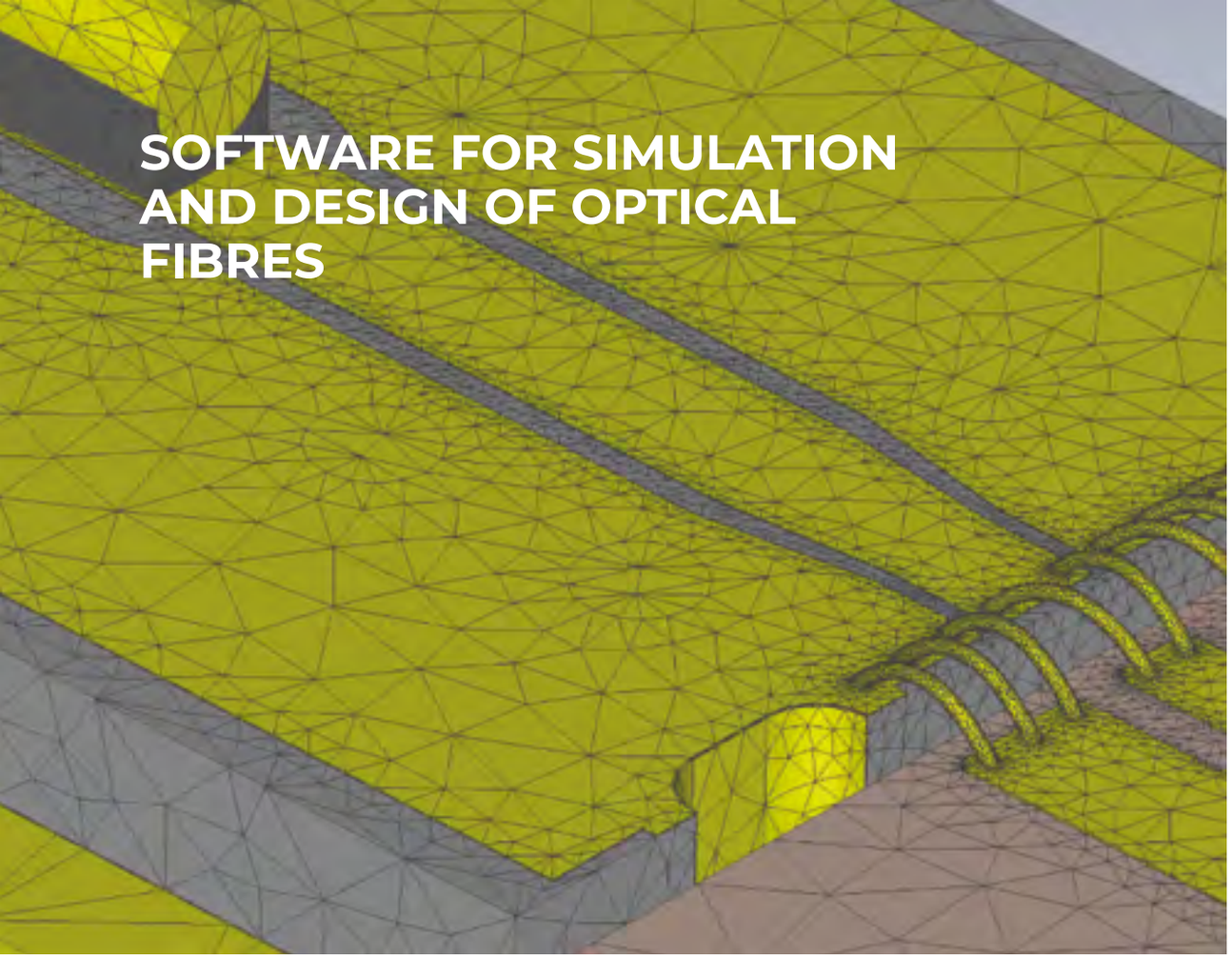


Image source: promotional materials of ESA

SUPPLIER TECHNOLOGY DESCRIPTION:

CST Studio Suite, developed by Dassault Systèmes (France), was created for multiphysics electromagnetic simulation, including coupling with other physical domains. Its primary purpose is the high-precision modelling of antennas and radio-frequency (RF) components used in space missions.

The solution has been validated in projects carried out for the European Space Agency and Japan Aerospace Exploration Agency, including the BepiColombo mission, confirming its exceptional accuracy in analysing structures with complex geometries and at very high frequencies. Reliability and computational precision are critical in projects subject to stringent constraints on mass and power consumption, which are typical of space systems.

RECIPIENT TECHNOLOGY DESCRIPTION:

The company Argotech a.s. adapted CST Studio Suite for the modelling of optical fibre components and the design of photonic integrated circuit (PIC) packages intended for high-throughput data transmission. In this context, high throughput refers to the ability to handle very high-frequency signals, characteristic of modern fibre-optic communication systems, while maintaining resistance to electromagnetic interference, inter-channel crosstalk and elevated operating temperatures.

The use of CST Studio Suite reduced standard simulation times from approximately eight days to six hours, significantly streamlining the design process. The software is also employed in research projects funded under the Horizon 2020 programme, such as PhLEXSAT, where it enables analysis of structures operating at frequencies of around 90 GHz and optimisation of multi-channel systems to minimise crosstalk.

TECHNOLOGY TRANSFER DESCRIPTION:

The technology transfer involved applying CST Studio Suite's space-proven electromagnetic simulation expertise to photonics and data transmission systems. Argotech a.s. adapted the software for modelling fibre-optic components and integrated photonic circuits, significantly shortening analysis cycles and accelerating the overall design process.

The transfer also included tailoring simulation methodologies to the specific requirements of high-frequency opto-electronic components, while preserving the precision and reliability characteristic of solutions used in space missions.

Source: Promotional materials of the European Space Agency

Supplier:
Dassault Systèmes S.E

Space Technology Category: **Sensors and Measurement Techniques**

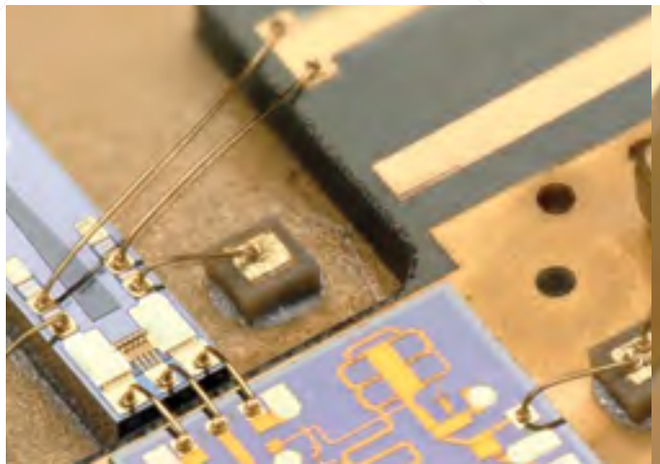
Recipient: **Argotech a.s**

Organisation Type: **SME**

Target Industries:
Telecommunications, photonics, semiconductors

Technology Readiness Level (TRL):
TRL 9

Year of implementation: **2022**



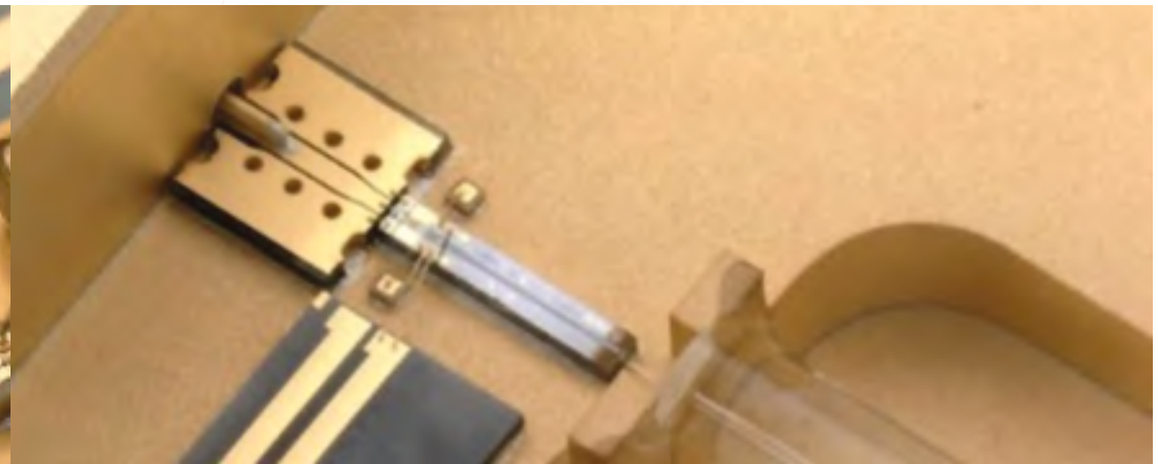


Image source: promotional materials of ESA

Image source: promotional materials of ESA

SOLAR GREEN HYDROGEN

SUPPLIER TECHNOLOGY DESCRIPTION:

RHP Technology GmbH developed advanced methods for photoreactor optimisation, drawing on its experience from space-sector engineering. Mechanical simulations were performed, including safety factor analysis and allowable pressure-drop assessments. In addition, detailed models of metal component thickness and mass were developed, taking into account variable temperature and pressure conditions.

The company manufactures plate-type channel plates that simultaneously act as static mixers. Their manufacturing process closely resembles that used for gas-system components in satellites. The transfer of space-grade engineering competencies to the photoreactor design aims to ensure high reliability, repeatable flow characteristics and resistance to process loads – standards required by the space environment and enforced by aerospace industry regulations.

RECIPIENT TECHNOLOGY DESCRIPTION:

The photoreactor developed by Redeem Solar Technologies GmbH integrates the functions of a photovoltaic cell, electrolyser and purification unit into a single device. It operates at ambient temperature, without the need for energy storage systems or power converters, significantly simplifying installation and reducing costs compared with conventional PV + electrolyser systems.

Its modular design enables flexible scaling of power output, while replaceable photocatalysts allow hydrogen production from various media – ranging from fresh water to wastewater or ammonia. The technology is suitable for locations with high energy demand, such as airports and industrial facilities, and its performance characteristics also indicate potential applicability in space, within the framework of In-Situ Resource Utilisation (ISRU) concepts.

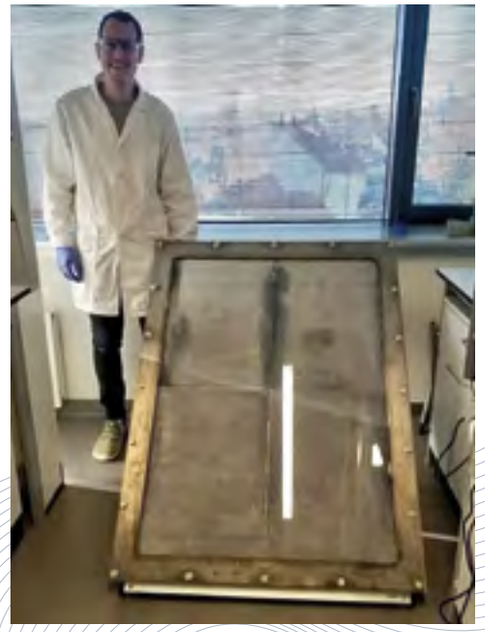
Redeem Solar Technologies GmbH, in cooperation with Hycenta, RHP Technology and TU Wien, is developing solutions that support green hydrogen production for the aviation sector, contributing to the reduction of its global emissions footprint.

TECHNOLOGY TRANSFER DESCRIPTION:

The technology transfer between RHP Technology and Redeem Solar Technologies GmbH involved leveraging RHP's expertise in precision component design to enhance the photoreactor architecture. This collaboration enabled refinement of key system components in terms of reliability, durability and manufacturing quality.

Applying solutions developed for the demanding environment of the space industry raised production standards and improved the operational stability of the system, while also allowing the technology to be adapted to the specific requirements of industrial and energy-sector applications.

Source: Promotional materials of the European Space Agency



Supplier: **RHP Technology GmbH**

Space Technology Category: **Sensors and Measurement Techniques**

Recipient: **Redeem Solar Technologies GmbH**

Organisation Type: **SME**

Target Industries: **Energy, aviation**

Technology Readiness Level (TRL): **TRL 3-4**

Year of implementation: **2024**

WATER RECYCLING SYSTEM – HYDROMARS EARTH

Image source: promotional materials of ESA

SUPPLIER TECHNOLOGY DESCRIPTION:

The HydroMARS system, developed by Airbus Defence and Space GmbH, was originally designed for water recycling on spacecraft and space stations. It applies solutions derived from microgravity research and advanced hydraulic engineering to purify and reuse water, ensuring crews have long-term access to potable water supplies.

The technology enables the creation of a closed-loop water cycle, which is particularly critical in environments where resupplying resources is highly limited or impossible.

RECIPIENT TECHNOLOGY DESCRIPTION:

HydroMARS Earth is an adaptation of this space-derived water recycling technology for terrestrial applications. The system has been tailored to meet the needs of cities, industrial facilities and regions facing water scarcity, enabling the recovery and reuse of water in buildings, industrial plants and agriculture.

The solution improves overall water resource efficiency and significantly reduces water losses during use, supporting sustainable water management practices.

TECHNOLOGY TRANSFER DESCRIPTION:

The technology transfer involved adapting the HydroMARS system – originally engineered to operate under microgravity conditions – for use in the Earth environment. This process included modifications to hydraulic systems, automation and filtration materials to accommodate local pressure levels, temperature ranges and water composition.

The adaptation also required the development of scalable modules, allowing seamless integration with municipal water and wastewater networks as well as industrial infrastructure. As a result, a technology initially created for space missions was successfully transferred to civilian applications, contributing to sustainable water resource management on Earth.

Source: Promotional materials of the European Space Agency

Supplier: **Airbus Defence and Space GmbH**

Space Technology Category: **Mechanical Components and Systems**

Recipient: **HydroMARS Ltd.**

Organisation Type: **SME**

Target Industries: **Water management, industry, agriculture, spatial planning and urban development**

Technology Readiness Level (TRL): **TRL 7**

Year of implementation: **2025**

PHLaS SKINCARE

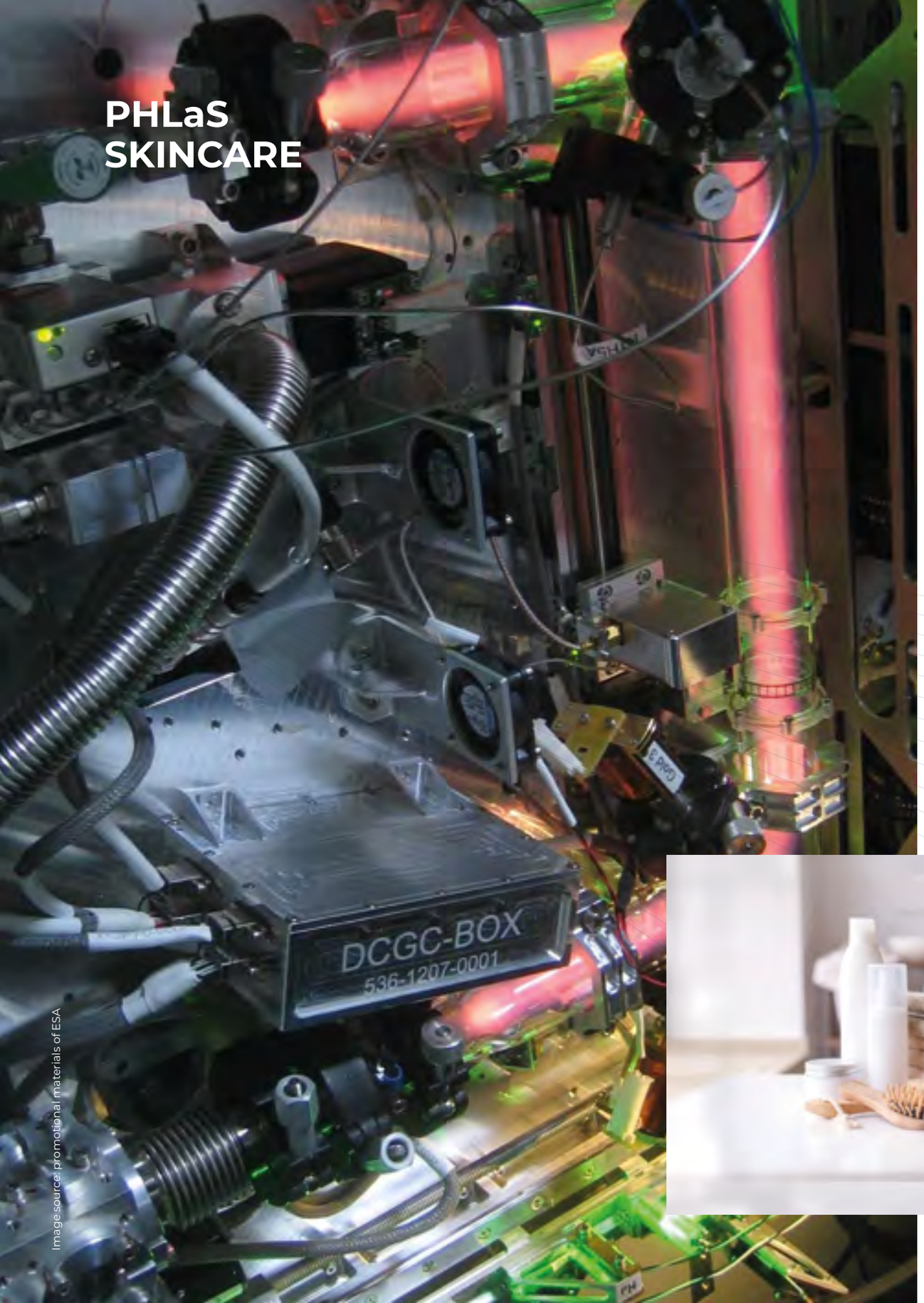


Image source: promotional materials of ESA

SUPPLIER TECHNOLOGY DESCRIPTION:

PHLaS (Photonic Life Science Sensor) technology was developed to monitor astronaut health, particularly physiological changes associated with long-duration exposure to space. By leveraging photonics, the system enables precise acquisition of health-related data, including skin condition monitoring and assessment of overall biological status.

The PHLaS technology originates from plasma research conducted under microgravity conditions aboard the International Space Station (ISS). Experiments involving so-called plasma crystals examined cold plasma with embedded microscopic particles, enabling observation of processes occurring at the atomic level. These studies were carried out by a research team from the Max Planck Institute for Extraterrestrial Physics, forming the scientific foundation for subsequent terrestrial applications.

RECIPIENT TECHNOLOGY DESCRIPTION:

PHLaS SkinCare adapts photonics-based technologies for skin health monitoring on Earth. The system employs advanced sensors that analyse skin changes in real time, enabling early detection of health issues such as inflammation, dermatological conditions, and age-related changes. This approach supports preventive care and evidence-based skin diagnostics in both clinical and consumer environments.

TECHNOLOGY TRANSFER DESCRIPTION:

Through the ESA Technology Transfer Programme, the results of space-based research were successfully transferred to terrestrial use.

In 2011, Terraplasma GmbH was established as a spin-off of the Max Planck Institute to commercialize cold plasma technologies. These solutions have since been implemented across multiple domains, including skin care and cosmetics (PHLaS SkinCare), medical applications (e.g. plasma care devices), hygiene and disinfection (e.g. PlasmaEgg), as well as pilot projects in water treatment. The PHLaS SkinCare case exemplifies how space-derived research can be translated into scalable, high-impact solutions for healthcare and consumer markets.

Source: Promotional materials of Terraplasma GmbH

Supplier: **Max Planck Institute for Extraterrestrial Physics**

Space Technology Category: **Natural sciences, pharmaceuticals, and medicine**

Recipient: **Terraplasma GmbH**

Organisation Type: **SME**

Target Industries: **Skin care and cosmetics; medicine (dermatology)**

Technology Readiness Level (TRL): **TRL 9**

Year of implementation: **2025**

Supplier: **Airbus Operations GmbH**

Space Technology Category: **Mechanical components and systems**

Recipient: **Airbus Operations GmbH**

Organisation Type: **Large enterprise**

Target Industries: **Climate and environmental protection; chemical industry; energy; CO_2 storage and utilization**

Technology Readiness Level (TRL): **TRL 5-6**

Year of implementation: **2024**

Graphic generated using AI

DIRECT AIR CAPTURE MODULE

SUPPLIER TECHNOLOGY DESCRIPTION:

The air filtration system developed by Airbus Operations for the International Space Station (ISS) is a module designed to remove carbon dioxide (CO_2) from the station's internal atmosphere. The device uses a fan to draw air through a filter containing a dedicated amine-based sorbent capable of adsorbing CO_2. Once saturation is reached, the filter is heated, releasing the captured carbon dioxide, while the purified air is returned to the habitable module. This process ensures a stable and safe atmospheric composition for astronauts.

The technology must meet stringent requirements associated with space operations, including high reliability, durability, energy efficiency, and resistance to severe mass and volume constraints. Continuous operation and crew safety are critical, which is why the system's design and materials are subject to particularly strict standards.

RECIPIENT TECHNOLOGY DESCRIPTION:

The adaptation of the CO_2 filtration module for terrestrial applications takes the form of a Direct Air Capture (DAC) system, enabling the removal of carbon dioxide directly from ambient air. Air is drawn into the device and passed through a filter containing an amine-based sorbent that adsorbs CO_2 molecules. Once the sorbent becomes saturated, the system switches to regeneration mode: the filter is heated, releasing carbon dioxide as a concentrated stream.

The recovered CO_2 can be utilized in industrial processes, further chemically converted (e.g. into synthetic fuels or materials), or permanently stored. This technology enables the closing of the emissions loop by reducing net emissions through the capture of carbon dioxide that has already been released into the atmosphere.

TECHNOLOGY TRANSFER DESCRIPTION:

The DAC modules developed by Airbus are derived from adsorption technology used in the life support system aboard the ISS, where reliable CO_2 removal from the station's atmosphere is essential to maintaining safe air composition and stable living and working conditions for astronauts.

Building on this space-proven technology, Airbus developed a solution suitable for terrestrial deployment, enabling direct capture of CO_2 from ambient air. The adaptation of this technology for climate protection purposes was supported by the European Space Agency through the ESA Spark Funding Germany programme.

Source: Promotional materials of the European Space Agency

Image source: promotional materials of ESA

AGXX ANTIMICROBIAL COATING TECHNOLOGY

SUPPLIER TECHNOLOGY DESCRIPTION:

The AGXX technology, developed by Heraeus Precious Metals GmbH & Co. KG and tested aboard the International Space Station (ISS), is an innovative antimicrobial coating whose mode of action is not based on the release of metal ions, but on a catalytic redox reaction combined with micro-electrical effects. The coating demonstrates high efficacy against more than 130 microorganisms, including silver-resistant strains of E. coli.

The solution was developed in response to the need to maintain a high level of sterility in space environments, where each new astronaut introduces microorganisms onto the ISS. The application of AGXX coatings on station modules effectively limited microbial adhesion to surfaces, helping to maintain a high level of microbiological cleanliness and reducing the frequency of required disinfection procedures.

RECIPIENT TECHNOLOGY DESCRIPTION:

Aponix GmbH, based in Heidelberg, integrated the AGXX coating into its vertical farming modules. The coating prevents biofilm formation and inhibits bacterial growth on structural components, supporting hygiene and operational efficiency in urban farming systems while increasing the durability of cultivation modules.

TECHNOLOGY TRANSFER DESCRIPTION:

The technology transfer involved applying the space-grade AGXX coating – originally developed for the ISS environment – to terrestrial applications, specifically vertical farming systems. The process was facilitated through the European Space Agency (ESA) Spark Funding programme in Germany. Implementation of the technology enabled the introduction of AGXX coatings into the urban and vertical agriculture market, contributing to enhanced food safety and improved hygiene in plant production.

Source: Promotional materials of the European Space Agency

Supplier:
Heraeus Precious Metals GmbH & Co. KG

Space Technology Category:
Materials, coatings and processes

Recipient:
Aponix GmbH

Organisation Type: **SME**

Target Industries: **Vertical farming; urban food production; hygienic and sanitary systems in plant cultivation**

Technology Readiness Level (TRL):
TRL 9

Year of implementation: **2023**

Image source: ESA, Graphic generated using AI

EXAMPLES OF INNOVATIVE APPLICATIONS OF SOLUTIONS IN THE SPACE SECTOR

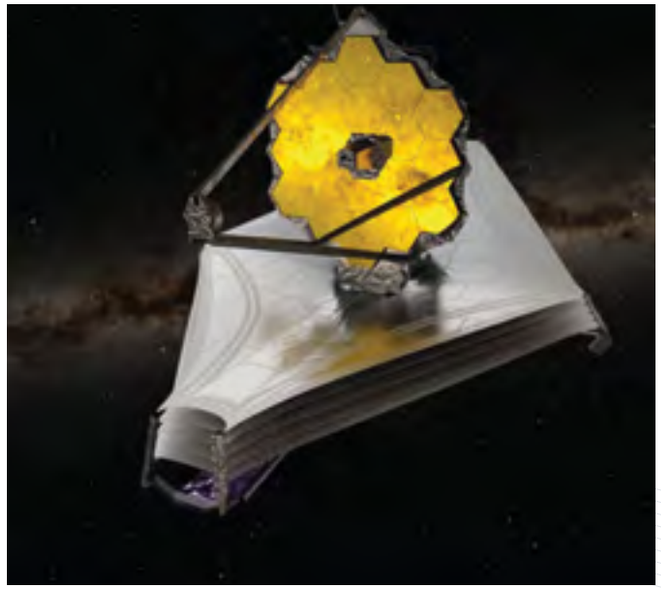
Image source: promotional materials of Omni3D sp. z o.o.

MATERIAL EXTRUSION ADDITIVE MANUFACTURING

SUPPLIER TECHNOLOGY DESCRIPTION (TERRESTRIAL SOLUTION)

For many years, Omni3D sp. z o.o. [Ltd.] has been developing and manufacturing large-format industrial additive manufacturing solutions based on Fused Filament Fabrication (FFF) technology. The systems developed by the company are characterized by high reliability and mechanical strength, as confirmed by applications involving the production of precise, lightweight, and geometrically complex industrial components.

The company's competencies stem from extensive experience in FFF technology, enabling on-demand production of functional prototypes, tooling, and durable end-use parts. The NATO AQAP 2110:2024 certification confirms compliance of Omni3D's processes with stringent military and aerospace standards.



RECIPIENT TECHNOLOGY DESCRIPTION (SPACE APPLICATION)

Within the European Space Agency (ESA) StarTiger programme, high-performance 3D-printed components were developed for use in a hexapod platform. The printed parts included cable trays, spacers, and PCB covers.

The hexapod platform, used by ESA, enables precise positioning of satellites and onboard instrumentation in order to simulate spaceflight conditions at the Astrophysics Laboratory in Marseille (France). The project employed the BREVA hexapod – a six-legged robotic platform manufactured by SYMETRIE S.A.S. – on which a coronagraph was mounted to record solar corona radiation under satellite shadow conditions. Each hexapod leg is equipped with a brushless DC motor with an integrated encoder, allowing precise, multi-directional platform adjustment through controlled extension and contraction of the legs.

Hexapods are widely used for payload positioning, telescope stabilization, and satellite testing. The 3D-printed components provide precise motion control and protection of sensitive electronics in demanding environments, demonstrating the value of additive manufacturing technologies in space structures and mechanisms.

ADAPTATION CHARACTERISTICS

SYMETRIE S.A.S., which designs and assembles hexapods in-house, faced significant delays caused by reliance on external component suppliers. These challenges were exacerbated by the global supply chain crisis in 2022 and the COVID-19 pandemic, which severely disrupted delivery schedules and component availability.

To overcome these issues and avoid further project delays, SYMETRIE invested in the Omni3D Factory 2.0 NET system. This decision proved to be a model example of B2B cooperation, enabling a transition from dependence on external suppliers to self-sufficient in-house production. The results were immediate and measurable: the company gained the ability to manufacture critical components on demand, reducing production costs by approximately 40%.

The technology also provided greater design freedom, enabling the creation of complex geometries unattainable with conventional manufacturing methods, resulting in more functional and efficient components. As a result, SYMETRIE S.A.S. was able not only to secure its own production needs but also to respond more rapidly to urgent customer orders, increasing operational flexibility and market competitiveness.

Source: Promotional materials of Omni3D sp. z o.o. [Ltd.]

Supplier:
Omni3D sp. z o.o. [Ltd.]

Space Technology Category:
Materials and manufacturing processes

Recipient:
Symétrie S.A.S.

Organisation Type: **SME**

Technology Readiness Level (TRL):
TRL 9

Year of implementation: **2021**

POWDER MATERIAL SINTERING METHOD (U-FAST)

Image source: promotional materials of GeniCore sp. z o.o.

SUPPLIER TECHNOLOGY DESCRIPTION (TERRESTRIAL SOLUTION)

The U-FAST technology, developed by GeniCore sp. z o.o. [Ltd.], is an advanced powder sintering method that enables extremely rapid and energy-efficient consolidation of metals, ceramics, and composites. The process uses precisely controlled electric current pulses to heat and sinter the material in a time-frame significantly shorter than that of conventional sintering methods. As a result, it delivers improved microstructure, enhanced mechanical properties, and a reduced risk of material defects.

The technology was originally developed for industrial applications such as the manufacture of tools, machine parts, and components requiring high wear resistance.

RECIPIENT TECHNOLOGY DESCRIPTION (SPACE APPLICATION)

As a result of transferring U-FAST technology to the space sector, a dedicated U-FAST Space Sintering Platform was developed. The technology was adapted to meet the requirements of NASA (United States), enabling the sintering of structural and functional materials under vacuum or controlled protective atmospheres.

This solution allows for the production of high-density, high-precision components essential for rocket engines, thermal protection systems, and space electronics. U-FAST also supports the development of novel materials designed to operate under extreme environmental conditions, representing a significant step forward in advanced materials engineering for space applications.

ADAPTATION CHARACTERISTICS

The technology was tailored to meet stringent space-sector requirements, enabling its application in research and development projects related to propulsion systems and structural materials.

The transfer contributed to an increase in the technological competencies of the recipient and significantly expanded GeniCore's international market offering, strengthening the company's position within the global advanced materials innovation ecosystem.

Source: Promotional materials of GeniCore sp. z o.o. [Ltd.]

Supplier:
GeniCore sp. z o.o. [Ltd.]

Space Technology Category:
Materials, coatings and processes

Recipient:
NASA

Organisation Type: **SME**

Technology Readiness Level (TRL):
TRL 8

Year of implementation: **2023**

RHEAS – INNOVATIVE MULTICOMPONENT ALLOYS FOR HIGH-TEMPERATURE APPLICATIONS

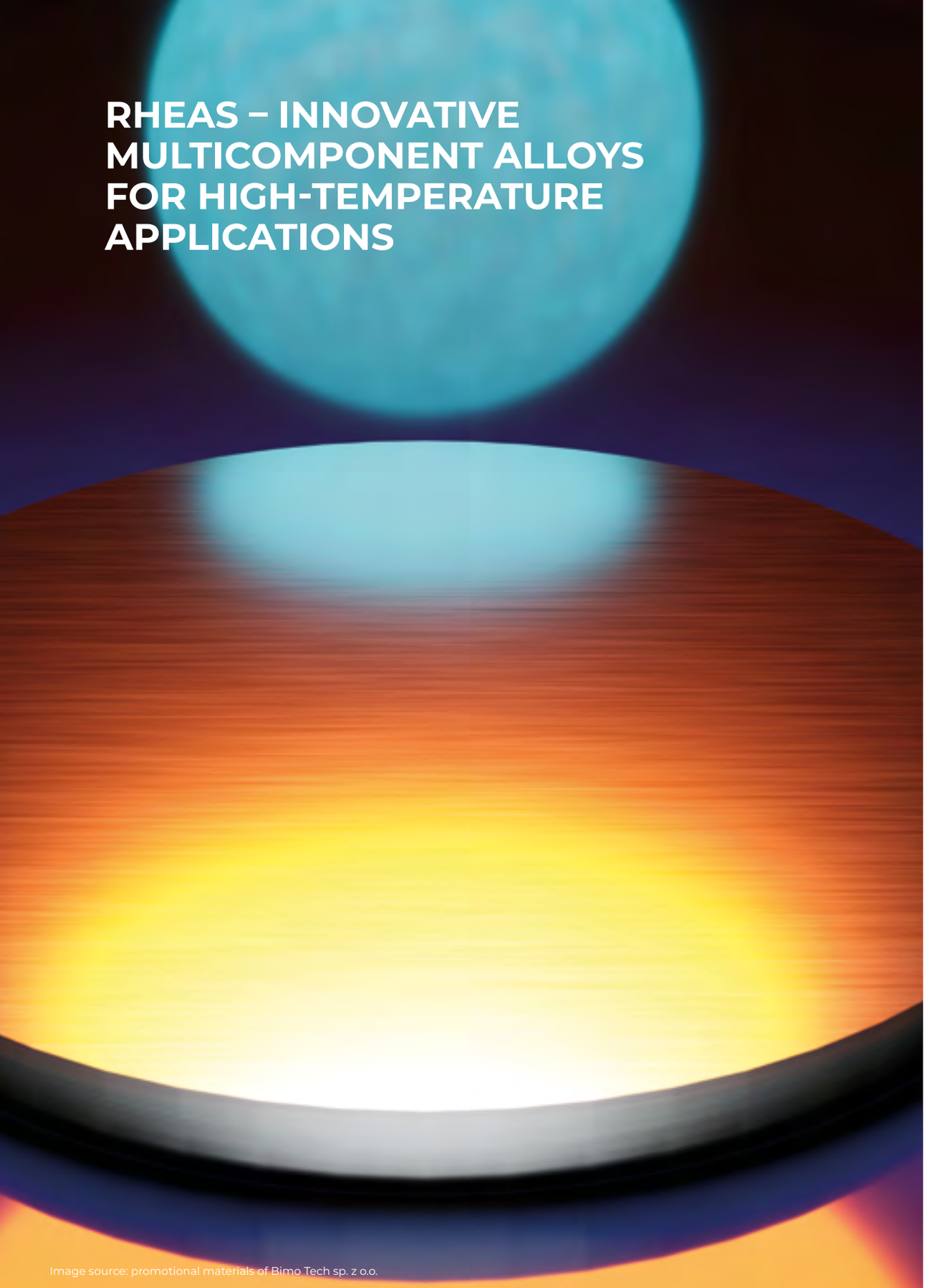


Image source: promotional materials of Bimo Tech sp. z o.o.

SUPPLIER TECHNOLOGY DESCRIPTION (TERRESTRIAL SOLUTION)

Refractory High-Entropy Alloys (RHEAs) represent a new class of advanced metallic materials that combine multiple elements in near-equiatomic proportions. Unlike conventional alloys – where one primary element dominates (e.g. nickel in nickel-based superalloys) – RHEAs leverage the synergistic properties of several refractory metals such as tungsten, molybdenum, niobium and tantalum. These metals are characterized by extremely high melting points and exceptional resistance to harsh environmental conditions.

The technology was originally developed for nuclear energy applications, particularly for fusion reactor environments, where materials are exposed to intense neutron radiation and direct interaction with plasma. RHEAs were designed for plasma-facing components and neutron shielding elements, offering high durability, structural stability and creep resistance under extreme thermal loads.

RECIPIENT TECHNOLOGY DESCRIPTION (SPACE APPLICATION)

RHEAs are currently being developed and tested for applications in the space sector, especially for next-generation reusable rocket engines. A key focus of research involves oxygen-rich preburners and other critical engine components, where conventional materials fail due to extreme temperatures and aggressive oxidizing environments.

Collaboration with ArianeGroup SAS enables assessment of the suitability of RHEAs for European space technologies, which is crucial for maintaining competitiveness and strategic independence in the launch vehicle sector.

ADAPTATION CHARACTERISTICS

RHEAs provide significantly higher performance and high-temperature resistance compared to traditional superalloys. They are fully compatible with additive manufacturing technologies, enabling cost-effective production of complex components, improved reusability, and enhanced rocket engine performance. At the same time, this technology strengthens Europe's strategic autonomy in advanced materials and propulsion technologies.

Source: Promotional materials of Bimo Tech sp. z o.o. [Ltd.]

Supplier:
Bimo Tech sp. z o.o. [Ltd.]

Space Technology Category:
Materials, coatings and processes

Recipient:
ArianeGroup SAS

Organisation Type: **SME**

Technology Readiness Level (TRL):
TRL 4-6

Year of implementation: **2025**

Graphic generated using AI

POTENTIAL OPPORTUNITIES FOR SPACE TECHNOLOGY TRANSFER

With each year of Poland's membership in the European Space Agency (ESA), awareness among Polish enterprises and research institutions of the value that the space sector brings to technological development continues to grow. Increasing demand for new solutions in electronics, software, materials, and complex systems means that a rising number of companies and research centres, while developing innovative technologies, are deliberately considering their potential application in space.

In its latest document outlining the vision for future technology development, ESA identifies areas that should already be intensively developed today so that by 2040 outer space can become a regularly utilised "territory" – with mature infrastructure, an operational economy, and a permanent presence of humans and robots. This perspective makes it possible to better understand the directions in which humanity's presence in space will evolve, as well as which technologies will be required and, in fact, desired for future space missions.

The entities presented in this catalogue have identified genuine potential for applications of their solutions beyond the space sector. At the same time, there is a clear trend of a steadily increasing number of organisations recognising the importance of applying space technologies in non-space sectors. Engagement in cooperation with ESA Technology Brokers significantly contributes to the inclusion of new enterprises and institutions in the growing space ecosystem.

Author: Jarosław Chojnacki,
ESA Technology Broker

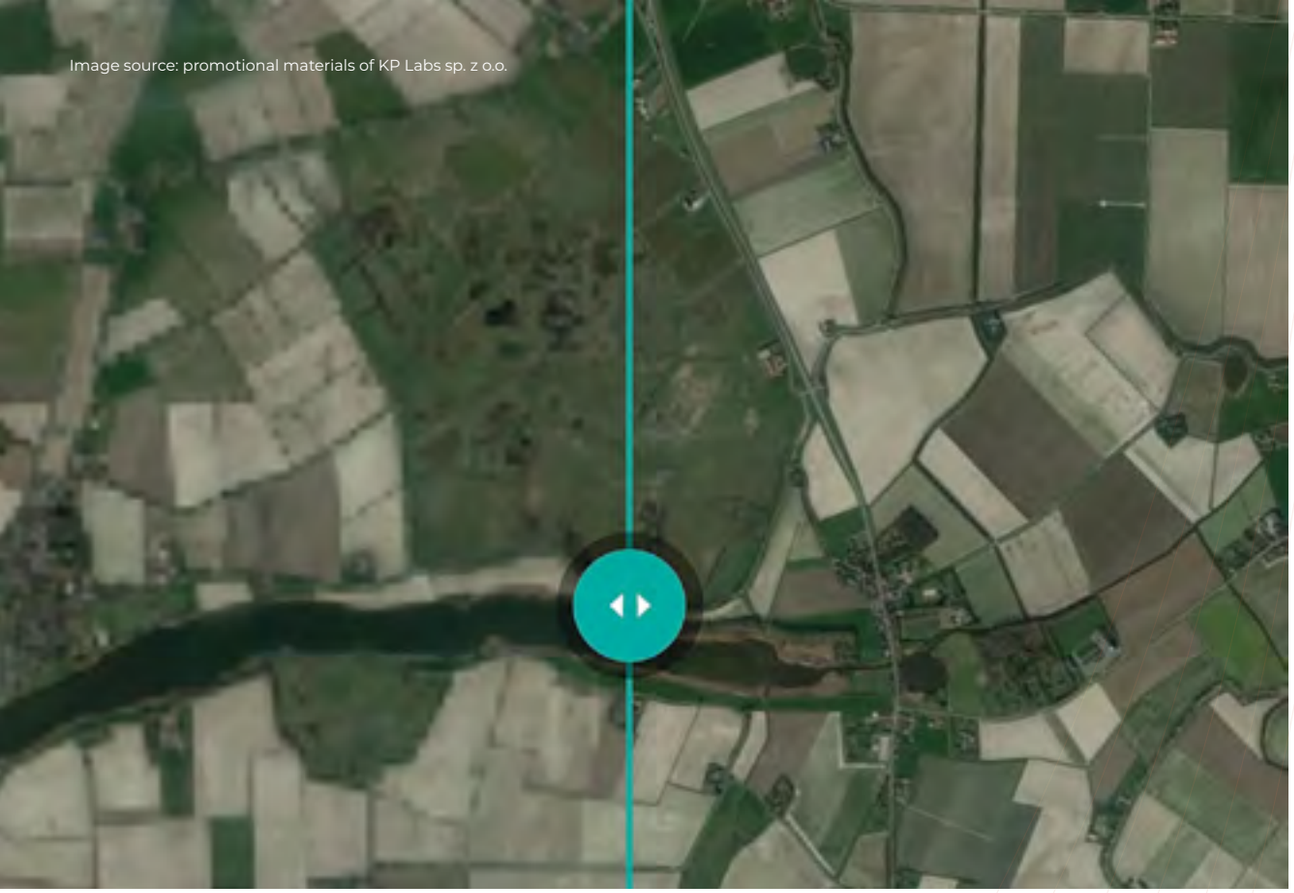


Image source: promotional materials of KP Labs sp. z o.o.

ARTIFICIAL INTELLIGENCE–BASED IMAGE QUALITY ENHANCEMENT TECHNOLOGY

TECHNOLOGY DESCRIPTION

Super-Resolution Reconstruction (SRR) technology enables a substantial improvement in the quality of acquired images, even when using satellite instruments with limited native resolution. It goes beyond simple image sharpening, delivering an overall enhancement of image quality and detail by analysing and exploiting the statistical properties of the data. SRR also enables the fusion of information from different spectral ranges, increasing the amount of useful data derived from a single image.

This technology provides a significant advantage in satellite image analysis, as improved resolution and image quality in Earth observation lead to more accurate and detailed interpretations. This facilitates both human analysis and processing by artificial intelligence algorithms. Enhanced images enable easier detection, discrimination, separation, counting of objects, and classification of observed surface types. The results produced by super-resolution methods can be analysed using standard workflows, while SRR algorithms developed by engineers are delivered to users in the form of image processing and analysis software that can be applied similarly to other analytical tools.

TECHNOLOGY TRANSFER POTENTIAL CHARACTERISTICS

Super-resolution (SRR) technology is characterised by a high transfer potential due to its ability to significantly increase image resolution and detail, resulting in sharper edges and improved object separation. Typical image upscaling factors range from two to three times, with even higher scaling possible in certain cases. A particularly effective approach is multi-image SRR, which combines multiple low-quality images into a single high-resolution output.

KP Labs sp. z o.o. develops this technology for satellite imaging applications using deep neural networks and advanced statistical methods. The resulting higher-detail images support both manual and automated analysis, facilitating the identification of objects such as roads, buildings, and infrastructure elements. For satellite data users – ranging from urban planners to intelligence services – SRR delivers significant added value and also enhances the performance of other artificial intelligence algorithms, for example in ship detection, crop monitoring, and forest analysis. The ability to obtain high-quality imagery even from nanosatellites and instruments with limited resolution makes this technology particularly attractive for commercial and industrial deployment.

BUSINESS OPPORTUNITIES RESULTING FROM POTENTIAL TRANSFER

The Super-Resolution Reconstruction (SRR) technology developed by KP Labs sp. z o.o. [Ltd.] significantly enhances image quality, including imagery acquired from nanosatellite constellations and instruments with limited resolution. By leveraging deep neural networks and advanced statistical techniques, it delivers images with greater detail, sharper edges, and improved object separation. SRR increases the amount of information available for both manual and AI-supported automated analysis.

While the technology already finds broad application in precision agriculture, urban planning, environmental protection, and critical infrastructure monitoring, its potential extends far beyond the traditional downstream satellite data market. SRR can be effectively applied wherever image precision is critical. This includes medical diagnostics, where improved image quality in computed tomography, magnetic resonance imaging, or ultrasound can increase sensitivity in detecting pathological changes, support structural tissue analysis, and reduce the need for repeat examinations. Similarly, in public safety and surveillance, enhanced resolution enables more accurate identification of objects and events, while in industrial inspection and quality control it allows more precise detection of defects in manufacturing processes.

Thanks to its flexibility and universality, SRR represents a solution with strong implementation potential both within the space sector and across a wide range of industries that rely on high-quality image analysis.

Source: Promotional materials of KP Labs sp. z o.o. [Ltd.].

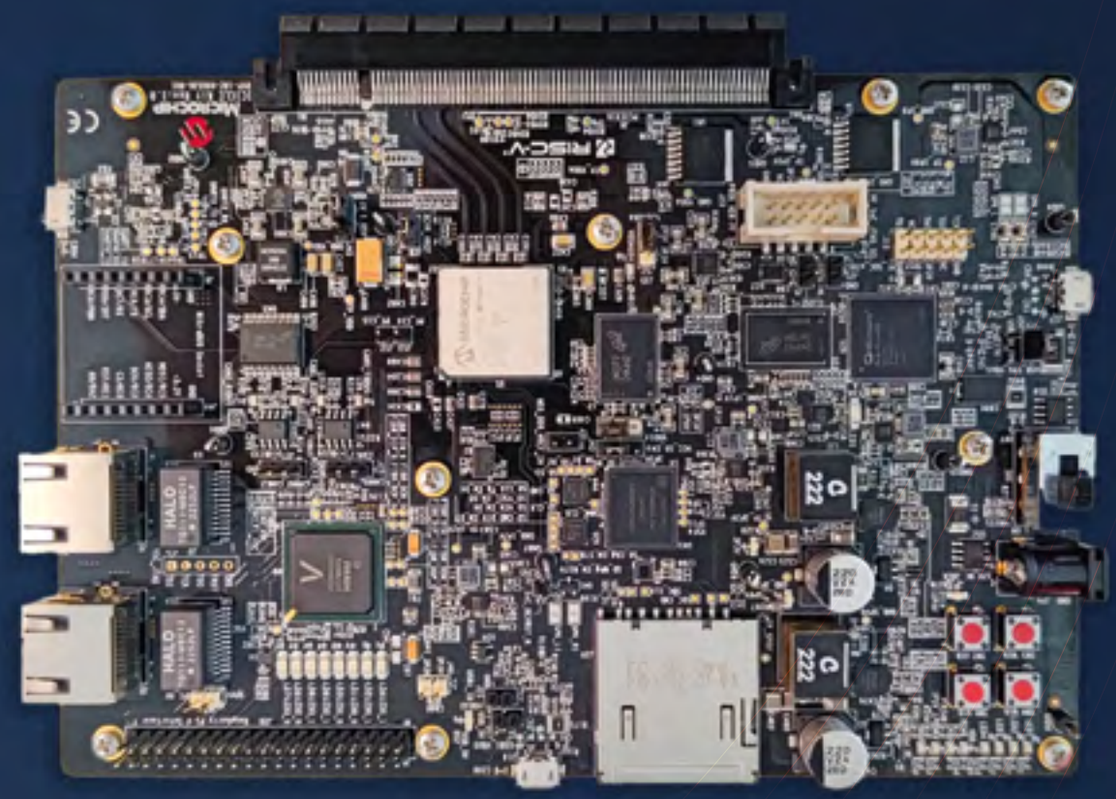
Supplier:
KP Labs sp. z o.o. [Ltd.]

Organisation Type: **SME**

Technology Readiness Level (TRL):
TRL 5

Space Technology Category:
Digitalisation, computer hardware and software

CRYPTOGRAPHIC KEY MANAGEMENT SYSTEM



Supplier: **AROBS Polska sp. z o.o. [Ltd.]**

Organisation Type: **SME (based in Poland, with a large majority shareholder)**

Technology Readiness Level (TRL): **TRL 4**

Space Technology Category: **Communication and information**

Image source: promotional materials of AROBS Polska sp. z o.o.

TECHNOLOGY DESCRIPTION

The system is designed to enable satellites to securely verify software update packages in a manner resistant to threats posed by quantum computing–based attacks. The solution envisions the development of a Plug & Play module intended for direct installation onboard satellites or for use in ground-based applications (e.g. telecommunications systems).

The proposed solution takes the form of a physical hardware module – an electronic unit containing the PQC ASTrAL IP Core with embedded software leveraging a cryptographic accelerator. The PQC ASTrAL encryption module enables the reception of unsecured data for signing or encryption, followed by retransmission as secured data. It also supports the reception of secured data for authentication or decryption, after which the data are forwarded in plaintext form.

In addition, the system provides cryptographic key generation and verification, system status reporting to the ground station, and remote configuration capabilities from the ground segment.

TECHNOLOGY TRANSFER POTENTIAL CHARACTERISTICS

The design solutions developed within the PQC ASTrAL framework offer strong potential for future applications beyond the space sector, particularly in areas where data security is of critical importance. Within the space domain, the solution is targeted at satellite operators and integrators, with whom discussions are currently underway to define end-user requirements.

Hardware-based implementations of post-quantum cryptographic algorithms can be deployed in a wide range of configurations, including encryption, key generation and digital signatures, sender identity verification, and securing networks and systems across subsystems, platforms, and devices. Such solutions are applicable to critical infrastructure, defence and national security, as well as the ICT sector – wherever the highest level of information protection is required.

BUSINESS OPPORTUNITIES RESULTING FROM POTENTIAL TRANSFER

Through consultations on the parameters of the PQC ASTrAL encryption module under development, the project team has identified strong potential for the creation of an innovative product. Some end users are not yet fully aware of the opportunities offered by this niche; however, several have indicated that if the solution proves easy to integrate in a Plug & Play manner, it could attract significant market interest.

Within the next six months (between October 2025 and April 2026), completion of the current ESA contract is planned, with the objective of advancing the product to Technology Readiness Level 4 (TRL 4). Over the subsequent two years, the company intends to leverage further technology development support under the ESA ARTES 4S programme and, in cooperation with a selected end user (a satellite integrator), reach TRL 6.

Within a five-year horizon, commercial sales of PQC ASTrAL modules are expected to commence, with estimated production volumes of at least several dozen units per year.

Source: Promotional materials of AROBS Polska sp. z o.o. [Ltd.]

GALAGO – AN INNOVATIVE MOBILE PLATFORM FOR LUNAR EXPLORATION

Supplier: **Astronika sp. z o.o. [Ltd.]**

Organisation Type: **SME**

Technology Readiness Level (TRL): **TRL 5**

Space Technology Category: **Automation and robotics**

Image source: promotional materials of Astronika sp. z o.o.

TECHNOLOGY DESCRIPTION

Galago is an innovative, lightweight and compact robotic platform developed for scientific and exploratory missions on the lunar surface. With a mass of up to 10 kg, the robot is equipped with three symmetrically arranged, actuated legs distributed evenly around the main platform. This configuration enables vector-based 3D locomotion through hopping movements.

The system was specifically designed for the conditions of lunar gravity, which require an efficient and energy-saving propulsion concept. Its key subsystem – the actuator – features a compact and modular design (110 × 190 × 82 mm, weight below 1.5 kg), stores a limited amount of energy (up to 50 J), and is characterised by very low power consumption (below 5 W).

Jumping efficiency is estimated at 60–70%, allowing the robot to reach heights of 3 to 7 metres, depending on surface characteristics. This capability enables Galago to access hard-to-reach areas such as steep slopes, deep craters, permanently shadowed regions, boulder fields and lava tubes. The system architecture can also be scaled for lower-gravity environments, enabling potential use in missions to small moons (e.g. Phobos) or asteroids.

The project is carried out by the Polish company Astronika sp. z o.o. [Ltd.] in cooperation with the Space Research Centre of the Polish Academy of Sciences, and is funded by the European Space Agency (ESA).

TECHNOLOGY TRANSFER POTENTIAL CHARACTERISTICS

The Galago technology demonstrates significant transfer potential due to its compact design, high energy efficiency and ability to operate in challenging terrain. Although the system has not yet been deployed in an actual space mission and requires further development and testing, its design principles and engineering assumptions enable the transfer of key solutions to terrestrial applications.

The primary motivation behind the system's development was to create an alternative to traditional wheeled rovers and to validate critical technologies (such as mechanical subsystems) in environments closely resembling real lunar conditions. This approach supports the future acquisition of so-called space heritage, i.e. operational experience gained through space missions.

BUSINESS OPPORTUNITIES RESULTING FROM POTENTIAL TRANSFER

The technology offers promising applications in terrestrial solutions, particularly in areas requiring operation in hard-to-access or hazardous environments. The platform may be used in crisis management, search and rescue operations, or as an inspection robot. Thanks to its ability to reach locations inaccessible to conventional vehicles, Galago can serve as an innovative tool supporting emergency services – especially when equipped with a 3D camera and monitoring systems.

The compact size, low weight and high energy efficiency of the platform enhance its competitiveness within the mobile robotics and inspection systems sector.

Source: Promotional materials of Astronika sp. z o.o. [Ltd.]

Image source: promotional materials of Extremo Technologies sp. z o.o.

OXYGEN SENSOR FOR CLOSED-LOOP SYSTEMS

TECHNOLOGY DESCRIPTION

An innovative oxygen sensor was originally developed for the Space Volcanic Algae experiment conducted within the framework of the Polish IGNIS mission. The device constitutes a key component of life support systems and enables research on oxygen-producing extremophile microorganisms under space conditions.

The sensor is distinguished by its exceptionally high sensitivity, allowing the detection of very low oxygen concentrations – an essential capability in closed environments such as space stations or lunar habitats.

TECHNOLOGY TRANSFER POTENTIAL CHARACTERISTICS

The sensor technology developed under space conditions can form the basis for next-generation devices designed to monitor photosynthesis processes and microorganism growth in closed-loop systems. This opens pathways to applications in bioreactors, biopanels and advanced life support systems, with potential use in medicine, pharmaceuticals, biotechnology and environmental protection.

BUSINESS OPPORTUNITIES RESULTING FROM POTENTIAL TRANSFER

The sensor was designed for precise monitoring of microalgae photosynthesis in space, where tracking even minimal changes in oxygen concentration is critical. This technology, developed within the IGNIS mission, can be transferred to terrestrial applications to improve the efficiency of photosynthesis processes in controlled environments.

As a result, it enables optimal control of oxygen and biomass production in closed-loop systems. The company's near-term plans include leveraging this technology for the development of biopanels and bioreactors intended for both scientific research and commercial applications in biotechnology, medicine and environmental protection.

Source: Promotional materials of Extremo Technologies sp. z o.o. [Ltd.]

Source: Promotional materials of Extremo Technologies sp. z o.o. [Ltd.]

Supplier:
Extremo Technologies sp. z o.o. [Ltd.]

Organisation Type: **SME**

Technology Readiness Level (TRL):
TRL 9

Space Technology Category:
Sensors, electronics, optics and measurement systems for Life Science experiments

GROWING ECONOMIC IMPORTANCE OF SPACE TECHNOLOGY TRANSFER PROCESSES

“Innovation is the foundation of ESA’s mission, because developing solutions for the space sector is an extremely complex undertaking. As a result, technology transfer opens up a wide range of new business opportunities, strengthening European know-how, creating jobs, fostering prosperity and improving quality of life. Private investment in the European space sector continues to grow and reached a record level in 2024 – European space ventures raised more than €1.5 billion, representing a 56% increase compared to 2023.” – Luca del Monte, Head of Commercialisation at the European Space Agency.

Technologies originating from the space sector are increasingly playing a key role in the development of an innovation- and knowledge-based economy. Solutions created for missions and operations in the space environment must meet exceptionally high requirements in terms of reliability, efficiency, durability and material resistance. Their adaptation to terrestrial applications therefore opens up new opportunities for a wide range of sectors, including industry, medicine, energy, transport and process automation. Space-derived technologies include not only advanced components and materials, but also methods of design, optimisation, miniaturisation and testing that can be applied across many areas of the economy.

An increasingly important role in this process is played by the New Space sector, whose development is driven by private companies, startups and organisations capable of rapid prototyping and flexible adaptation of technologies to market needs. This naturally strengthens the importance of dual-use technologies.

The solutions presented, together with descriptions of their potential applications beyond the space sector, make it possible to identify growing economic demand. There is increasing interest in material technologies, biotechnology, energy, chemical solutions, technologies for food production, as well as automation and robotisation of industrial processes. At the same time, companies emphasise the importance of access to testing environments, laboratories, research infrastructure and opportunities to conduct pilot projects.

As space technology transfer gains importance, so does the need to plan commercialisation pathways, analyse user needs, and develop value propositions and business models. Equally important is the involvement of industry partners already at the technology development stage. Companies that achieve the greatest success treat space technology transfer not as a one-off activity, but as a permanent element of organisational development and competitive advantage.

A key step is identifying which elements of a process, product or service can be improved through solutions originating from the space sector. This should be followed by an analysis of available solutions and technologies, as well as verification of their technological and business readiness levels, in order to select those that can be adapted within a defined timeframe and at a predictable cost.

Equally important is the engagement of external partners: research institutes, technology centres, ESA brokers, technology transfer offices, universities, or companies with implementation experience or a proven track record of successful

allows the time from concept to pilot, and subsequently to market implementation, to be significantly shortened. Intellectual property protection across different markets, market analyses, business model design and securing financing for the scaling phase are also critical aspects. In many cases, success depends not solely on the quality of the technology itself, but on the ability to support it with an appropriate commercialisation strategy.

Technology transfer enables not only the creation of new or improved products, but also the building of competitive advantage based on knowledge, flexibility and adaptability. In a global economy, these are the very factors that determine companies’ market positions and their capacity for international growth.

Author: Paweł Kwiatkowski,
ESA Technology Broker

Graphic generated using AI

Graphic generated using AI

ENTITIES PRESENTED IN THE CATALOGUE

1. **27G – TECHNOLOGY LTD.**
   https://27g.space/
2. **AGH UNIVERSITY OF SCIENCE AND TECHNOLOGY**
   https://www.agh.edu.pl/
3. **AIRBUS DEFENCE AND SPACE GMBH**
   https://www.airbus.com/en
4. **APONIX GMBH**
   https://www.aponix.eu/
5. **ARGOTECH A.S.**
   https://www.argotech.cz/
6. **ARIANEGROUP S.A.S.**
   https://ariane.group/en/
7. **AROBS POLSKA SP. Z O.O. [LTD.]**
   https://arobs.pl/
8. **ASTRONIKA SP. Z O.O. [LTD.]**
   https://astronika.pl/
9. **BIMO TECH SP. Z O.O. [LTD.]**
   https://bimotech.pl/
10. **BLACKPIN GMBH**
    https://www.blackpin.app/
11. **BLUE DOT SOLUTIONS SP. Z O.O. [LTD.]**
    https://www.bluedotsolutions.eu/
12. **CREOTECH INSTRUMENTS S.A.**
    https://creotech.pl/
13. **DASSAULT SYSTÈMES SP. Z O.O.**
    https://www.3ds.com/
14. **EXTREMO TECHNOLOGIES SP. Z O.O. [LTD.]**
    https://extremo.tech/
15. **GENICORE SP. Z O.O. [LTD.]**
    https://genicore.eu/
16. **HERAEUS PRECIOUS METALS GMBH & CO. KG**
    https://www.heraeus-precious-metals.com/en/
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    https://hydromars.eu/
18. **KMSENSE AEROSPACE SOLUTIONS B.V.**
    https://kmsense.com/
19. **KP LABS SP. Z O.O. [LTD.]**
    https://www.kplabs.space/
20. **KRP MECHATEC GMBH**
    https://www.krp-m.de/en/
21. **MAX PLANCK INSTITUTE FOR EXTRATERRESTRIAL PHYSICS**
    https://www.mpe.mpg.de/
22. **MIRORES MINING DATA SERVICES SP. Z O.O. [LTD.]**
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    https://symetrie.fr/en/
29. **TERRAPLASMA GMBH**
    https://www.terraplasma.com/

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