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ScaleUp

BUILDING EUROPE'S SPACE COMMERCIALISATION NETWORKS

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BUILDING EUROPE'S SPACE
COMMERCIALISATION NETWORKS

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PREFACE

It is with great pleasure that I introduce the first edition of the ScaleUp Book. Under ESA's leadership, Europe is advancing its technological prowess in space while embracing a new economic era. This era thrives on fast innovation, private investment, and most importantly, the talented individuals who turn bold ideas into impactful solutions.

The ScaleUp Book isn't just a book. It offers a window into the stories of extraordinary people behind the commercial space industry – the talents and entrepreneurs who are unlocking space's vast potential for the benefit of society. It highlights the essential support provided by ESA and its member states, enabling these innovators to thrive. A prime example of this support is the 20th anniversary of ESA's Business Incubation Centres (ESA BICs), a network that now empowers over 2,000 start-ups.

From my experience, managing innovation has become a critical skill. In today's dynamic space economy, success hinges on more than technological breakthroughs – it requires commercialisation and sustainable growth. This edition shines a light on those who are driving this transformation.

Let's explore a universe of treasure together.

Josef Aschbacher
Director General of ESA

FOREWORD

Progress and innovation in the Space industry relies on healthy collaboration between a variety of partners. While technology and funding are essential prerequisites, it is people who are the critical ingredient. Visionary entrepreneurs who dare to take risks and explore new markets using dedicated innovation networks like ESA's Business Incubation Centres (ESA BICs), Technology Transfer Brokers, and the Phi-LabNET, who guide, connect, and support Europe's innovators along their commercialisation journey.

This edition highlights such individuals. It captures their personal stories powering entrepreneurship in a period when the Space sector is undergoing radical evolution and disruption. Stories of passion, ingenuity, and teamwork transforming ideas into tangible benefits for our economy and society at large.

We also wish to express gratitude for the foresight of ESA leadership, whose commitment to entrepreneurship and commercialisation has become a cornerstone of ESA's mission.

The steadfast backing from ESA's member states is vital; fueling the network's dynamic growth and shaping a truly international community for space-based entrepreneurship and innovation.

To all of those who drive space commercialisation forward, we dedicate this edition.

Your ScaleUp management team,

From left to right: Roberto Cossu, Philip Thomas, Luca Del Monte, Johann Richard, Niels Eldering, Gianluigi Baldesi

THE NEW SPACE FRONTIER: DIVERSITY, INNOVATION AND COMMERCIALISATION

INTERVIEW WITH GÉRALDINE NAJA, DIRECTOR OF COMMERCIALISATION, INDUSTRY AND COMPETITIVENESS AT ESA

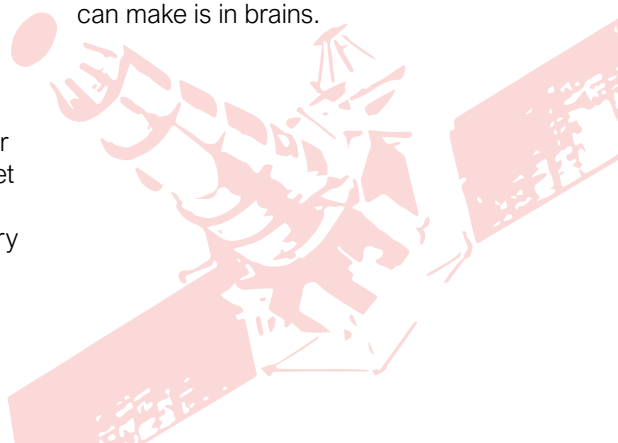
In an era of rapid transformation in the space sector, Géraldine Naja, Director of Commercialisation, Industry, and Competitiveness at the European Space Agency (ESA), is a pivotal figure. With over 30 years of experience in the space industry, she has witnessed the sector's evolution and led efforts to foster commercialisation and innovation. In this interview, she shares insights on the shifts in the space industry, the role of entrepreneurship, and the importance of diversity in shaping Europe's space future.

Géraldine, thank you for joining us today. You have been around for quite some time. Over the past 30 years, what are the most significant developments you've observed in the space industry?
Indeed, the past two decades have been transformative. One of the biggest changes I've seen is the democratisation of space. When I started in the late 1980s, space was mainly driven by public funding and government-led initiatives. Large, government-backed agencies and organisations dominated the sector, and private companies had little involvement. But today, space is no longer just a government enterprise; it has become a new market, driven by commercialisation and customer-focused solutions.

Another major development is the entry of new actors such as private companies like SpaceX and Blue Origin. They bring a different mindset and a willingness to take risks. This has made space more accessible and competitive. Today, even young entrepreneurs can start a small business or design and manufacture a satellite. This was unthinkable 30 years ago.
We're also seeing the emergence of new markets, such as in-orbit services. Think of satellite repair or life extension missions. This market didn't exist before, and it's a clear indication of how much the industry has evolved.

With all these developments, which ones do you think will have the greatest impact on the space sector and Europe's role in it?
The biggest game-changer for Europe will be how quickly we can adapt to these changes. At ESA, we often talk about the importance of speed, capital, and talent. Speed is essential because the space industry's innovation cycles are getting shorter. Fast contract placements and simplified processes will be crucial if we want to keep pace with our competitors, particularly in the US and China.

Another key factor is capital. Historically, space was funded almost exclusively by public money. But now, we're seeing significant interest from private investors. At ESA, we've built a network of over 60 investors, and they're starting to make real investments in space. But let's not forget that talent is the most critical factor. Without the right people - whether they are engineers, business professionals, or innovators - none of this will be possible. The best investment we can make is in brains.



You mentioned talent, which brings us to the question of skills. Beyond engineering, what skill sets are necessary for Europe to lead in the new space economy?
While engineering and science remain crucial, we now need a broader range of skills. Business acumen, market development and legal expertise are increasingly important as space becomes more commercialised. We're no longer just building satellites; we're creating businesses, markets and customer-driven solutions.

At ESA, we're fostering this talent through programmes like our Business Incubation Centres. These centres help start-ups by giving them access to resources, networks and, most importantly, business guidance. But we also need to attract talent from other sectors like quantum physics and artificial intelligence. These areas are developing outside the traditional space sector but have the potential to revolutionise space systems.

What advice would you give to young entrepreneurs entering the space sector?
I have a lot of admiration for them. It takes a lot of courage to start your own business, especially in the space industry where the stakes are high. My advice? Be persistent and confident. Starting a space company is tough, but the most successful entrepreneurs I've seen are those who don't give up.

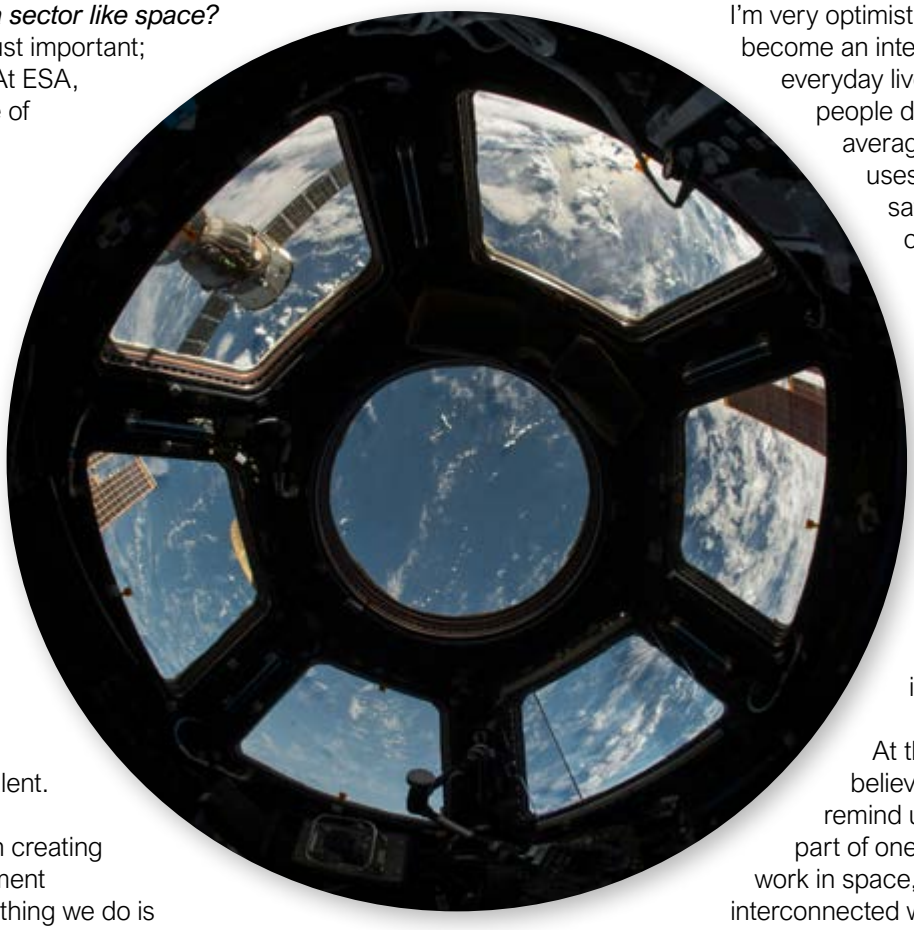
A special note for female entrepreneurs: don't doubt yourself. I've observed that women tend to

"A special note for female entrepreneurs: don't doubt yourself. I've observed that women tend to underestimate their capabilities more often than men"

underestimate their capabilities more often than men. You have the skills, and you can always learn what you don't know. The key is to stay confident and open to new ideas, even if you are not the one who invented them.

This actually touches upon the topic of diversity. Is diversity a crucial topic in a sector like space?
Diversity is not just important; it's a necessity. At ESA, we see the value of diverse teams in terms of gender, age, and cultural backgrounds. I'm particularly proud that my team has a perfect gender balance and is the youngest team at ESA. It sends a signal that you can be young and still take on responsibilities. That's crucial for attracting new talent.

We also focus on creating inclusive recruitment processes. One thing we do is ensure that our interview boards are diverse, with men and women, younger and older members, and representatives from different countries. This leads to more diverse hires, as alike tends to hire alike. If you want a diverse team, your recruitment process needs to reflect that.
I believe that once you achieve a certain level of diversity, it becomes self-sustaining. People feel more comfortable applying to an organisation where they see others like themselves. But in the beginning, you might need a bit of an accelerator to kickstart that diversity. Once you have it, it tends to grow naturally.



Do you think diversity within a team also attracts more investment, particularly in startups?
Yes, absolutely. Investors today look at the team more than anything else. They want to invest in people, not just ideas. Diverse teams tend to perform better because they bring a wider range of ideas and solutions to the table. I often say that diversity is not a burden, it's an asset. Especially in startups, having a mix of people with different experiences can be the difference between success and failure.

Looking ahead, what is your vision for the future of space in Europe?
I'm very optimistic. Space has become an integral part of our everyday lives, even if most people don't realise it. On average, each of us uses around 40-50 satellites a day—for communications, navigation, weather forecasts, and even financial transactions. My hope is that people will become more aware of how much space contributes to their daily lives and, as a result, take more interest in the industry.

At the same time, I believe that space can remind us that we are all part of one planet. When you work in space, you realise how interconnected we all are. This understanding is essential if we are to solve the global challenges we face on Earth, from climate change to resource management. Space gives us a unique perspective, and I'm excited to see how and if possible to help Europe continue to lead in this field.

STAIRWAY TO SUCCESS: FINANCING THE SPACE TRANSFORMATION

A CONVERSATION BETWEEN LUCA DEL MONTE AND JULES VARMA

Luca del Monte, Head of ESA Commercialisation Services Department

A new generation of innovative space companies is drawing increasing attention from global investors. From in-orbit manufacturing to Earth observation, these companies present a vision of a world transformed by space-enabled technologies. Getting there requires a sustainable financing ecosystem where the most competitive, innovative, and beneficial entrepreneurs can secure the investment needed for long term success.

PRIVATE INVESTMENT AND PUBLIC DEMAND

A thriving space ecosystem and an influx of private capital continue to fuel the rapid growth of Europe's space sector. Jules Varma, Commercialisation Officer at the European Space Agency (ESA), explains: "Europe's space sector has built a solid base of private capital financing, but companies—especially those working upstream—require and rely on public demand. When commercial markets and demand are limited, institutional contracts help start-ups demonstrate credibility and viability to investors." This underscores the continued importance of European Member States and institutions as customers for emerging products and services. As Jules states: "Public actors and private investors both play synergistic roles in

advancing the European space sector. By aligning our priorities, we can more effectively support strategic start-ups developing innovative products and deliver on the return on investment that will then attract continued investment into the space ecosystem."

THE INVESTOR PERSPECTIVE AND THE IMPORTANCE OF PRIVATE CAPITAL

The importance of balancing public demand and private investment is well understood across the sector. It is crucial to recognise, however, that ESA's efforts to boost private investment are not meant to redress a lack of public funding. Luca del Monte, Head of ESA's Commercialisation Services Department explains it is part of broader efforts to improve the cost-effectiveness and efficiency of ESA's missions. According to Luca: "ESA, in general, has to evolve away from a narrative based on infrastructure development to one that also includes market creation and a more encompassing vision in this respect." In such a vision, investment serves both as a facilitator and a proxy for market development.

Luca explains that ESA's end goal for the European space market is to create a landscape where public backing is no longer a prerequisite for enterprises looking to scale. Instead, they should be sustained by private investment and organic market demand. Increased investment helps to indicate market maturity, demonstrating growing investor confidence, validating demand, and identifying key value centres. At the same time, attracting investors to the space sector allows for companies to innovate and develop use cases beyond ESA's mission structure. The aggregate result is a more competitive European ecosystem, offering a robust, full-service sector that reflects the vast opportunities in space.

This requires a certain degree of investor confidence to get the ball rolling, and it's here that Luca highlights a central challenge in space investment. He says: "We've seen how, in deep-tech sectors, investors are often willing to invest a lot of money to take long term risks—even in capital-intensive sectors like biomedicine, where returns often only come after twenty years or so. Yet in space, where we seem to have the same barriers, they're much more risk averse." When asking investors why this was the case, a lack of familiarity and historical benchmarks in the space sector emerged as a recurring theme.

ESA'S GOAL: CREATING A SUSTAINABLE SPACE ECOSYSTEM

However, Luca envisions a necessary evolution of ESA's strategy beyond its current initiatives, structured around three pillars: Market Awareness Integration, Commercial Alignment, and Access to Finance.
Under the first pillar, Market Awareness Integration, ESA aims to build a deeper understanding of financial and commercial markets, relevant regulations, and business strategy at a programme level.
The ESA Ventures and Financing Office is advancing this goal by offering services across all ESA directorates, harmonising business plan assessments, and providing market insights through company landscaping. The office is also working to deepen the agency's awareness of financial markets, proposing thematic discussions in platforms like the Space Finance Lab and the European Centre for Space Economy and Commerce, and conducting studies to map available debt instruments. Together, these initiatives strengthen the

agency's overall strategy and serve to bolster the European space ecosystem.

The second pillar, Commercial Alignment, builds on the first by fostering a closer synergy between ESA's missions and commercial activities in the space sector. In practical terms, this means prioritising support for companies already engaged in initiatives such as the ESA Phi-LabNET, Business Incubation Centres (BICs), and the Technology Transfer Programmes. This approach not only highlights companies with proven business models and investor backing but also encourages ESA to incorporate market development considerations into its mission planning. Collectively, these efforts allow ESA to support market creation across a diverse range of programmes.

The third pillar, Access to Finance, centres on expanding structures to facilitate and accelerate access to financing. This includes reinforcing and extending ESA's partnerships with investors and collaborating with European institutions to create mechanisms that improve access to private capital. The ESA Investor Network includes over 80 members, with a focus on commercial banks and Corporate Venture Capital alongside traditional Venture Capitalists. This broader network aims at offering essential debt financing options for companies at their growth stages.

Another significant step towards achieving these goals is the creation of the ESA Marketplace, designed to facilitate collaboration and promote business development across the space sector. As Gianlugi Baldesi, Head of Ventures and Financing Office at ESA notes: "In the last 15 years, the space sector has changed its narrative, shifting the focus from exploration to the creation of concrete socio-economic impacts." The economic return on investment, with an average of three euros for every euro invested, reflects this new vision. "In some cases, the return is up to eight euros for every euro invested, but what really matters is that space today is ubiquitous: it influences sectors as diverse as energy, agriculture, and finance." In 2022, the ESA Ministerial Council approved the launch of the ESA Marketplace, which by 2025 has drawn interest of 200 companies, and has been allocated €33 million from 8 Member States. The initiative's economic impact will be assessed in the coming months, highlighting the new and growing financial role of the ESA Marketplace.

FURTHER OPPORTUNITIES IN DUAL-USE TECHNOLOGIES:

European actors have also recognised the potential of dual-use applications as a way to broaden the market for space technology and stimulate its investment appeal. Dual-use strategies extend the applicability of space technologies beyond civilian use towards security applications. Jules Varma notes:

Jules Varma, ESA Commercialisation Officer

"Companies can not only sell to international entities for peaceful purposes, but also to the same organisations for defence, boosting their revenue potential." By tapping into both commercial and security needs, dual-use strategies could unlock new revenue streams and attract a broader range of investors. Luca echoed this new approach, highlighting how dual-use has already emerged as part of high-level strategy among European institutions: "For many investors, dual-use was once a barrier, but now, with new support from the European Investment Bank (EIB) and funds like NATO's Innovation Fund, they're viewing it as a gateway." He added that dual-use investors are already engaging with ESA BIC companies, illustrating the natural alignment with ESA's activities. Although ESA's mandate remains focused on security rather than defence, these investors represent a strategic source of private capital that supports ESA's mission while aligning with Europe's broader space objectives.

RUNNING THE SPACE RACE: STAYING ABREAST OF THE COMPETITION

Philip Thomas, Head of ESA ScaleUp Programme Division

We are living at a time when Space is undergoing a profound change and transformation globally. Never before have such a surge of innovative technologies been deployed by private companies, who are being supported by state actors to dominate the global landscape. In a large part this is due to launch becoming more accessible and affordable. This trend is set to continue with inevitable breakthroughs in super heavy launchers commoditising the market further, making price, reliability, and cadence the most important factors. This in turn will create conditions for significantly bigger payloads to be orbited, allowing newer and more complex space architectures to be assembled, refuelled, maintained and updated, underpinned by disruptive business models which will seed future dual-use space markets.

All these developments are causing countries globally to wake up to the reality that a strong presence in space secures terrestrial prosperity and security. What is startling is that the pace of space is being set by a handful of private companies who are investing significantly with public and private capital, to rapidly deploy assets in order to create and capture future markets. It is now beyond question that we are in a space race. Countries that deprioritise space and reduce funding at this time risk being left behind, with the gap becoming so large that it becomes unfeasible to catch up in the future, resulting in a forced reliance on non-European providers.

Thankfully, Europe has a laid a strong foundation with various ESA commercialisation networks spread across ESA Member States - starting with the Phi-LabNET (launched at CM22) to support rapid ideation towards developing commercial solutions, the world-leading ESA BIC (Business Incubator Centre) Network that continues to grow and evolve since being initiated more than 20 years ago, the Technology Transfer Broker Network that has been spinning-in and spinning-off technologies for more than 35 years, and the Investor Network is today comprised of more than 80 members drawn from various investor classes.

ESA commercialisation networks are the backbone of driving European space innovation into commercial space markets worldwide. Longstanding commercialisation networks complemented by newer networks ensure that relevant and world-leading support is being offered by ESA to companies within ESA Participating States. At a time of significant geopolitical, commercial, technological, economic and social change, it is now more important than ever that Europe stays the course to stay abreast of the competition. New entrants are joining the space race with deep pockets, determination to succeed, singular political will, and clarity of focus.

Europe must not only run this space race but set the pace for others – it is possible with a renewed commitment to Space so that the future does not become winner-takes-all, but is kept sustainable and equitable for all.

PREPARING FOR THE COMING IN-ORBIT REVOLUTION

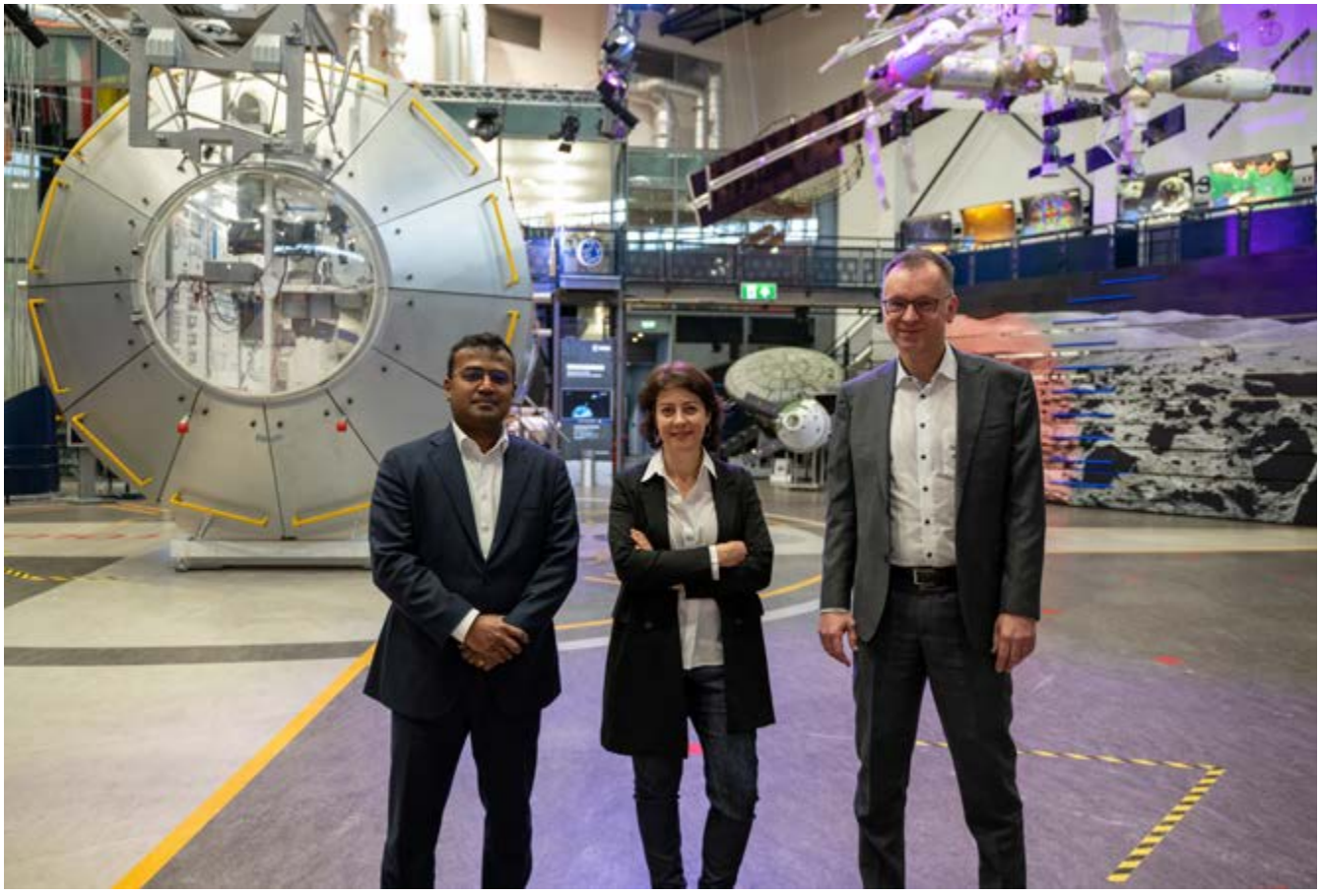
FIRESIDE CHAT WITH ESA'S PHILIP THOMAS, AGATA JOZWICKA-PERLANT AND BERNHARD HUFENBACH

"Europe must act in a unified, coordinated manner to remain competitive."

INTRODUCTION

The evolution of space is at a tipping point. With the number of launches per year expected to soon reach 300, and with ever increasing amounts of payloads orbited, it is a matter of time before space companies start assembling and maintaining large complex infrastructures in-orbit for government and commercial customers. It is now not a question of if this will happen, but when it will happen. The in-orbit revolution is a fundamental prerequisite for the lunar economy and the deep space economy. Without this essential in-space infrastructure, it will be orders of magnitude more expensive and challenging to harness and explore space for the benefit of humanity. Agata Jozwicka-Perlant, Bernhard Hufenbach and Philip Thomas discuss this fascinating subject, bringing different perspective from their respective positions in ESA and drawing upon their extensive experience in ESA, industry and government.

Agata Jozwicka-Perlant is a manager of the team within ESA's Future Space Transportation Ecosystem Programme (FLPP), which is vital for developing the next generation of space transportation systems. With expertise in both the



technical and business aspects of space commercialisation, Agata's work is crucial for de-risking new technologies and integrating commercial solutions into the space industry.

Bernhard Hufenbach, with over 30 years of experience at ESA, has witnessed the transformation of the space sector from a government-led initiative to a more commercially driven field. Since 2016, he has focused on commercialisation innovation management, emphasizing cross-industry collaboration and the integration of non-space industries. His work involves finding innovative procurement methods and involving non-space industries as users or solution providers within space programs.
Philip Thomas heads the ScaleUp Programme at ESA. His role focuses on designing, deploying, growing and refining space commercialisation networks across ESA Member States, so that space companies are supported at every step in their journey. As a former UK senior civil servant with responsibility for space, and with extensive experience in government and industry, he offers a unique perspective on the synergies between the public and private sectors that are shaping Europe's space ecosystem.

CURRENT AND CHANGING LANDSCAPE

The space sector has undergone a profound transformation as it shifts from government-led missions to a blended public-private model. This shift is fundamentally redefining how space missions are conceived, funded, and executed. Agata highlights the increasing role of

private funding, “Private money has come into the game, bringing lots of newcomers and changing the landscape of space activities as we’ve known them.”
Philip Thomas further underscores this change: “Private actors, particularly in the U.S., are able to move at a scale comparable to institutional actors. One should not underestimate their ability to create, shape, and disrupt markets. The world today is very different compared to when space was the domain of governments focused on R&D, science and exploration, without any commercial motive. Today, with private investment driving profit making, the commercialisation of space is accelerating.”
As space agencies like ESA continue to play a critical role, there is a fundamental shift in perspective. Agata explains: “We have changed the way that space transformation is done. In the past the focus was on developing launchers, now we must think about launch as a service – this changes the way that companies position themselves”. The emergence of “space as a service” offers both a competitive advantage and a source of economic growth for Europe, as it unlocks a broader array of business opportunities for private companies. Agata adds that ESA’s evolving role as an enabler, rather than a primary driver, is key to this shift, and she concludes “we enable private sector to provide commercial services that are useful for both civil & security-defence application (eg: in space transportation and refuelling).”
Further emphasising the market evolution, Philip notes, “It’s not an accident that what you have now emerging in the launch market is the commoditisation of launch; customers are looking at the price point, and things are being driven more and more in that direction.”
However, he also warns that the rise of private actors may lead to market consolidation, with larger players incentivised to reduce competition. “In industries like online search, digital technology, and semiconductors, dominant players have acquired competitors, emergent challengers and created high barriers to entry. The same dynamic is likely to unfold in space as well, with market leaders ensuring their continued dominance.”
Bernhard draws on his perspective of the exploration programme to highlight the sectors changes: “In the last years the programme was mainly focused on the ISS:

“The ability to deploy, refuel, and modularize space infrastructure, while maintaining it in orbit indefinitely, is where the sector is heading. This approach is critical to Europe’s future space relevance”

development, operation, utilisation. In the last year we have changed it, opening access to ISS to non-institutional users."
He expects space agencies to remain as the primary customer and end user in the immediate term, soon beginning to shift towards procuring services.

OPPORTUNITIES

The influx of private funding has unlocked opportunities for new entrants and novel approaches to space infrastructure. As Agata notes, "The ability to deploy, refuel, and modularize space infrastructure, while maintaining it in orbit indefinitely, is where the sector is heading. This approach is critical to Europe's future space relevance."

CHALLENGES

Despite the opportunities, the commercialisation of space faces several challenges. Regulatory frameworks, funding mechanisms, and technological hurdles remain key issues. The coordination between public and private sectors is essential to ensuring sustainable growth and development.
Philip highlights the challenges Europe faces on the global stage: "Europe is competing with nations that are larger, wealthier, and more capable of acting swiftly, without needing to build consensus among many nations. Europe must act in a unified, coordinated manner to remain competitive."
Agata continues, showing that within this coordination challenge hides a unique strength. "Europe, once aligned, will have diversification of development and thinking, making us adaptable. After we find a way to go in the same direction, it will be very hard to destabilise us."

COMPETITION AND COLLABORATION

The European space technology sector is facing global competition, necessitating transformation within both public and private sectors. Bernhard stresses the importance of ensuring European autonomy: "Our solutions should be free of non-European licensing constraints, especially in critical technologies, yet compatible with other markets."
At the European level, ESA is undergoing a transformation across technological, business, and operational processes. Agata explains, "ESA is shifting from being a prescriptive administration to a facilitator of a space technology ecosystem. This ecosystem should leverage both established and new players, fostering a team spirit toward 'Space Team Europe' through a mix of cooperation and competition."
To further emphasise the global nature of space commercialisation, cooperation with non-European

stakeholders is vital. Countries like the U.S., China, and India are rapidly expanding their space efforts, but collaboration with them can help shape international standards and create a more inclusive and competitive market. This collaboration ensures that Europe remains a key player in defining space infrastructure.

VISION FOR THE FUTURE

ESA has a clear vision for an end-to-end space transportation ecosystem, one that includes routine access to space and interoperable, reusable in-space transportation vehicles (ISTVs). Agata elaborates, "As ESA, we act as technical and business enablers, supporting the industry and also serving as anchor customers. We expect the industry to take the lead in implementing this vision."

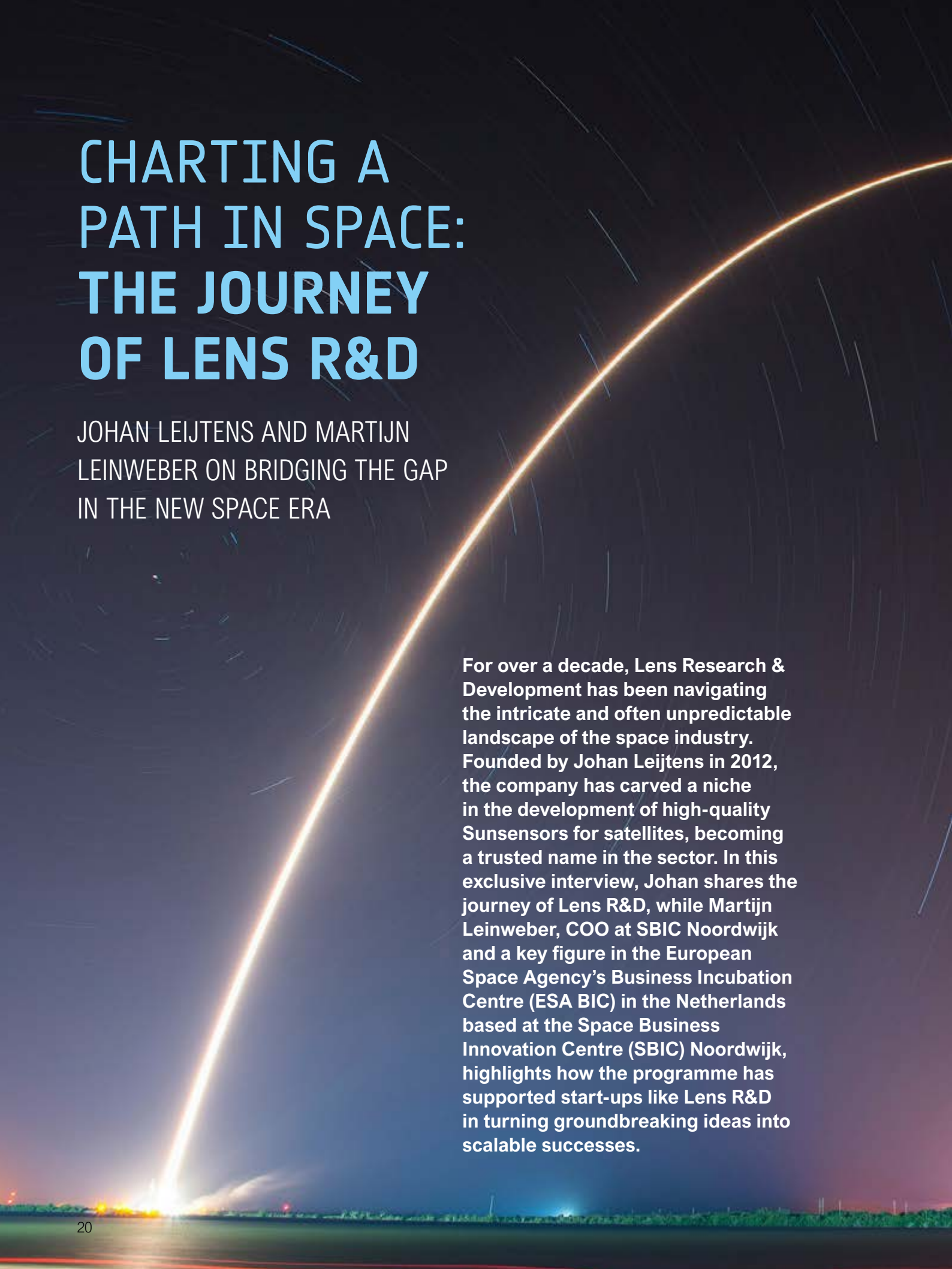
"We must look beyond the traditional space sector and engage industries such as biotech, agriculture, and energy. These sectors can drive technological innovation in space and enable new business models that integrate space capabilities into terrestrial industries."

Bernhard adds, "We need to explore new commercial avenues and engage other industries like biotech, which can make Europe a more competitive player on the global stage. The future of space commercialisation is not just about space technologies but integrating space capabilities into the fabric of other industries."

Philip stresses the need for Europe to be proactive: "Europe faces a choice: follow or lead. With private actors emerging, Europe must act swiftly to avoid high barriers to entry in an increasingly competitive market. If we are to lead, we must take action today, leveraging public-private partnerships, creating policies that encourage innovation, and focusing on emerging technologies."

CONCLUSION

The commercialisation of space in Europe is at a pivotal moment, with abundant opportunities for growth and innovation. Insights from Philip, Agata, and Bernhard emphasise the importance of collaboration, both within the space sector and with other industries. Private funding plays a central role in shaping the future of space commercialisation, but challenges such as regulatory frameworks and market competition must be addressed strategically. By embracing these opportunities and addressing these challenges, Europe can solidify its leadership position in the global space industry and drive the next frontier of space exploration and commercialisation. Europe must focus on establishing itself as a leader, moving decisively to shape the future, and using its technological strengths to define the path forward.



CHARTING A PATH IN SPACE: **THE JOURNEY OF LENS R&D**

JOHAN LEIJTENS AND MARTIJN LEINWEBER ON BRIDGING THE GAP IN THE NEW SPACE ERA

For over a decade, Lens Research & Development has been navigating the intricate and often unpredictable landscape of the space industry. Founded by Johan Leijtens in 2012, the company has carved a niche in the development of high-quality Sunsensors for satellites, becoming a trusted name in the sector. In this exclusive interview, Johan shares the journey of Lens R&D, while Martijn Leinweber, COO at SBIC Noordwijk and a key figure in the European Space Agency's Business Incubation Centre (ESA BIC) in the Netherlands based at the Space Business Innovation Centre (SBIC) Noordwijk, highlights how the programme has supported start-ups like Lens R&D in turning groundbreaking ideas into scalable successes.

> Space is a challenging industry, and I'm not afraid to tell it like it is

BUILDING EXPERTISE FROM THE GROUND UP

Johan began his career in electronics, gaining hands-on experience with scientific and military equipment before transitioning to the space sector. "At Oldelft, I developed systems engineering expertise and worked on the ENVISAT MIPAS project. At TNO, I broadened that expertise and became involved with Sunsensors," he shares. "These skills laid the foundation for my entrepreneurial leap into developing high-reliability Sunsensors for satellite applications. Building on my experience with the Delfi-C3 satellite programme, the goal became to develop the first ESA-quality, single-chip true digital Sunsensor. Creating these sensors was, and still is, a complex process. However, with the ESA qualification of our analogue Sunsensors and the delivery of the chip for the digital counterpart, we are making steady progress toward achieving this goal."

ESSENTIAL SUPPORT

Starting a company focused on space hardware is no small feat, especially when competing in a market dominated by large players. Johan credits ESA BIC Noordwijk with providing the essential support needed to get Lens R&D off the ground. "The programme offered more than just financial assistance; it gave me access to expertise, administrative guidance, and a network of like-minded start-ups," he explains. Martijn vividly recalls Johan building a cleanroom in a converted garage to meet ESA's stringent standards—a testament to his resourcefulness. "Without ESA BIC, navigating the complexities of contracts and compliance would have been overwhelming for innovators like Johan," Martijn says.

Johan Leijtens

NAVIGATING A SHIFTING SPACE LANDSCAPE

The space industry has undergone significant transformations since Johan's early days. "In the early 2000s, small satellites were a niche. Today, they're a cornerstone of the New Space economy," he notes. The emergence of mega-constellations like OneWeb and Starlink has driven demand for reliable and cost-effective components. "While some companies prioritise speed to market, our focus remains on quality and longevity. We've seen a shift back to reliable, high-performing satellites after early ventures produced short-lived, low-quality products."

BALANCING QUALITY AND SCALABILITY

One of the critical challenges Lens R&D faces is balancing the high standards of ESA qualification with the need for scalable production. "Our Sunsensors are designed to withstand extreme conditions, from cosmic radiation to temperature fluctuations," Johan says. "Despite being a small team of four, we've managed to refine our processes for series production, allowing us to deliver high-quality products used in missions across the globe. The key is maintaining a delicate balance between cost, reliability, and speed. This is where our partnership with ESA BIC continues to provide strategic value."

Martijn Leinweber

SUPPORTING THE NEXT GENERATION

Having benefitted from ESA BIC's guidance, Johan is now committed to giving back. "I've been fortunate to receive support during challenging times, and I want to share that experience with new start-ups," he says. Johan regularly mentors the young entrepreneurs that are currently incubated at ESA BIC Noordwijk, offering candid advice drawn from his journey. "Space is a challenging industry, and I'm not afraid to tell it like it is. If I can help others avoid the pitfalls I encountered, it's worth the effort."

BRIDGING THE GAP

Both Johan and Martijn see a critical role for programmes like ESA BIC in fostering European innovation. "Upstream space projects, like hardware development, often require longer timelines and significant investment," Martijn explains. "ESA BIC provides the support and stability needed to bridge the gap between concept and market-ready product." Johan agrees, emphasising the need to maintain a strong space technology base in Europe. "Without programmes like ESA BIC, we risk losing our competitive edge to regions with more aggressive investment in space."

INTERVIEW
WITH KEVIN DEDIEU
AND HÉLÈNE HUBY

INNOVATING FROM ABOVE AND BELOW **DOWNSTREAM AND UPSTREAM IN SPACE**

Unravelling the dynamic space ecosystem, two key sectors often emerge: upstream and downstream. The former refers to developments in the in-space and in-orbit market sector, whereas the latter describes the use of space technology down here on Earth. In this double feature, we explore two companies leading the charge in these domains. Kevin Dedieu of Descartes Underwriting discusses how his innovative insurance company leverages Earth observation technology to tackle climate-related risks. Hélène Huby of The Exploration Company reflects on her company's milestones and its role in shaping Europe's evolving space economy from an upstream point-of-view. Together, these pioneers demonstrate how innovation from above and below is shaping a new era for space.

DESCARTES UNDERWRITING DISRUPTION THROUGH DOWNSTREAM

Descartes Underwriting, launched in 2019 as a start-up from ESA BIC Nord France, has a clear goal: using downstream space technology to make climate-related risks more insurable. Co-founder and CSO Kevin Dedieu shares his journey and vision for what lies ahead.

Kevin Dedieu

DO YOU STILL CONSIDER YOURSELVES A START-UP?
Well, yes and no. We're still growing very fast, like a start-up - with a 40% annual growth rate - but I believe we've established ourselves as a recognised insurance brand and are evolving into a scale-up. With 18 offices in 10 countries and over 200 employees, including 100 specialists in meteorology, software, and risk analysis. Though, from the beginning, we had the goal of going global.

WHAT LESSONS HAVE YOU LEARNED SINCE LAUNCHING DESCARTES?
That it's okay to make mistakes, as long as you learn from them. Challenges helped us refine our processes and build a stronger foundation for the future. Listening to the market is also of great importance. Engaging with early adopters allowed us to tailor our offerings to client needs, which has been critical to our success.

WHAT HAVE BEEN SOME OF DESCARTES' BIGGEST MILESTONES SO FAR?
Becoming a recognised name in the insurance industry across the globe, generating $200+ million in premiums. Our leadership in leveraging space technology and parametrics to innovate insurance products is a second milestone that underscores our growth and influence.

> **"As climate change intensifies, the demand for weather-related insurance is rising."**

HOW DOES SPACE TECHNOLOGY FACTOR INTO YOUR APPROACH?
Downstream space technology is revolutionising the insurance industry. Satellites now enable us to replace outdated methods, like sending teams across the globe for risk surveys assessments. Instead, we gather better, more accurate parametrics data remotely, improving efficiency and tailored coverage.

WHO IS THE MAIN BENEFICIARY OF THIS GAMECHANGER?
As climate change intensifies, the demand for weather-related insurance is rising. But the insurance gap is also widening—especially in vulnerable regions like the tropics. We work with global institutions to develop innovative products, protecting communities most affected. Our goal is to help close this protection gap and ensure reliable coverage for all.

WHAT'S NEXT FOR DESCARTES UNDERWRITING?
We're entering an exciting new phase. Beyond expanding our global reach, we aim to broaden our product portfolio by integrating AI and advanced data analytics. This will enhance our pricing models and allow us to deliver even more innovative, tailored solutions to meet the evolving needs of our clients.

THE EXPLORATION COMPANY PIONEERING UPSTREAM TECHNOLOGY

The Exploration Company is at the forefront of the rapidly evolving space industry, pioneering advancements in upstream technology with its reusable and in-orbit refillable spacecraft Nyx. Co-founder and CEO Hélène Huby shares her insights on the company's journey as well as her own.

WHO OR WHAT HAS INFLUENCED YOUR JOURNEY THE MOST?
My fascination with space stems from the teamwork it inspires. Space exploration shows what humanity can achieve when we combine complementary talents to create something greater than ourselves. This shared vision has profoundly influenced both my career and The Exploration Company's ethos.

WHAT DOES SUCCESS MEAN FOR THE EXPLORATION COMPANY?
Success is delivering on what we promise. Since our inception, we've consistently met our cash targets, maintained cost stability within 5%, and kept our flight readiness on schedule. We're incredibly proud of being awarded phase one of ESA's LEO cargo return service, securing contracts with commercial space station providers, and our first Ariane 6 demonstration flight.

WITH THE KNOWLEDGE YOU HAVE NOW, WHAT WOULD YOU DO DIFFERENTLY IF STARTING OVER?
I worked on the Orion Vehicle and witnessed firsthand the transformation of space exploration. I realised that the future involves more stations around Earth and the Moon and eventually spaceflights to Mars. If I could start over, I would embrace the unknown even sooner—creating innovative and useful solutions for this future.

WHAT ARE YOUR AMBITIONS FOR THE COMPANY OVER THE NEXT DECADE?
By 2030-2035, I foresee regular spaceflights between Earth, Moon, and Mars. We'll see mega satellite constellations enabling broadband communication and applications like autonomous vehicles. Different types of space stations—private, military, refuelling, and research—will shape this ecosystem. Aligning our work with these trends is key.

HOW DOES SPACE TECHNOLOGY CONTRIBUTE TO SOLVING GLOBAL CHALLENGES?
Space technology is revolutionising how we approach problems. It improves communication, enables scientific discoveries, and fosters innovation. We see ourselves as enablers, building solutions that address current needs while preparing for future demands.

WHAT ROLE DOES EUROPE PLAY IN THE FUTURE OF SPACE?
Europe has immense potential to lead in space innovation. By fostering collaboration and leveraging expertise, we can build a sustainable and transformative space economy that benefits everyone.

Hélène Huby receiving the 20th ESA BIC anniversary Honourable Award

> **"Space exploration shows what humanity can achieve when we combine complementary talents."**

SPACE FOR BUSINESS, BUSINESS FOR SPACE

A CONVERSATION ABOUT THE IMPORTANCE OF MANAGEMENT EDUCATION FOR THE SPACE SECTOR.

The intersection of business and space is becoming more critical as the space sector evolves from primarily government-driven programmes into a commercial and self-sustaining industry. Recognising this, the European Space Agency (ESA) and three business schools from the university of St Gallen, the Nova School of Business and Economics, and the Erasmus University Rotterdam, launched the Space for Business Executive Education Course, designed to equip professionals with the business acumen needed to thrive in the growing space economy. The part-time programme spans eight months and includes residential weeks in three different countries. René Olie, Program Director Space for Business and closely involved in the course's development, and Cornelis (Niels) Eldering from ESA's Entrepreneurship and Business Incubation Services office, sat down to share their insights into its origins and significance.

RECOGNISING THE NEED: FROM ENGINEERING TO ENTREPRENEURSHIP

As René and Niels reflect on the journey leading to the course's creation, they confirm that the increasing commercialisation of space was a key driver. "It's one thing to build a rocket, but it's quite another to make it financially viable," René explains." Niels adds: "This realisation sparked the development of a course that not only addresses technical capabilities but also the business strategies necessary for success in the space sector." Both agree: "For many years, space was the domain of engineers. But today, the landscape is changing rapidly. Space is becoming more commercial, more competitive, and ultimately more dependent on business innovation." Niels: "Twenty years ago, as part of ESA's Technology Transfer Programme, we focused primarily on how space technologies could be applied to non-space markets. But the challenge arose when founders were trying to make the leap into entirely different sectors with their space-based concepts. They didn't always know how to set up a business, which led to the growing recognition of the need for business education in this field and eventually also int the emergence of our start-up support system, the ESA Business Incubation Centres (ESA BICs)."

"For ecosystems to really make an impact, you not only need to attract new talents, but also train the managers already shaping the industry."

The Space for Business Executive Education Course was born from this trend. Space companies today are not only technological powerhouses; they are also reshaping the business models of the entire industry. "What people like Elon Musk and Jeff Bezos have achieved isn't just remarkable for its technology," René notes, "but for the way they have approached space as a business." He continues: "We're witnessing the emergence of new business models in the space sector. Companies are no longer in space just for science and exploration: they're there to solve real-world problems. That's where our course comes in. We prepare professionals to think beyond engineering and focus on profit and loss, sustainability, and creating value."

COURSE STRUCTURE AND IMPACT

The programme is designed for professionals already working in

(left) Cornelis Eldering (right) René Olie

> **“The most successful space companies today aren’t just technologically advanced. They’re financial and marketing savvy.”**

the sector, as well as for those looking to transition into space from other industries. Niels explains: “Truthfully, together with the Global Alliance in Management Education (CEMS), we’ve already been training management students for two decades now. Moreover, our ESA Academy increasingly targets business students alongside science and engineering students to join the challenge of space innovation. For example, through the ESA Academy Technology Transfer, Application & Innovation Workshop and the CubeSat Summer School. However, with the rapidly changing space ecosystem and the need to stimulate growth, it became clear that we had to extend these efforts into life-long learning opportunities and make business education accessible for professionals already working in the sector”. Niels continues: “For ecosystems to really make an impact, you not only need to attract new talents, such as students, but also train the managers already shaping the industry.”

One of the course’s key components is the impact project. Participants are encouraged to work on real-world challenges and apply their learning in practice. René shares an example: “We’ve had participants from various backgrounds, including finance, design, and international management, who came into the course curious about how their skills could translate to the space sector. One participant even developed a start-up idea during the course: a resource platform for space companies to order satellite parts in a way that’s much more aligned with today’s supply-chain systems. This isn’t just theory; it’s a direct contribution to the space economy.”

A GROWING DEMAND FOR BUSINESS SKILLS IN SPACE

Reflecting on broader industry trends, René sees a growing demand for business expertise: “The most successful space companies today aren’t just technologically advanced. They’re financial and marketing savvy. They know how to recruit the right talent, how to calculate risk and return, and how to operate sustainably.” As space becomes more accessible, companies must be able to navigate complex market dynamics; from regulatory hurdles to securing investment. “This course is about creating leaders who can steer the space sector into its next phase of growth,” René emphasises. “We need people who can think commercially, who understand the market and how to position their company to thrive.”

LOOKING AHEAD

Both René and Niels are optimistic about the future of the programme and its impact on the space industry. René: “We’re at an inflection point. As space becomes more commercial and the private sector takes on a larger role, the need for business skills will only grow. This course is a way to equip people with the tools they need to succeed in this rapidly changing environment.” Niels continues: “Space offers opportunities for anyone with a passion for innovation and a drive to bring profitable solutions to global business challenges. That’s exactly what we are preparing our participants for.”

REACHING FOR THE STARS

A CONVERSATION BETWEEN FRANK HUGI AND TIM HEIJMANN

Meet Frank Hugi, Program Manager for Strategic Space Projects working for Beyond Gravity, and Tim Heijmann, Senior Space Industry Consultant at Evenflow. Both alumni of CEMS—the prestigious Global Alliance in Management Education—they've maintained a strong friendship and even embark on annual camping trips under the Swiss stars. In this conversation, Frank and Tim reflect on their career paths, the progress the space industry has made and their ongoing excitement for space from a business point of view.

A starry night makes the Jochpass even more spectacular.

Tim and Frank at their CEMS graduation in Sydney.

Tim: "Remember when we met back in 2012, way before we ever considered a career in space? You threw a party at the start of our bachelor's degree in international business administration at Erasmus University in Rotterdam. You made an amazing Swiss cheese fondue. I was blown away and decided to stick around, having at least annual cheese fondues with you ever since! It's crazy to think that was over a decade ago."

Frank: "Yeah, that was a fun start to our friendship. It's interesting how the link to space came in later for both of us. For me, space was not even on the radar during our bachelor's as I felt it was so out of reach. But once it got our attention, I started thinking more seriously about how the space industry needed people like us. Not just engineers, but business minds too, who work hand in hand on tangible solutions."

Tim: "I had my turning point during my exchange in Los Angeles. My campus was just a ten-minute drive from SpaceX, where they were working on the Falcon 9 rocket. No orbital rocket had been successfully landed for re-use, but they were getting close, and the commercialisation of space was in full swing. It made me realise that the space industry would need more than just rocket scientists, they need commercial capacity too. With a business degree, you could play a key role."

Frank: "Back then, the space industry relied heavily on public funding, which was slow and didn't leave much room for error. Then, suddenly, things started moving fast. Private companies disrupted the market, making space more commercially viable. It wasn't just about rockets anymore; it was about data, satellites and creating value for new ventures and for broader ecosystems."

"It wasn't just about rockets anymore; it was about data, satellites and creating value for new ventures and for broader ecosystems."

Tim: "And that's where we come in. Just because something is exciting and works technically doesn't mean it's a viable business idea. We perform that commercial sanity check, making sure that there's a market demand for the technology being developed. It's about moving from a 'tech push' to a 'market pull' and building solutions that users actually need."

Frank: "Space is incredibly complex and highly competitive. You hear stories about profitable start-ups, but there's also a lot of risk. It's easy to get lost in the fast-evolving market. You could spend 20 years working on a project, only to find the market has moved on by the time you're ready to launch. It's a harsh environment."

Tim: "At Evenflow, we do strategic work, such as evaluating the European space investment landscape for organisations like the European Investment Bank and ESA. We also support start-ups to commercialise their space solutions, or big corporations to use space data in their decision making. We work across the whole space value chain, which is very rewarding."

Frank: "My role at Beyond Gravity is similar as I look at the business side of things: customers, value chains, and the data we can generate. We're a 40-year-old international company with over 1.500 employees and we have in-depth space

Waking up to a view of the Brienzer Rothorn with Lake Brienz in the background.

knowhow. As we make sure our solutions address the future space industry, we strive to bring new applications by emphasising rapid iteration, and by putting data as one of our important strategic pillars."

Tim: "We're not only talking about building rockets and satellites anymore; we're talking about using space data to improve or even save lives. Whether it's predicting floods or understanding where to place wind farms, space technology is being used for real-world solutions that contribute to building climate resilience and the green transition."

Frank: "Exactly. We have a responsibility to use space technology to solve real problems. For example, satellites can help monitor environmental changes and alert us to potential disasters before they happen. It's a powerful tool that can make a real difference, and that's why I'm so excited about it."

Tim: "Space is evolving quickly. A decade ago, launching satellites was prohibitively expensive. Now, it costs less than $4,000 per kilogram, with projections of dropping to less than $500 in the coming years as new launch systems push the boundaries of cost efficiency. That's just a fraction of what it used to be. This will open new opportunities for start-ups and even universities to send probes into space. It's amazing to think how much has changed since we were students. Back then, space felt within reach, but now it's here."

> **"When you look up at the night sky, you are not looking only at stars. You are looking at satellites."**

Frank: "And we still manage to go camping every year, just to disconnect and reflect under the stars. Which is a great way to take a break from everything. It's funny though; these days, when you look up at the night sky, you are not looking only at stars. You are looking at satellites. It really brings home how much space has changed in just a few years."

"When you look up at the night sky, you are not looking only at stars. You are looking at satellites."

Tim: "Space has become tangible, something we interact with every day. And it's only going to grow from here. That's why I think now is the perfect time for young talent to enter the space industry. There are so many opportunities to make a real impact."

Frank: "That's because space is no longer just for engineers; it's for anyone with a passion for innovation. Whether you're in business, data science, or even environmental studies, there's a place for you in this industry. Some even consider having a hotel in space in the coming years, imagine! Space is vast and complex, but not impossible to enter from different backgrounds."

Tim: "Definitely. I'm very excited to see where it goes from here. In-orbit economies, off-world bases on the Moon and Mars, and soon enough affordable trips to space!"

BRILLIANT MINDS NEED GOLDEN HANDS

Behind every successful venture, you'll find 'golden hands': the skilled craftspeople whose expertise transforms raw ideas into marketable innovations. These artisans do more than just build; they create tangible value, crafting the products that captivate customers, attract investors, and ultimately steer progress. In the space sector, where innovation and precision are paramount, this talent is indispensable.

From concept to reality, space innovations require more than just vision: they rely on skilled hands to turn theoretical designs into functional hardware. As the industry becomes increasingly interdisciplinary, design-led, and sustainability-focused, the significance of these 'golden hands' will only grow. But where do craftspeople come from, and how do they fit into the evolving space ecosystem? This article explores the critical role of craft in space innovation, focusing on the hands behind the hardware that shape the success of space start-ups.

For many, the launch of the rocket is the most vivid image of space. Yet, every part of this journey has been meticulously tested here on earth. From the fine-tuned gyroscopes that keep the spacecraft on the right trajectory, to the launch pad that must withstand immense forces, the machinery is just one part of the equation. The skilled hands of craftspeople design, build, and perfect each component, ensuring the technology works seamlessly. As Frank Molster, Project Manager LIS-TOP at Leidse instrumentmakers School (LiS) comments "Instrument makers are crucial in making the required instruments and parts and in most cases are already in the design phases. They help the scientists and engineers to avoid mistakes in their designs."

Take Rocket Factory Augsburg, for example: the company aims to manufacture rockets much like cars, through streamlined assembly lines. But before you reach mass production, you need to prove your concept works with a prototype. As additive manufacturing and automation continue to advance, it may be tempting to lean on these tools from the outset. The allure of 3D printing lies in its apparent limitless potential: the promise of rapid prototyping, reduced waste, and complex geometries at the push of a button. Yet even the most sophisticated technologies depend on the foundational work of craftspeople to bring initial designs to life, troubleshoot early flaws, and inform the path to scalable production. From selecting the right fabrication methods to recognising subtle flaws that machines might miss, their insight ensures that designs are not only manufacturable but reliable, repeatable, and robust. As the industry pushes toward long-duration missions, in-space manufacturing, and a circular approach to hardware, the need for adaptability, repair, and reconfiguration will only grow. We'll need not just automated systems, but people who can build, fix, and improvise, keeping systems running in environments where spare parts are limited and every gram counts. Automation may optimise production, but it's human craft that keeps it grounded. By embedding traditional making skills into advanced space design, we don't slow progress: we humanise it.

The contribution of golden hands, however, extends far beyond enabling launch. When space technologies are adapted into entirely new applications for terrestrial markets, they must first undergo rigorous testing to determine their functionality, investment potential, and market relevance. In both the upstream and downstream sectors, craftspeople play a critical role in translating bold ideas into practical, scalable, and desirable innovations. From creating deployable structures like solar sails to tailoring the Apollo-era space suits by hand and assembling intricately layered thermal blankets, craftspeople have long applied traditional techniques to solve some of space exploration's most complex engineering challenges.

Throughout human history, we've shaped our world with our hands. Carving tools, stitching garments, forging metal. Craft has always been central to our progress. Now, as we reach for the stars, that same ingenuity and skill is more vital than ever. In the era of new Space, craft is finding renewed relevance, as design itself becomes a differentiator, in function and form. Competing technologies are emerging with unique aesthetics, materials, and user experiences, echoing how space-grade carbon composites now appear in high-performance cars.

A MATCH MADE ON EARTH, IS A MATCH MADE IN HEAVEN

Not only start-ups but well-established industry similarly recognises the immense value of golden hands. For instance, take the German manufacturer Schweyer Feinmechanik. They specialise in high-precision parts made of stainless steel, aluminium, and titanium, "Our first space customer simply found us on the internet. And since we were located close-by, they contacted us", shares Daniel Dichtl, Senior Mechanical Engineer at Schweyer. The company had, until then, no business in space. But they took the challenge, rolled up, and delivered: "We have learned about new high-performance

“Increasingly, start-ups are leveraging the expertise of manufacturers from diverse industries, such as automotive, medical, and aviation, that share a commitment to robustness and precision.”

plastics for harsh space conditions. They can be machined like metal. Really incredible”, he adds.

Identifying the need for specific components is only part of the equation for space start-ups. Securing a manufacturer capable of meeting the stringent requirements of space-grade quality and precision can be challenging, particularly for nascent companies lacking established networks. Increasingly, start-ups are leveraging the expertise of manufacturers from diverse industries, such as automotive, medical, and aviation, that share a commitment to robustness and precision. This kind of cross-industry collaboration not only facilitates access to high-quality production but also serves as a powerful driver of innovation. Transferring solutions between space and non-space sectors -whether through materials, methods, or design approaches- is, in itself, a fundamental form of innovation, enabling companies to draw on existing excellence while adapting to new contexts.

One of the key services of an incubation centre is to match-make start-up companies with skilled suppliers, saving valuable time in their search. In addition to the Start-ups Meets Crafts initiative, in 2018, ESA BIC Bavaria and the Chamber of Crafts for Munich and Upper Bavaria (Handwerkskammer) launched the Space Meets Crafts programme specifically for this purpose. Suppliers like Schweyer, with decades of expertise in high-tech markets, are fervent participants. This collaboration fosters ideal partnerships that accelerate development. These programmes are invaluable as they provide start-ups with the opportunity to showcase their products early, thus increasing their chances of attracting investment. While early-stage funding helps build prototypes, demonstrating a functional product to potential customers is key to advancing and securing further support. A demonstration, in this sense, serves as a crucial tool for start-ups to establish credibility and make their case to investors.

Speaking the same language as manufacturers enables these matches. Rasmus Arnt Pedersen, CEO and founder of the Danish ESA BIC start-up North Propulsion, and his team thrive with their ability to collaborate effectively with manufacturers is central to turning ideas into testable hardware. “If you approach a new manufacturer and ask to produce a rocket engine, that can make them nervous,” he explains. “But if you tell them, you need a gas nozzle, they relax. The conversation becomes much easier.” This form of technical fluency is not incidental, but cultivated through direct, hands-on experience. Pedersen and his team developed these capabilities during their time in university student organisations, where they had access to production machinery and the opportunity to fabricate components manually. As he notes, “You need that expertise. There is no way around that.”

INSOURCING VS OUTSOURCING

As space start-ups scale, one of the critical decisions they face is whether to insource or outsource craft skills. Insourcing allows for greater control over production, intellectual property, and quality assurance, although it requires significant investment in both human capital and infrastructure. Conversely, outsourcing can provide flexibility and speed, allowing start-ups to access high-quality parts without the need for in-house manufacturing capabilities. However, this flexibility often comes at the expense of control over the production process, which can impact both quality and intellectual property security. Therefore, start-ups must weigh not only cost and time-to-market considerations but also their long-term strategy, risk tolerance, and the degree of control they wish to maintain over their products.

Ben van Berge Henegouwen, Owner and General Manager of the Dutch company West End, a specialist in machine works with over 75 years of experience and home to 40 skilled craftspeople, emphasises that the decision to insource or outsource should be customer-centric: “If a customer calls on a Friday night because a part is broken, the

answer should not be ‘Oh yes, let me call one of my suppliers.’” In this way, understanding customer priorities plays a central role in determining what should be built in house, illustrating that craftspeople are attuned to customer demands, and responsiveness to urgent requests. “Choose to manufacture yourself what is critical to the customer” Ben continues.

Rasmus Arnt Pedersen, CEO and Founder of North Propulsion, provides a practical example of how space start-ups might approach the decision to insource or outsource: “Let’s pick welding, for example, if this was a part of our trade secrets for our propulsion engine, then it would make sense to insource that.” Securing intellectual property and maintaining control over the most critical aspects of production is therefore key.

Jerre Sweers, Founder and CEO of Stellar Space Industries, echoes this sentiment: “My goal is to become as much vertically integrated as possible, including machining in-house.” For Jerre, relying on external suppliers for metallic components poses a significant risk, as the quality and price of these parts can fluctuate unpredictably. “By manufacturing internally, we can control costs, ensure quality, and offer better prices ourselves.” Vertical integration, therefore, provides companies with greater stability and the ability to control every aspect of the production process, which is particularly valuable in the high-stakes, precision-driven space industry.

GOLDEN HANDS – A RARE COMMODITY?

Latitude, an alumnus from ESA Business Incubation Centre Nord France, recognises the value that skilled personnel bring to their operations. With a goal of offering 50 rocket flights per year -i.e., approximately one per week- the company faces the challenge of meeting this ambitious target with a highly skilled workforce. To streamline its production line and ensure consistency, Latitude has invested in its own machinery and hired specialists in welding, machining, assembly, and testing. However, finding the right talent remains a challenge, especially as these skill sets are both rare and in high demand. As Isabelle Valentin, the company’s COO, explains, “These profiles are not very common, and at the same time high in demand. We invest a lot into employer branding. For many, working in space is a dream come true.”

While the allure of space may draw people to start-ups directly, it is not necessary to work at a space company to contribute to space missions. Manufacturers from diverse industries can play an equally crucial role. For instance, Belgian electronics manufacturer ST Engineering trains its employees to solder electronics to space standards, enabling them to work on hardware for space, aviation, and medical sectors. Danny de Smet, Sales & Marketing Manager at ST Engineering, proudly points out the pride his employees take in their work, noting, “They just see how much they can achieve. At the end of the day they can point to the sky, for example to the International Space Station, and say ‘I touched this’. That is very rewarding.”

As the space sector continues to grow, so too will the demand for skilled workers. Many space companies are proactively building relationships with universities and technical schools to ensure a steady pipeline of talent. In some cases, the most effective way to protect a company’s “secret sauce” and long-term strategy is by training these essential skills in-house, creating a skilled workforce that drives future success.

ROLL UP YOUR SLEEVES

In short, these hands craft the products that captivate customers, impress investors, and ultimately shape the future of space exploration. It is this ability to create tangible value that makes their hands ‘golden’, highly prized, and instrumental in generating revenue. It is important that we keep nurturing these talents, to connect golden hands with brilliant minds, and realise space innovation.

UNITED FOR THE STARS: HOW STRATEGIC PARTNER-SHIPS DRIVE SPACE INDUSTRY INNOVATION

The space sector is undergoing a profound transformation, evolving from a domain traditionally dominated by government programs to a thriving commercial marketplace. In this rapidly changing landscape, collaboration has shifted from a strategic choice to a necessity. Partnerships—between start-ups and established industry giants, as well as public and private entities—are playing a pivotal role in reshaping the space economy. These collaborations are not only overcoming barriers to entry but also accelerating innovation, benefiting the entire ecosystem. As a multinational organisation, the European Space Agency (ESA) stands at the forefront of this movement, with its Partnership Initiative for Commercialisation (EPIC) embodying this commitment.

Joana Kamenova, ESA EPIC Lead

Launched in 2022 under the newly formed Commercialisation, Industry and Competitiveness Directorate, EPIC draws on over 20 years of business incubation expertise. It works with a powerful array of partners, including Airbus, Altair Engineering GmbH, Ellipsis Drive, Iceye, Idaero Solutions, GEOSAT, Novaspace (formerly Euroconsult), OVHCloud, Planet Labs GmbH, Sinergise, Thales Alenia Space, and UP42 GmbH. Along with ESA Business Incubation Centres (ESA BICs), Technology Brokers, and ESA Phi-labNET, EPIC connects hundreds of space-related start-ups to the expertise, products and services, and networks they need to thrive.

"Partnerships are transformative for emerging ventures navigating the complex and competitive landscape of the space industry," says Joana Kamenova, lead for the EPIC initiative. "When we pool the resources, expertise, and vision of the best minds in the field, we move faster and further. Collaboration benefits everyone—even competitors—by driving progress across the entire ecosystem."

BENEFITS TO START-UPS: EMPOWERING THE NEXT GENERATION OF INNOVATORS

For start-ups entering the space sector, the barriers to entry can be daunting, given the sector's regulatory, technological, and financial complexities. However, partnerships through EPIC provide these start-ups with essential resources that can significantly accelerate their development. Companies like OVHCloud and Altair Engineering offer tailored services that allow start-ups to focus on what matters most: innovation. OVHCloud, for example, offers scalable cloud services that are especially beneficial during the growth phase of start-ups. "With open standards, we allow start-ups to work with multiple providers, giving them the flexibility to choose the best solutions for their needs," says Philip Marais, Global Start-Up Program Director at OVHCloud. "Our transparent pricing model, which eliminates bandwidth costs, provides significant savings, especially for start-ups dealing with vast amounts of data."

Altair Engineering, a leader in engineering simulation, provides start-ups with unlimited access to cutting-edge simulation and data analytics tools. "We want to offer as many start-ups as possible the chance to benefit from our technologies to speed up proof-of-concept development and certification," says Paolo, Colombo, Senior Global Director at Altair. "This access is crucial for start-ups and SMEs, who often lack the resources to implement the same technologies as larger market players."

By partnering with these industry giants, start-ups can leverage the same technologies used by established players, positioning them for faster growth and innovation. These synergies not only benefit the start-ups but also create new opportunities for their partners, fostering a mutually beneficial environment where knowledge and resources are shared.

BENEFITS TO PARTNERS: EXPANDING REACH, GAINING INSIGHT, AND INVESTING IN THE FUTURE

For established companies, partnerships with start-ups provide more than just an opportunity to give back to the ecosystem. They also offer valuable strategic advantages, including market insight and access to emerging technologies.

For Altair, participation in EPIC enables the company to engage directly with the next generation of space innovators, providing insight into market trends and technological developments. "Despite having

“It’s our passion for start-ups that truly drives this collaboration. We want to support their acceleration, invest in their future, and through this, invest in the future of the entire ecosystem. It’s much like the philosophy of a venture capitalist.”

almost 40 years of experience in the sector, connecting with innovators and disruptive ideas challenges us to evolve our products and anticipate future applications,” says Paolo. “Through this collaboration, we can stay ahead of the curve.”

For OVHCloud, the partnership strengthens its commitment to data sovereignty and sustainability. “Through this partnership, we’re adding to the value proposition of protecting space data—ensuring it remains where it originates,” explains Philip. “This is crucial for supporting the growth of New Space in Europe. Additionally, we focus on sustainability with energy-efficient servers and helping our partners reduce their carbon footprints.”
By joining EPIC, partners like OVHCloud and Altair are not only shaping the future of the space sector but also gaining new business opportunities and strengthening their own innovation capabilities. These partnerships allow them to refine their products, stay competitive, and remain at the forefront of the rapidly evolving space economy.

BENEFITS TO THE ECOSYSTEM: FUELLING GROWTH AND ADVANCING GLOBAL COMPETITIVENESS

As the space sector becomes increasingly competitive, strategic partnerships are crucial for the growth of the entire ecosystem. These collaborations go beyond simply helping start-ups and established companies succeed—they help to advance the broader space economy by creating a sustainable, collaborative environment that fosters long-term growth and innovation.

Philip highlights the importance of collaboration in a competitive market: “Our collaboration with ESA through EPIC reflects a shared commitment to promoting innovation and entrepreneurship within the space economy. The sector is inherently complex, and the higher the barriers to entry, the more essential collaboration becomes. By partnering, we can help early-stage ventures overcome these challenges and boost Europe’s competitiveness on the global stage. Even as commercialisation drives competition, collaboration remains critical to growth, especially when partners unite across borders to pool their expertise and resources.”

Similarly, Altair’s participation in EPIC is rooted in the belief that start-ups are the disruptors of the industry. “ESA is a reference point for the space sector, and this partnership is a source of pride for us,” says Paolo. “But it’s our passion for start-ups that truly drives this collaboration. We want to support their acceleration, invest in their future, and through this, invest in the future of the entire ecosystem. It’s much like the philosophy of a venture capitalist.”

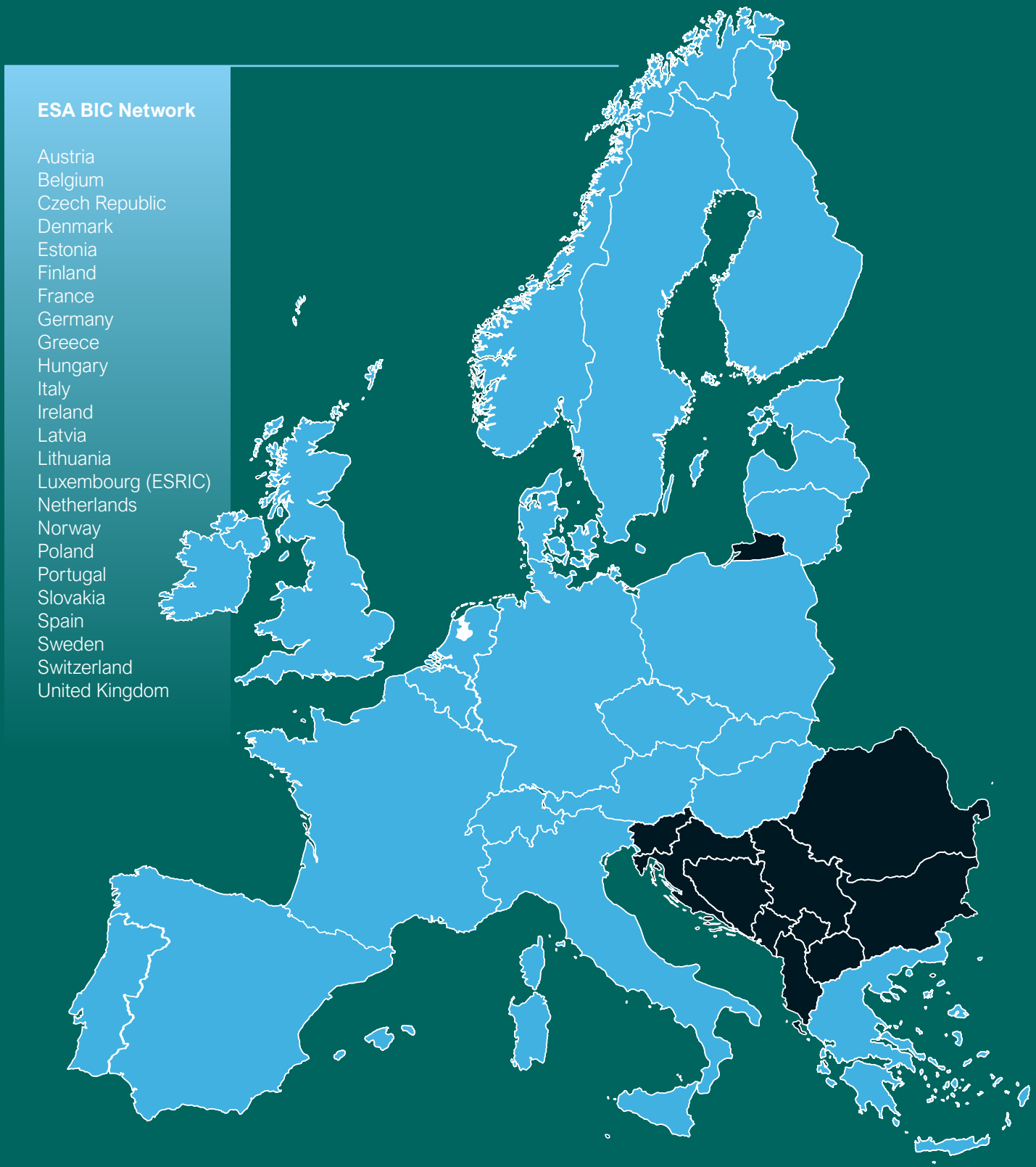
These synergies are key to creating a space ecosystem that thrives not only through technological advancements but also through shared values. As start-ups grow, so does the entire sector, pushing the boundaries of what’s possible in space exploration, communication, and commercialisation.

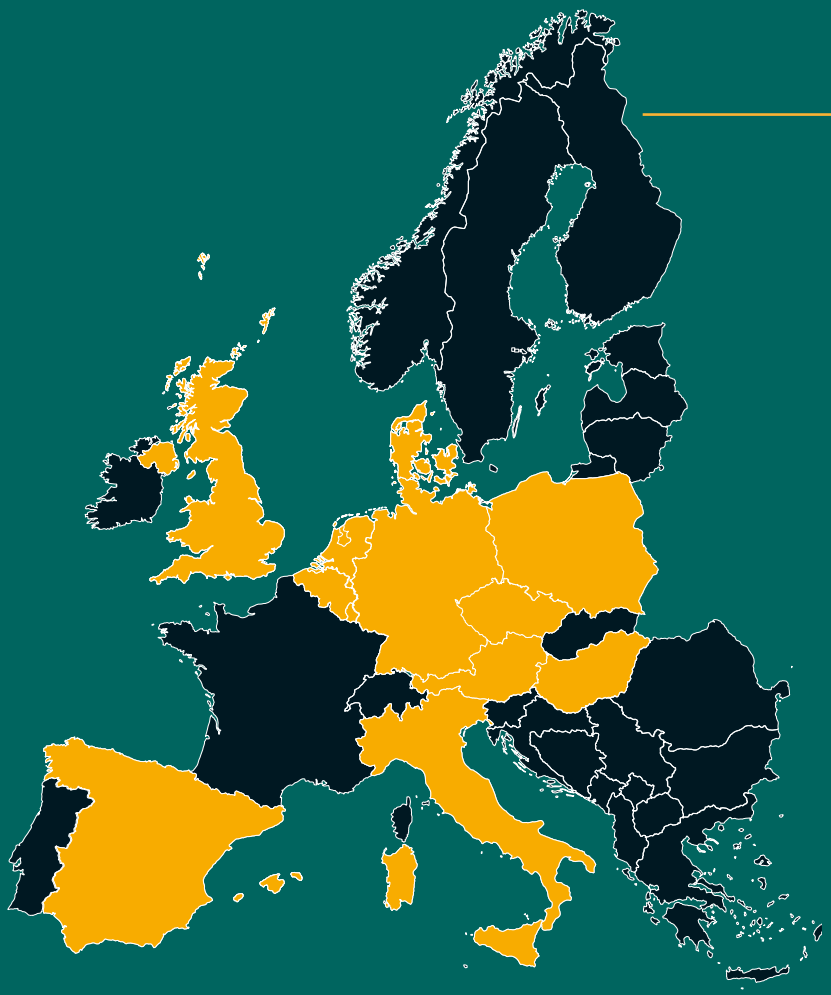
CONCLUSION: A THREEFOLD VALUE PROPOSITION

In summary, the value of EPIC is threefold: start-ups gain crucial resources to accelerate their growth; partners gain valuable market insights while investing in the future; and ESA is empowered to advance the entire ecosystem. Through EPIC and its strategic partnerships, the space sector is entering a new era of growth, driven by collaboration and shared expertise. As the space economy continues to evolve, these partnerships will provide the forward-thinking solutions that shape the future of space technology on Earth and beyond.

As start-ups and partners develop and succeed, they contribute to the growth of the entire ecosystem, ensuring a sustainable, innovative, and globally competitive space sector for years to come.

ESA COMMERCIALISATION NETWORKS





ESA Technology Broker Network

Austria
Belgium
Czech Republic
Denmark
Germany
Hungary
Italy
Luxembourg
Netherlands
Poland
Spain
United Kingdom

ESA Phi-LabNET

Austria
Finland
Ireland
Netherlands
Norway
Poland
Spain
Sweden
Switzerland
United Kingdom

20 YEARS OF ESA BICS: POWERING EUROPE'S SPACE ENTREPRENEURSHIP

Recently, the European Space Agency (ESA) celebrated the 20th anniversary of its Business Incubation Centres (ESA BIC) network. At the time of launching the first ESA BIC at ESTEC, in Noordwijk, The Netherlands, the idea of space entrepreneurship was still in its infancy. The space sector was largely dominated by established system integrators, aerospace giants, and public research institutions. The concept of small, agile start-ups entering the highly regulated and capital-intensive world of space seemed improbable to many. Yet two decades later, the ESA BIC network has grown into one of Europe's largest and most successful incubation initiatives, nurturing thousands of start-ups and becoming a cornerstone of the European New Space Economy.
As ESA BICs mark their 20th anniversary, it is worth reflecting on their evolution, the many milestones reached, and their role in shaping Europe's competitive edge in space innovation.

FROM TECHNOLOGY TRANSFER TO ENTREPRENEURSHIP

The ESA BICs were initially designed as a technology transfer initiative. The idea was simple: leverage ESA's investments in cutting-edge space technologies and make them available to entrepreneurs for non-space applications. Materials, robotics, sensor technologies, developed for space missions all had clear potential in other industries. Soon, downstream applications were added to the mix, i.e. data derived from satellite infrastructure, i.e. positioning and earth observation data. ESA BIC start-ups were spanning commercial space applications from hardware to software, and spanning industries like agriculture, logistics, energy, and health.

Niels Eldering, Head of ESA Entrepreneurship and Business Incubation Section
Inês Plácido, ESA BIC Network Coordinator

This early model positioned the ESA BICs primarily as a gateway between the space domain and terrestrial markets. Entrepreneurs apply with business ideas that use space technologies to solve everyday problems. Support includes non-equity funding, access to ESA, as well local technical and business expertise, including links to regional development funds. Importantly, ESA BICs are never stand-alone endeavours; they are designed as multi-sponsored incubators. Local governments, development agencies, and private stakeholders co-fund and co-manage the centres, ensuring that both European and regional priorities are addressed.
In recent years, the number of start-ups working on the upstream side of space, i.e., rockets, satellites, and in-orbit infrastructure, has grown rapidly, increasing from a few percentages to almost a quarter of all start-ups currently selected by ESA BICs. This increase is in line with the global trend of the New Space Economy, where entrepreneurial ventures are taking on roles once reserved for large aerospace corporations.

A GROWING AND IMPACTFUL EUROPEAN NETWORK

What began as a handful of centres has grown into a truly pan-European network. Today, 36 ESA BICs operate across Europe, with more than 230 start-ups supported each year and a cumulative total of over 2000 start-ups nurtured to date. These numbers reflect not only steady expansion but also the rising ambition of entrepreneurs in joining the New Space Economy.
The programme's impact is visible across the continent: ESA BIC start-ups are active in both downstream applications and upstream activities including launch

The wider ScaleUp team.

services, spacecraft technologies, and orbital infrastructure. This dual focus has helped balance Europe's space innovation landscape, ensuring that the benefits of space extend beyond the traditional aerospace industry. The last few years highlight just how much ESA BICs contribute to Europe's economy and innovation capacity. According to a recent study with 792 respondents from the ESA BIC Network, in 2024 alone, ESA BIC companies generated €321+ million in revenues, raised €394+ million of private investment, and created and sustained 6372+ full-time jobs. During the period 2020-2024, more than €1.64 billion of private investment has been raised, and more than 766 patents were granted. Perhaps most importantly, alumni report a remarkable 9.2 out of 10 satisfaction rating, which is a strong endorsement of the value of the programme.

BUILDING ECOSYSTEMS AND PARTNERSHIPS

Over two decades, ESA BICs have incubated companies that are now part of an international space ecosystem. Examples include:

- ISAR Aerospace (Germany) – developing cost-efficient launch solutions.
- D-Orbit (Italy) – a pioneer in in-orbit services and logistics.
- Unseenlabs (France) – a global leader in maritime surveillance from space.
- Open Cosmos (UK) – providing end-to-end satellite missions.
- ClearSpace (Switzerland) – tackling orbital debris removal.
- The Exploration Company (Germany) – working toward reusable spacecraft for human and cargo missions.

These success examples demonstrate how ESA BICs can transform early-stage ideas into companies competing on the global stage.

Furthermore, the ESA BICs don't operate in isolation. They form part of a larger ecosystem of partnerships designed to strengthen Europe's innovation base. For example, the ESA Partnership Initiative for Commercialisation (EPIC) connects start-ups with established industrial and institutional partners -domestic and abroad-, creating opportunities for collaboration, tailored business support and access to international customers.

Equally notable is ESA's longstanding collaboration with business schools, such as CEMS, The Global Alliance in Management Education. These collaborations link the space sector with top management schools worldwide. Over 20 years of cooperation have produced dozens of projects and helped prepare a new generation of managers capable of bridging the gap between engineering and business innovation.

LOOKING AHEAD

The global space economy is expanding at unprecedented speed, with new opportunities emerging in areas such as human spaceflight, in-space manufacturing, space resources, and orbital infrastructure. For Europe to stay competitive, it must not only excel in engineering but also in business innovation and ecosystem building.

ESA BICs will continue to play their pivotal role in this future. They provide a platform for entrepreneurs to experiment, grow, and scale, while also serving as gateways for private investors, regional policymakers, and established space companies to engage with Europe's most promising innovators. The ESA BIC model will continue to evolve, to remain relevant and essential for addressing varied challenges facing space entrepreneurs today as the industry goes through radical transformation. After 20 years, the mission of ESA BICs remains both simple and ambitious: to turn bold ideas into thriving businesses and to ensure that Europe has a strong, entrepreneurial presence in the global space economy.

THE ESA BIC TEAMS

ESA BIC ANDALUSIA

ESA BIC Andalusia is led by CATEC and powered by a strong public alliance between the Spanish Space Agency (AEE), the Regional Government of Andalusia, and the City of Seville.

ESA BIC AUSTRIA

ESA BIC Austria, run by Science Park Graz, helps visionary founders turn space tech into real-world impact. With expert guidance, strong networks, and a passion for innovation, it is where ideas take off.

ESA BIC BAVARIA

ESA BIC Bavaria, managed by Anwendungszentrum GmbH Oberpfaffenhofen, has 5 locations across the region and has fostered so far the creation of more than 250 start-ups and over 5,000 jobs in over 20 years.

ESA BIC BADEN-WÜRTTEMBERG

ESA BIC Baden-Württemberg is managed by a consortium of IHK Reutlingen and CESAH as prime. The ESA BIC is a driver for tangible changes in agriculture and forestry, social responsibility, New Space and mobility.

ESA BIC BARCELONA

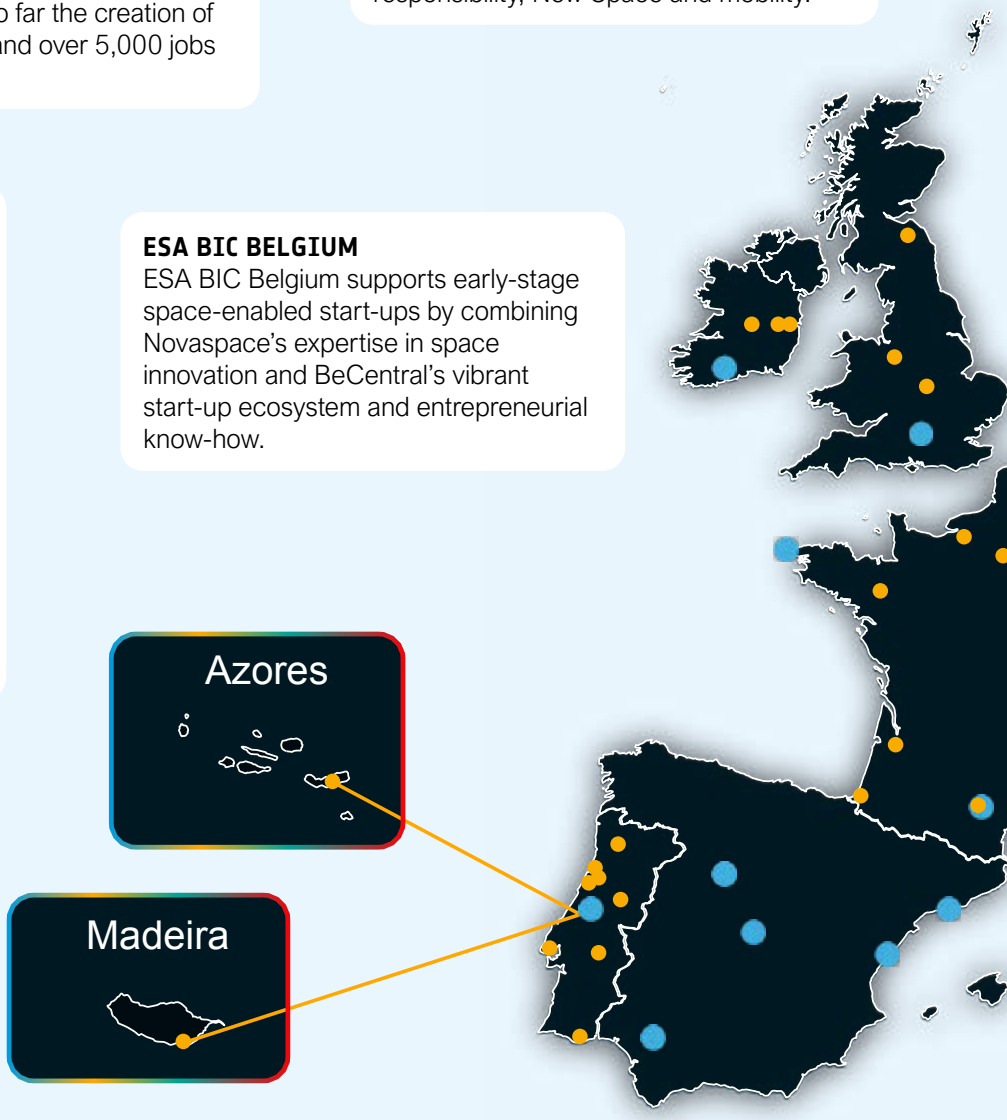
ESA BIC Barcelona, managed by Parc Mediterrani de la Tecnologia, helps transform space technologies into viable businesses that generate impact in Earth Observation, telecommunications and beyond, aligned with European, national and Catalan strategy.

ESA BIC BELGIUM

ESA BIC Belgium supports early-stage space-enabled start-ups by combining Novaspace's expertise in space innovation and BeCentral's vibrant start-up ecosystem and entrepreneurial know-how.

ESA BIC CASTILLA Y LEÓN

ESA BIC Castilla y León, operated by Instituto para la Competitividad Empresarial (ICE) de Castilla y León, accelerates start-ups with the support of 50+ strategic partners and institutions linked to aerospace and other disruptive technologies.



ESA BIC FINLAND
Established in 2017 and led by the Aalto University Foundation, ESA BIC Finland's connections and networks help deep tech startups to leverage their potential in space.

ESA BIC DENMARK
As part of the Danish ecosystem for deep tech start-ups and led by the Technical University of Denmark (DTU), ESA BIC Denmark connects start-ups and the relevant stakeholders, to trigger innovation, collaboration, funding and growth of space start-ups.

ESA BIC LITHUANIA
ESA BIC Lithuania is coordinated by Visoriai Information Technology Park since 2023. It has so far supported start-ups in areas such as software and satellite data, photonics, mechatronics, propulsion and life sciences.

ESA BIC HUNGARY
ESA BIC Hungary is operated by Design Terminal and integrates national and regional space activities and builds bridges between early-stage ventures, talent networks, and key innovation initiatives.

ESA BIC HESSEN
Managed by CESAH and situated adjacent to the European Space Operations Centre (ESOC), ESA BIC Hessen provides incubatees and alumni with workshops, networking and showcase opportunities.

ESA BIC GREECE
Led by Corallia, ESA BIC Greece acts as a hub and catalyst for space entrepreneurship in Southeastern Europe. Since 2021, it has helped increase the number of Greek space companies by 50%.

THE ESA BIC TEAMS

ESA BIC IRELAND

ESA BIC Ireland is headquartered in the Tyndall National Institute, and it is an integral component within Ireland's space ecosystem. It collaborates with the Irish Space Association and the Space Industry Skillnet to support space upstream and downstream start-up activities.

ESA BIC NOORDWIJK

ESA BIC Noordwijk was the very first ESA Business Incubation Centre in the network. Managed by SBIC, it pioneers the way for innovation and entrepreneurship in the space sector. The diversity of their start-ups is a major driver for incubation.

ESA BIC NORTH RHINE-WESTPHALIA

ESA BIC North Rhine-Westphalia, managed by EurA AG, supports visionary start-ups shaping the future of space, from Earth Observation and satellite navigation to the lunar economy and human spaceflight.

ESA BIC NORD FRANCE

Anchored in Northern France's maritime culture with the spirit of the sea – bold, collaborative, and forward-looking – ESA BIC Nord France, coordinated by Ouest BIC Technopoles, nurtures entrepreneurs exploring new frontiers in space and on Earth.

ESA BIC NORTHERN GERMANY

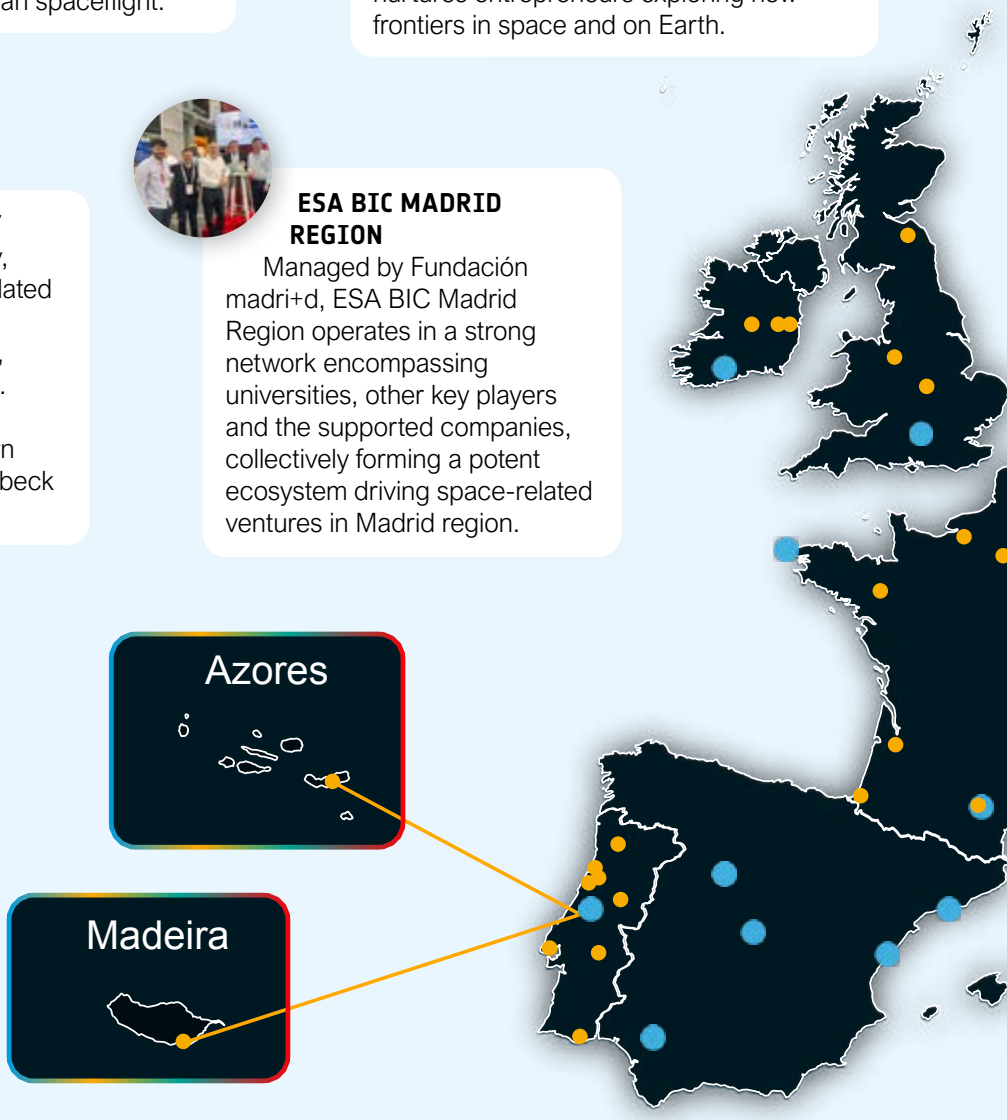
The ESA BIC Northern Germany, based in Bremen, fosters space-related start-ups across northern Germany, including Bremen, Schleswig-Holstein, and Mecklenburg-Western Pomerania. AVIASPACE BREMEN, AZO and BAB Bremen manage the ESA BIC Northern Germany together with Gateway49 Lübeck and Innovationport Wismar.

ESA BIC MADRID REGION

Managed by Fundación madri+d, ESA BIC Madrid Region operates in a strong network encompassing universities, other key players and the supported companies, collectively forming a potent ecosystem driving space-related ventures in Madrid region.

ESA BIC PORTUGAL

ESA BIC Portugal, managed by IPN, empowers start-ups that leverage space technologies and data to develop solutions for space and terrestrial markets. Since 2014, it supported 69 start-ups that achieved over €6.5 million in sales (2024) and raised over €26 million in investment.



ESA BIC NORWAY

Led by Kjeller Innovasjon, ESA BIC Norway is the national incubator for space-related business ideas and start-ups, a collective effort fosters innovation and supports entrepreneurs across diverse sectors, driving technological progress and start-up success throughout Norway.

ESA BIC SWEDEN

ESA BIC Sweden, managed by Arctic Business, helps bold ideas lift off and thrive in the space industry. Since its launch 10 years ago, ESA BIC Sweden selected nearly 70 innovative space-related business ideas and delivered tailored support and funding.

ESA BIC POLAND

ESA BIC Poland's aim is to create and strengthen the community of successful space related start-ups in Poland. Managed by the Industrial Development Agency JSC, ESA BIC Poland provides start-ups with the resources and support needed for commercial success.

ESA BIC LATVIA

ESA BIC Latvia, run by Commercialisation Reactor, focuses on science-first deep tech ventures. Backed by universities, investors, and partners, it is designed as a launchpad for bold new founders.

ESA BIC LAZIO

ESA BIC Lazio, operated by LazioInnova, benefits from its proximity to ESA's ESRIN site and strong Earth Observation heritage. With over 60 startups supported, it is expanding into commercialisation of the upstream sector.

ESA BIC MILAN

Powered by Politecnico di Milano and driven by the city's entrepreneurial spirit, ESA BIC Milan offers a captivating ecosystem that beckons space tech start-ups to embark on an extraordinary journey of exploration and growth.

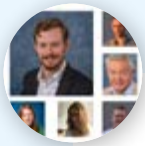
THE ESA BIC TEAMS

ESA BIC TURIN

ESA BIC Turin is a thriving hub for upstream and downstream space innovation. Run by I3P and backed by top-tier academic, institutional and industrial partners, ESA BIC Turin helps transform cutting-edge projects into market-ready ventures.

ESRIC

The European Space Resources Innovation Centre is an initiative of the Luxembourg Space Agency (LSA) and the Luxembourg Institute of Science and Technology (LIST) in strategic partnership with ESA, dedicated to space resources.



ESA BIC UNITED KINGDOM

ESA BIC United Kingdom, managed by STFC, helps entrepreneurs grow the industries of the future. It operates across four UK sites and is STFC's flagship deep tech incubation programme.

ESA BIC VALENCIA REGION

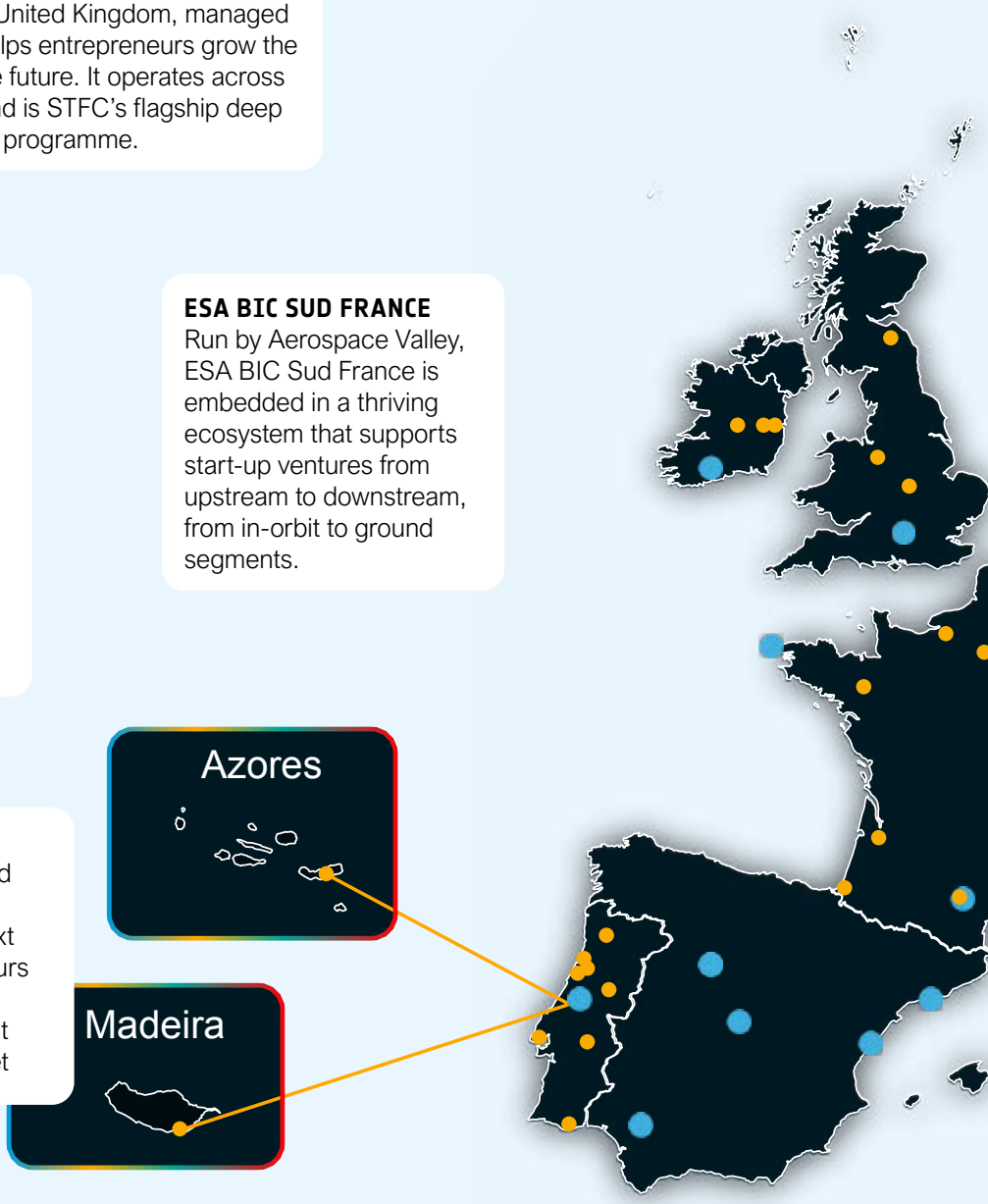
ESA BIC Valencia Region is operated by Aeroport Castelló and offers a fully tailored incubation programme combining hands-on support, flexible funding and a strong regional ecosystem to help space entrepreneurs grow with purpose and global ambition.

ESA BIC SUD FRANCE

Run by Aerospace Valley, ESA BIC Sud France is embedded in a thriving ecosystem that supports start-up ventures from upstream to downstream, from in-orbit to ground segments.

ESA BIC BRINDISI

ESA BIC Brindisi, managed by Distretto Tecnologico Aerospaziale, empowers the next generation of space entrepreneurs by leveraging a solid industrial and scientific network to support founders from concept to market

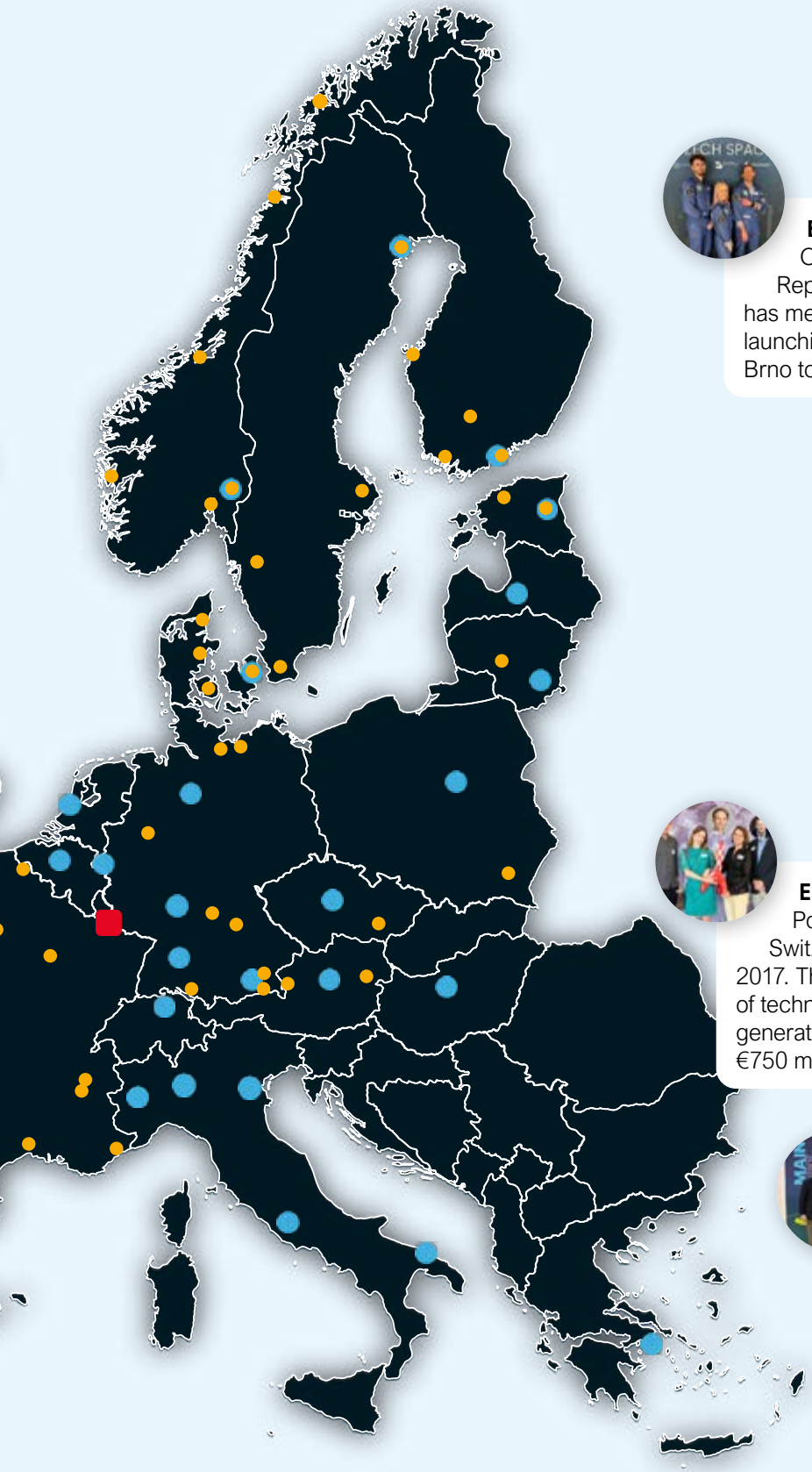


ESA BIC ESTONIA

Backed by a strong ecosystem, ESA BIC Estonia turns ambitious ideas into real space solutions. Led by Sparkup Tartu Science Park, ESA BIC Estonia start-ups tackle global challenges with deep-tech innovation.

ESA BIC CZECH REPUBLIC

Operated by CzechInvest, ESA BIC Czech Republic is where cutting-edge space tech has met legendary Czech ingenuity since 2016, launching innovative start-ups from Prague and Brno to the stars and beyond.



ESA BIC SLOVAKIA

Driven by a powerhouse consortium, the East Slovak Space Cluster, the Slovak University of Technology in Bratislava, and the University of Žilina, ESA BIC Slovakia has officially launched in 2025 to fuel bold ideas, empower space-driven start-ups, and boost Slovakia's competitiveness.

ESA BIC SWITZERLAND

Powered by ETH Zurich, ESA BIC Switzerland supported 87 start-ups since 2017. These start-ups span a diverse range of technologies and backgrounds and have generated over 1,500 high-tech jobs and €750 million in funding.

ESA BIC PADUA

ESA BIC Padua is part of the Italian ESA BIC network. ESA BIC Padua, operated by Officina Stellare, supports start-ups with a hands-on approach: space and commercialisation is our everyday business.

WHAT DO ENTREPRENEURS SAY ABOUT THE ESA BIC PROGRAMME?

ESA BIC BADEN-WÜRTTEMBERG
Thanks for giving me the stage to present at the Space Inspiration event of ESA BIC Baden-Württemberg and for four years of support!
— Sebastian Klaus, CEO, ATMOS Space Cargo

ESA BIC BRINDISI
Being in ESA BIC Brindisi is like having a mindful and skilled parent that guides you and continuously keeps you focused. It is an important support for opportunities in the space sector and mentorship on the start-up mindset.
— Pasquale Castellano, CEO, Dymension Space

ESA BIC CASTILLA Y LEÓN
ESA BIC Castilla y León has given us the opportunity to transform our scientific curiosity into concrete solutions, to connect with partners across Europe, and to keep pushing the boundaries of what's possible. Our journey from researchers to entrepreneurs is just beginning, and thanks to ESA BIC Castilla y León, we are proving that space technologies can make a real difference on Earth.
— Marco Veneranda, Co-founder, ASTRASPEC

ESA BIC CZECH REPUBLIC
We believe our product can significantly improve the efficiency of private flights around the world. Thanks to the support of ESA BIC Czech Republic, we were able to take our idea to the next level and gain valuable contacts in the aviation industry.
— Mark Wagner, Founder, Strafos

ESA BIC DENMARK
The ESA BIC incubation program in Denmark has been instrumental in supporting our progress. Through the ESA BIC, we established a critical partnership which enabled us to manufacture a refined and market-ready product.
— Elham Amiri, Founder and Director, QASE Tech

ESA BIC ESTONIA
The ESA BIC Estonia program opened doors for us to engage with top experts in the field and provided essential support to integrate our system with space communication.
— Henry Härm, CEO, Wayren

ESA BIC FINLAND
We decided to apply to ESA BIC Finland due to the high-quality reputation of the program. Since we are using satellite data, we wanted to gain expertise and knowledge and utilise their wide network.
— Samuli Junttila, Chief Scientist, KOKO Forest

ESA BIC GREECE
Our incubation journey with ESA BIC Greece has been transformative and the support we received was instrumental to our growth. The relationships we built with the team were exceptional, marked by trust and collaboration.
— Paulo Fioravanti, CEO, Circuits Integrated Hellas

ESA BIC HESSEN
The ESA BIC Hessen incubation really helped us move forward – especially through the great network and solid support along the way. For us, the biggest benefit was being part of an ecosystem that opened doors.
— Alexander von Breitenbach, CEO, Agrario Energy

ESA BIC HUNGARY
I encourage my fellow space researchers to consider applying to ESA BIC Hungary. The program provides excellent support in transforming scientific results into practical applications, helping to fulfil the mission of making 'space for everyone'!
— Zsuzsanna Benyó, CEO, SpaceABC

ESA BIC LAZIO
The incubation process at ESA BIC Lazio has been key in turning a space-based idea into a concrete solution for the terrestrial market, strengthening our business model and enhancing our expertise in space tech applied to the innovation of water resource management.
— Enrico Schiesaro, CSO, Neptune

ESA BIC MILAN
Being part of ESA BIC Milan has been a key milestone in the growth of SunCubes. The mentorship helped us define a clear go-to-market strategy and identify the most promising verticals for our technology. Access to Politecnico di Milano's facilities allowed us to rapidly move from prototyping to real testing, and the financial support provided that crucial boost needed to turn our vision into a tangible product.
— Alberto Chiozzi, Co-founder and CEO, SunCubes

ESA BIC NOORDWIJK
When you have the confidence in your vision and work hard to bring it to life, ESA BIC Noordwijk is a unique opportunity to propel your space-related project to success. You have the potential, so seize this opportunity and move forward with determination!
— Thomas Kaakeh, CEO, Terraprisma

ESA BIC NORD FRANCE
ESA BIC Nord France is a key player in the French space ecosystem, and obtaining its "label" was a true mark of credibility that allowed us to become part of it in turn.
— Guillaume Mohara, CEO, Arc Spac

ESA BIC NORTHERN GERMANY
It is incredibly helpful for a start-up to be in this incubation programme. From practical things like office spaces to workshops, coaching and invaluable contacts, the ESA BIC has been a great kickstart for us. It is not just the funding; it is an entire ecosystem of support.
— Alexander Epp, Co-Founder and Chief Business Development Officer, Marble Imaging

ESA BIC NORWAY
ESA BIC Norway has been a valuable contributor in accelerating our journey. Their support has helped us navigate the ESA ecosystem, identify the right resources, and access key funding opportunities. We consider ESA BIC a close partner and a valued member of the broader team that supported the launch of our first product: a non-pressurised EVA training suit.
— Christoffer Bauer Andreassen, Co-Founder and CEO, Nåva Space

ESA BIC POLAND
The most significant [support] was in obtaining approvals and licenses for the Ariane 6 launch. Thanks to the support of the ESA BIC Poland team, we could consult industry experts about the process and identify the best strategy for their mission. Besides that, we also received immense support from patent attorneys collaborating with the ESA BIC and networking opportunities at the events organised by the Incubator.
— Jakub Stojek, CEO, Orbital Matter

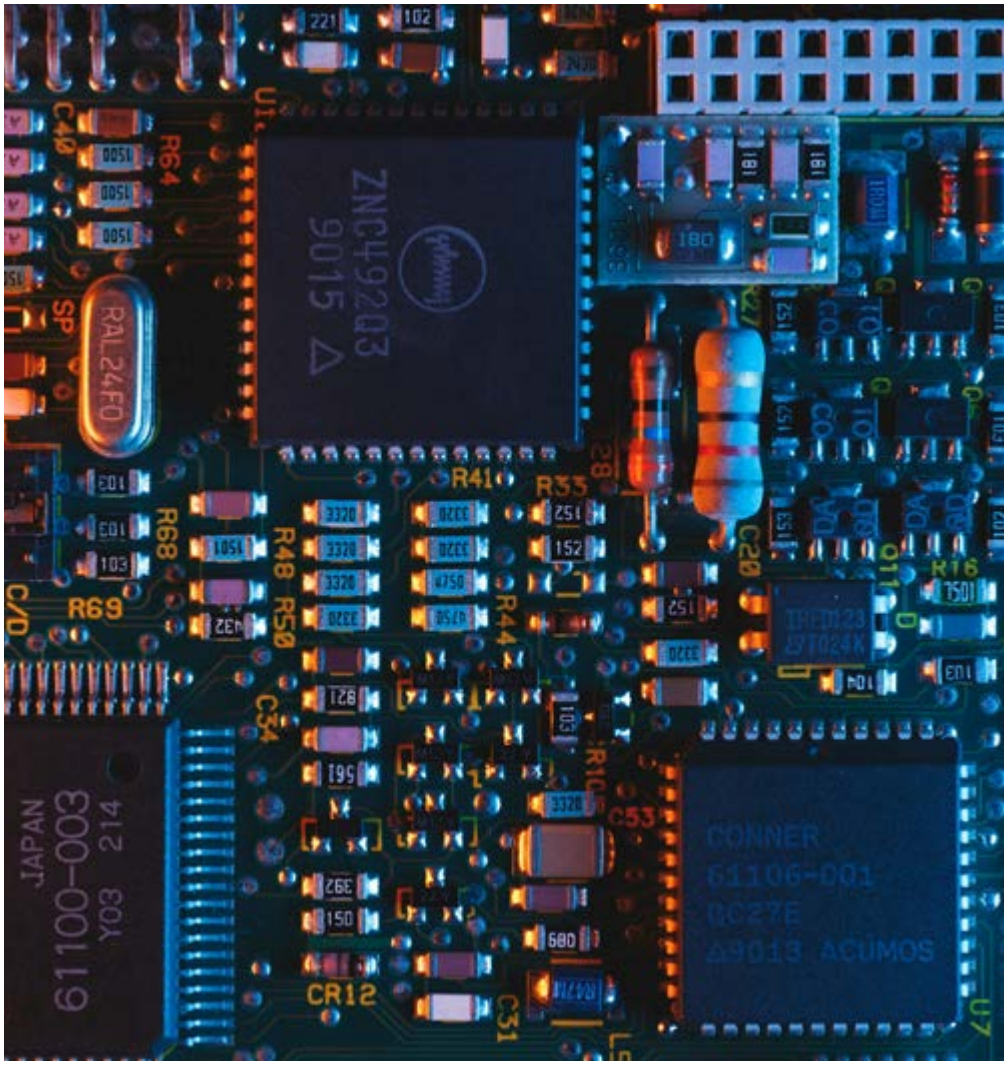
ESA BIC PORTUGAL
Thanks to ESA BIC Portugal, we turned an ambitious prototype into a tested product with real market traction. The access to expert mentorship and networking across Europe was game-changing.
— Tiago Morais, Co-founder, VirtuaCrop

ESA BIC SWEDEN
ESA BIC Sweden provided important support to us in the early stages of Hydromars. With help from ESA experts, access to lab space, and useful connections, we were able to move our work forward more quickly. The program also helped us build our first space-ready payload, which is scheduled for microgravity testing in summer 2025. Being part of ESA BIC Sweden gave us practical tools and recognition when we needed them most.
— Shorena Tsindeliani, CEO and Co-founder, Hydromars

ESA BIC SWITZERLAND
Partnering with ESA validated our technology at the highest standard. It is inspiring to see Swiss innovation move from the lab to orbit.
— Amaël Cohades, CEO and Co-founder, CompPair

ESA BIC TURIN
ESA BIC Turin was a true game-changer for us. The support we received - from funding and expert mentoring to strategic industry connections - helped turn our space technology into a real-world solution. We are especially grateful to the incredibly dedicated ESA BIC team and the program director, whose guidance, vision, and unwavering support made all the difference in our journey.
— Volodymyr Usov, CEO, Kurs Orbital

BRIDGING WORLDS: 35 YEARS OF ESA'S TECHNOLOGY TRANSFER SUCCESS



INTRODUCTION

Technology transfer is a rather unique activity within ESA – taking technologies developed for space and using them to solve challenges back on Earth. There is frequently a terrestrial – space – terrestrial route taken. Firstly, a technology is developed and then adapted and improved such that it can handle the harsh environment of space. It is these adaptions that then add great value when the technology is re-applied back on Earth. However, to ensure that such value is returned to the terrestrial markets, it was identified that ESA needed to play an active role and so the ESA Technology Transfer Programme was created in 1990. Back then, I believe that those who created the programme would have struggled to anticipate the growth and impact that this tiny (in the scale of space activities) programme would go on to achieve over the course of the next 35 years.

WHY SPACE TECHNOLOGY?

Space technology is a broad term and encompasses many different domains including hardware and software, ranging from materials to electronics, and can come in the form of patents, copyright, and secret know-how.

Whilst broad ranging there are several traits that these technologies have in common:

- Resistant to the wide temperature ranges, radiation exposure, and vacuum conditions faced by components whilst in space
- Miniaturisation and mass reduction to ensure launch costs are minimised
- High reliability as satellites need to operate for multiple years – even decades – without any servicing or intervention from engineers.

When applied back on Earth, these traits can give companies a credible competitive advantage, especially in markets where reliability and performance matter.

THE ROLE OF THE ESA TECHNOLOGY BROKERS

The establishment of a network of ESA Technology Brokers was one of the initial activities initiated under the Technology Transfer Programme and was originally named SpaceLink.

SPACELINK

Below, ESA Technology Brokers Johannes Schmidt (Germany) and Stefano Carosio (Italy) explain their role, how they operate, and the challenges faced on a daily basis.

Their involvement with the ESA Technology Broker Network dates to the 1990s so they have a vast array of experience to draw upon.

Q) Can you briefly describe the mission of the ESA Technology Brokers and the unique role that they play within the ESA commercialisation ecosystem?

Stefano Carosio (SC): The network of ESA Technology Brokers is an essential part of the broader commercialisation ecosystem, helping us engage with a wide range of industries and experts. This collaboration strengthens the preparation of technologies and companies for the transfer process, going beyond simple matchmaking to support the pre-commercial development stages. This ensures that all stakeholders are aligned, and the conditions for effective collaboration are established early on.

Stefano Carosio

As an engineering and innovation consultancy, our work as an ESA Technology Broker is grounded in a structured, cross-disciplinary problem-solving approach. We use systems engineering tools to break down industrial challenges into their functional components, abstracting them from the original sector and matching them with enabling technologies. This methodology is particularly effective in early innovation phases, supporting both spin-off and spin-in dynamics. It reflects the systems-level thinking characteristic of space programs, which increasingly mirror terrestrial product development in complexity and integration.

Johannes Schmidt (JS): Overall, the technology broker acts as a catalyst to the mutual advantage of the parties involved, whose neutrality is assured to the respective negotiating partners. Successful technology transfer initially takes place in the minds of

Johannes Schmidt

the people involved on the provider, receiver, and broker sides. The latter provide the impetus for lateral thinking processes, which then give rise to innovation projects for new manufacturing processes or products.
Personal mediation is particularly important here, as technology transfer requires mutual trust between the people involved, who usually do not know each other beforehand. The ESA Technology Broker's task is to awaken similar interests on the supplier and recipient sides for new products and business areas that had previously not been specifically considered by either the provider or the recipient.

Q) Can you walk us through the typical technology transfer process – from identifying a space technology to adapting it for commercial use on Earth?

JS: Whilst each technology transfer is unique there are a broad-based and targeted set of instruments used to facilitate and support transfer activities. These instruments primarily consist of the synergistic, bidirectional approaches of "technology push" and "market pull." These include compiling a list of space technologies deemed transferable and subsequently searching for potential customers, as well as identifying specific technological demands from industry and then searching for suitable solutions in the space sector. The "technology push" and "market pull" mediation tools were developed in the mid-1990s and have been used very successfully ever since.

Overview of technology push and market pull approach

For "technology push", the ESA Technology Broker will contact a prospective technology provider and the potential for exploitation outside the aerospace sector is assessed using the following main criteria:

- How suitable is the technology for transfer? Is it applicable to diverse or only niche applications?
- What is the cost of the technology and the provider's price point? Is it market driven, high but flexible, or high but inflexible?
- What stage of development is the technology at? Is it at idea/concept, prototype, or product stage?
- How novel is the technology? Is it cutting edge, state of the art, or obsolete?
- What is the status of the exploitation rights? Is it patented, protected in another form, or unprotected?

In addition to these technology-specific criteria, three further criteria are examined which are decisive prerequisites for marketing through technology transfer activities:

- How interested and engaged is the technology provider in marketing the technology?
- What is the quality of the information provided about the technology?
- How willing is the technology provider to engage with potential customers.

For "market pull", the ESA Technology Broker will work with a company that has a specific problem and is looking for a solution. The specific market requirements are determined using a technology requirements questionnaire, which has been adapted over the years to reflect changing needs and knowledge. This questionnaire collects information such as the current problem, what technologies are currently used, any technical or physical limitations, as well as business aspects such as the type of cooperation that is desired. These are all systematically recorded so that it can be presented in anonymised form to experts in the space industry and, at a later stage, targeted contacts can be established:

Incoming solution proposals from the space industry are analysed in three main ways before being forwarded to the contact person in the company with the technology need. These are:

- Is there a basic technical suitability?
- Is there a credible connection to space in the development?
- Is it compatible with the type of solution sought.

Taking the last point into account has proven very successful as it helps avoid irritation and misunderstandings on all sides. For example, it avoids engineering or research services being offered when market-ready or near-market solutions were expressly requested.

Since there is often a gap between the technology offered and the technology required that needs to be closed through adaptation, the technology provider offers assistance on how to proceed in such cases. If the technology provider and the recipient do not have suitable R&D capacities, they are referred to institutes or companies that can carry out such development, or cooperation partners are sought who wish to participate in the exploitation process themselves. In addition, many ESA Technology Brokers also offer ESA Spark Funding. This modest amount of funding helps foster buy-in from both parties and works to accelerate the product development process.

SC: I started my career as an ESA Technology Broker back in 1996, at a time when ESA sent thousands of physical copies of the ESA Transferable European Space Technology (TEST) catalogue across Member States. The goal was to generate interest from large and small companies in non-space sectors, encouraging them to request more information on specific technologies via postcards. I'm talking about old-school hardware mail! Then, we would send technology dossiers, either by fax or mail, provided by the space companies. These companies would sign a commercialisation agreement with us to outline licensing or further development with third parties. Through physical meetings and profitable interactions, we eventually reached the signature of technology transfer agreements. For instance, I remember the long negotiations between several parties when we supported the use of space technology to the development of the McLaren F1 mechanics' cooling suits, to provide comfortable working conditions in stressful, high-temperature situations.

The process of technology transfer today has evolved, but the core approach remains similar. It starts with proactive outreach to identify emerging needs and opportunities. We organise events in collaboration with industry associations, technological clusters, and national networks, leveraging their reach to maximise effectiveness. We also use digital campaigns and social media to cast a wider net and attract stakeholders who may not usually interact with the space industry. This combination allows us to create a funnel of qualified contacts, from which potential requests and collaborations emerge.
As mentioned earlier, once a specific case is identified, we apply a structured methodology for functional problem decomposition, which helps us search for solutions not by sector, but by function. This proactive approach opens up a much wider technological spectrum, allowing us to find surprising and high-impact matches.

Q) Which of the technology transfer projects that you have been involved with are you most proud of and why?

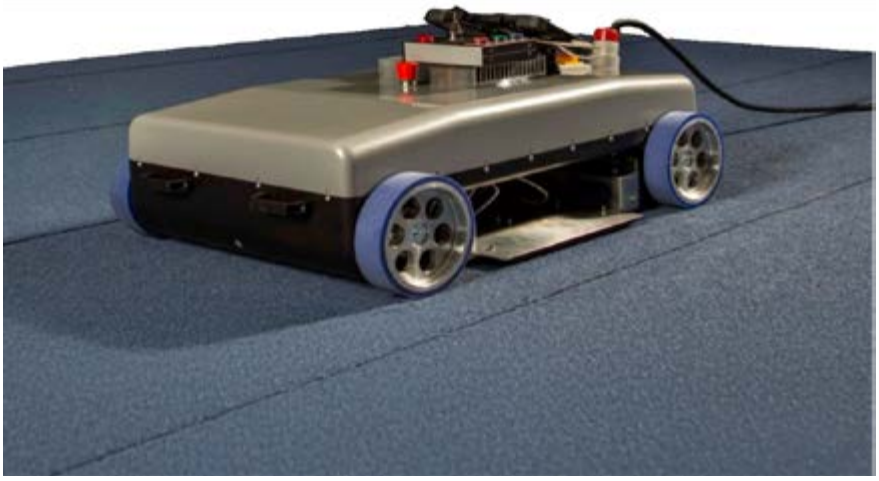
JS: I will always remember the transfer with Paralympian Wojtek Czyz. His personal story really moved me, and we were determined to help him. I was the project manager and invested a lot of my free time in addition to my working hours. In the end, it was a huge success with him winning gold at the 2008 Paralympic Games in Beijing - setting a new world record in the process. What made me very happy afterwards was that following his active career, he travelled around the world on a catamaran to help people with leg amputations in poor countries as part of his project sailing4handicap.

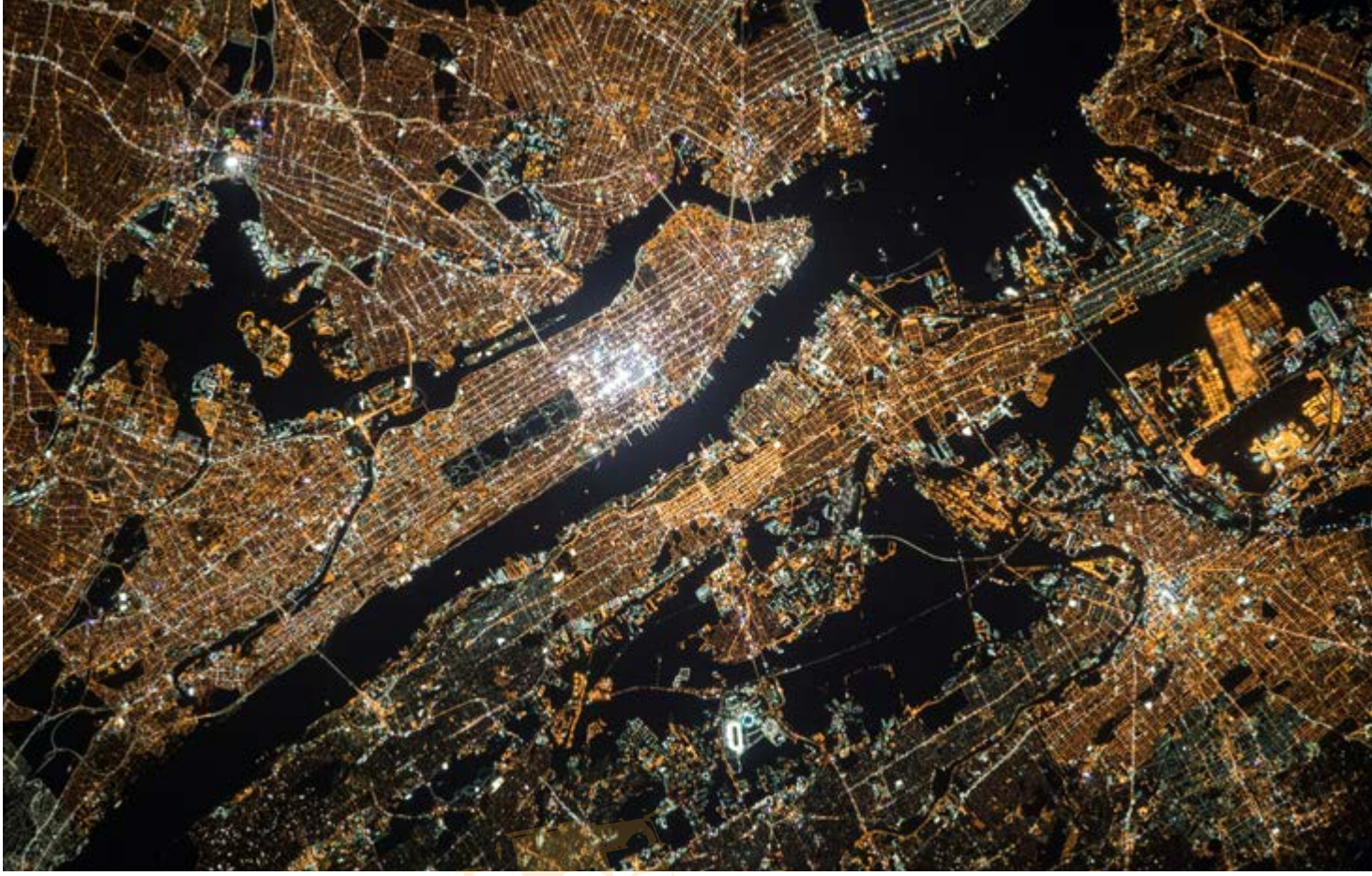
SC: Looking back, I am proud of several projects that have had a meaningful impact. I remember working on a wide variety of cases, such as quality control of textiles using space smart cameras, or the application of space-based shape memory technology to break marble and granite, replacing explosives in quarries. We collaborated with visionary entrepreneurs in Italy and stakeholders like the "Fabbrica del Duomo di Milano" working for centuries to extract the marble needed to preserve this world-wide known piece of cultural heritage, showing how space technologies can be adapted to create solutions in unexpected areas.

As already mentioned, I was involved in the development of a cooling suit for F1 mechanics, leveraging space technology to keep them comfortable in high-stress, high-heat conditions. There is even the tech transfer case of a shirt with self-rolling sleeves using smart materials, a pioneering approach to smart clothing.

The most rewarding part of these projects is seeing how space-derived solutions can address real-world challenges across a wide range of sectors.

One recent example of our work is the collaboration with Artigo, part of Mondo Group, and Inovalab, which led to the application of a space born technology into the sports flooring industry. This technology, which was originally used in the space sector, was repurposed to create a removable sports flooring system. Building on Mondo Group's leading position as key supplier of Olympic tracks, this application has the potential to generate spillover effects in several other sectors, such as hospital or train flooring, where Artigo holds a market leadership position. This project is a relevant example of how an industrial need could be met through a structured and cross-sectoral technological scouting process.





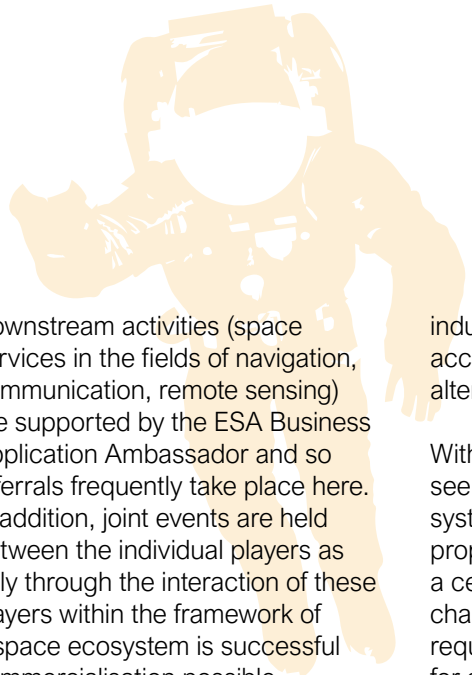
Q) How do you engage with the other ESA Technology Brokers and the wider ESA Commercialisation Network?

SC: ESA Technology Brokers operate within a network of networks, a structured and dynamic ecosystem that includes for instance ESA Business Incubation Centres (ESA BICs), BASS (Business Applications and Space Solutions) Ambassadors, InCubed Ambassadors, BSGN (Business in Space Growth Network) accelerators. These are key support roles within the broader ESA commercialisation family, a constellation of actors working together to connect the space sector with non-space sectors. This architecture connects regional, national, and thematic innovation communities, enabling deep collaboration, specialisation, and strategic alignment across domains and geographies. ESA plays a fundamental role as a trust builder and orchestrator, ensuring coherence across vision, execution, and values. This fosters long-term engagement, builds institutional credibility, and strengthens our collective ability to deliver real-world impact.

“Space technologies will become increasingly prevalent in our everyday lives.”

We collaborate systematically with other ESA Technology Brokers and ESA BICs, especially when interdisciplinary expertise or technical feasibility assessments are required. The ability to use the technologies sourced by all ESA Technology Brokers is very valuable as it provides a much larger pool of potential solutions compared to a single country. We are also currently working in close collaboration with all five ESA BICs in Italy, preparing the organisation of joint events that address shared areas of interest by leveraging complementary business networks and multipliers. For example, the textile sector, an important pillar of the Italian economy, has mobilised several start-ups to tackle challenges related to astronaut suits and flexible energy harvesting solutions. Within this framework, two ESA BICs alumni were recently awarded ESA Spark Funding for technology transfer projects targeting smart textiles.

JS: If the transfer process does not proceed as originally planned because technical or other obstacles appear insurmountable, alternative actions are drawn up in cooperation with the companies concerned in order to ultimately contribute to a successful outcome. In many cases this involves referring them to other members of the ESA Commercialisation Network. In particular, the extent to which the parties involved can derive added value from the ESA BICs or the ESA Business Applications Ambassador will be examined. Young companies (<5 years) are often better suited for incubation at an ESA BIC, where they can develop their business ideas and products in a more structured environment.



Downstream activities (space services in the fields of navigation, communication, remote sensing) are supported by the ESA Business Application Ambassador and so referrals frequently take place here. In addition, joint events are held between the individual players as only through the interaction of these players within the framework of a space ecosystem is successful commercialisation possible.

Q) What emerging technology or market trends do you believe will shape the next wave of tech transfer in the coming years?

JS: In my opinion, space technologies will become increasingly prevalent in our everyday lives. Due to the growing benefits of data from space, social issues such as security, health, nutrition, climate protection and adaptation, and CO2 avoidance will be increasingly influenced. In addition, I see the technology areas of quantum, hybrid materials, communication, monitoring, treatment, and care of people, including demographic change, as very promising.

SC: The future of technology transfer will be shaped by two macro trends. On one side, there is a pressing need to foster "again" the development of enabling technologies as a competitive factor for economies in the future and which are by definition sector-neutral, such as advanced materials or quantum technologies. On the other side, there is an equally urgent need to accelerate innovation to market in order to strengthen competitiveness and to reshore manufacturing and industrial processes while ensuring access to raw materials or develop alternatives.

Within this framework, we see technology transfer as a systemic tool to enable new value propositions, with space playing a central role due to its specific challenges and demanding requirements. The growing pressure for affordable energy will create synergies with emerging sectors such as small and modular nuclear reactors, which share similar challenges in materials development and process control to space.

This convergence extends to the use of digital twins and data-driven approaches, which have the potential to revolutionise product development, including in areas like life sciences, where good simulation practices are becoming an emerging paradigm to accelerate drug development and the knowledge gained in space with accelerated biological processes could be a game changer. Altogether, these emerging domains open up new opportunities for space and technology transfer.

Another important trend will be the integration of sustainability goals into the early stages of technology transfer. There is growing demand, and responsibility, to leverage space technologies not only for efficiency or competitive advantage, but also to contribute to environmental and societal goals such as clean energy, decarbonisation, and circular economies. At the same time, sustainability is becoming a core element of new space developments, including the carbon footprint of missions, debris mitigation, and circular economy approaches for long-term missions. This shift will shape both the problems we address and the solutions we propose.

Regarding broker activities and operational models, we foresee increasing potential in the use of digital platforms powered by artificial intelligence to manage the early stages of technology scouting—commonly referred to as the "fuzzy front end." These tools will enable us to profile hundreds of companies, identify functional needs, and match them with promising solutions. Once interest is generated, brokers will step in to develop the business case, define the technological path forward, and facilitate agreements.

In this context, collaboration between ESA, national delegations, and other stakeholders within the network will be key to driving the next wave of innovation and supporting the growth of the new space economy.

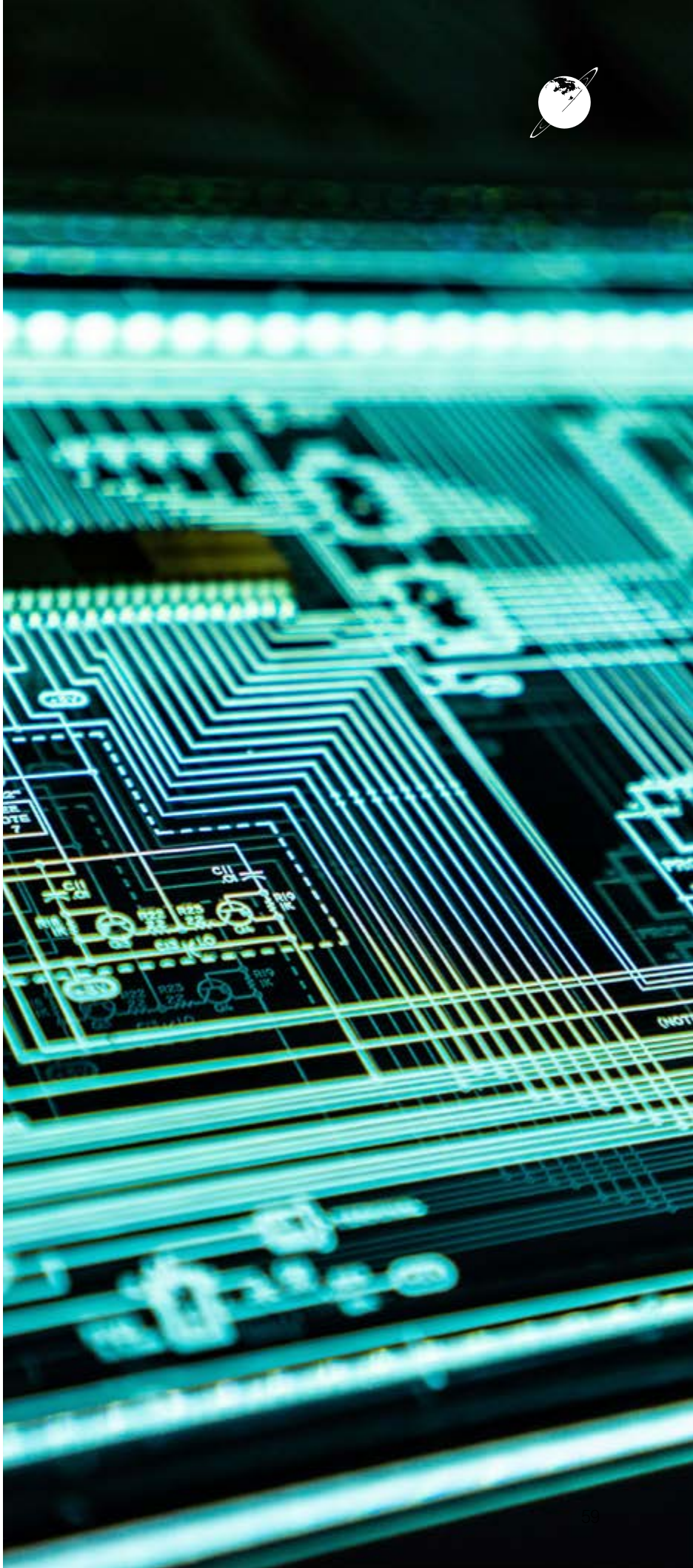
CONCLUSION

35 years is a long-time frame over which innovation occurs. There have been highs, lows, incremental improvements, and huge leaps. During this time, there have been hundreds of people involved, and it is down to these people that we are where we are today. Their drive, dedication, and conviction that space could and should impact the lives of everyone back on Earth is inspirational. As the current custodian of the ESA Technology Brokers I can but quote Sir Isaac Newton: "If I have seen further, it is by standing on the shoulders of giants".

I look forward to seeing where the next 35 years takes us!

Matthew Edwards ESA Technology Broker Network Coordinator Matthew is a Commercialisation Officer at the European Space Agency (ESA), where he also serves as the coordinator of the ESA Technology Broker Network. With more than a decade of experience, he plays a key role in facilitating space-related technology transfers and supporting the development of innovative start-up companies. Matthew's expertise lies in bridging the gap between space research and industry, helping to bring cutting-edge space technologies to market and drive economic growth. His work is instrumental in fostering collaboration between various stakeholders, including researchers, entrepreneurs, and industry leaders.

Matthew Edwards



FROM SPACE TO SKIN: HOW TERRAPLASMA'S SPACE HERITAGE IS TRANSFORMING LIFE ON EARTH

A case study on Terraplasma GmbH supported by the ESA Technology Broker Germany

Gregor Morfil

A COSMIC BEGINNING

Terraplasma GmbH was founded in 2011 as a spin-off from the Max Planck Institute for Extraterrestrial Physics (MPE) in Garching, Germany. The company was co-founded by Prof. Dr. Gregor Morfill, a renowned physicist who served as the director of MPE. The foundation of Terraplasma was built upon decades of research in plasma physics and its applications in space. These plasma crystal laboratories have been operated aboard the International Space Station by more than 30 astro-and-cosmonauts with the current laboratory, PK4, installed in ESA's Columbus module.

Terraplasma's mission is to translate complex plasma science into practical solutions for everyday challenges. With a dedicated team of scientists, engineers, and specialists, Terraplasma focuses on making cold plasma technology accessible for various applications, including medicine, skincare, disinfection, and environmental sustainability.

PHLAS: SPACE SCIENCE MEETS SKINCARE

In collaboration with the European Space Agency (ESA), Terraplasma contributed to the development of PHLAS, an innovative project applying cold plasma to everyday skincare. Designed to combat acne, inflammation, and bacterial skin conditions, PHLAS devices gently disinfect the skin while promoting healing and regeneration—all without chemical additives or invasive methods.

This marks a significant advancement in dermatology, offering consumers a safe, effective skincare solution built on decades of space-grade engineering.

PLASMA CARE®: HEALING CHRONIC WOUNDS

Terraplasma's most recognised healthcare innovation, Plasma Care®, is a CE-certified medical

device used in hospitals and clinics across Europe and recently approved in Brazil. This handheld, non-invasive tool delivers cold plasma directly to wounds, eliminating pathogens—including multi-resistant bacteria—and significantly accelerating healing.

Clinical studies have demonstrated that Plasma Care can reduce wound size by up to 80% in just 30 days, often accompanied by pain relief. For patients with diabetic ulcers, pressure sores, or infected wounds, this represents a medical breakthrough.

PLASMAEGG®: PORTABLE DISINFECTION, ANYWHERE

Expanding beyond clinical environments, Terraplasma collaborated with Kimetec GmbH to develop the PlasmaEgg®—a mobile, cold plasma disinfection chamber. Designed to sanitise objects ranging from lab tools to mobile phones and personal items, the PlasmaEgg achieves thorough decontamination without heat, water, or chemicals.

By disrupting the proteins and DNA of harmful microbes, it offers a sustainable alternative to conventional sterilisation methods in both public and private settings.

TACKLING 'FOREVER CHEMICALS': PFAS IN WATER

In an ambitious environmental initiative, Terraplasma is piloting cold plasma technology to reduce PFAS—toxic 'forever chemicals'—in drinking water. At a test site in Burgkirchen, Germany, engineers are treating water samples with plasma under real-world conditions. Early results offer hope that this approach could one day help purify contaminated water supplies on a global scale.

BRINGING SPACE INNOVATION DOWN TO EARTH

From the sterile interiors of spacecraft to skincare, hospitals, and even water systems, Terraplasma is proving that space technology is not confined to orbit. By translating cold plasma research into practical tools for everyday life, the company stands as a powerful example of how space innovation can enhance health, hygiene, and environmental sustainability here on Earth.

As we continue to explore the universe, companies like Terraplasma ensure that the benefits of space research don't just stay among the stars—they come home with us.

ESA TECHNOLOGY BROKER CASE STUDIES

NEXT-GENERATION PHOTOREACTOR FOR SCALABLE, ON-DEMAND GREEN HYDROGEN

Supported by ESA Technology Broker Austria – Brimatech

COUNTRY
Austria

OVERVIEW
Green hydrogen and hydrogen-based synthetic jet fuels are set to play a pivotal role in the decarbonisation of the aerospace industry. At present, aviation is responsible for over 2.5% of global annual carbon emissions—a figure that is projected to grow without significant technological shifts. While hydrogen is widely regarded as a cornerstone of the future energy system, its uptake in aerospace has been limited by high production costs and complex logistical challenges.

The real issue is not just producing sufficient hydrogen, but in doing so sustainably and at scale. Photocatalytic reactors offer a promising solution. Unlike traditional systems that rely on photovoltaic panels combined with electrolysis, these reactors use sunlight directly to split water molecules—simplifying the process and improving efficiency.

Crucially, photocatalytic hydrogen production can be situated at the point of use, removing the need for extensive transport infrastructure and reducing associated energy losses. The technology also offers advantages in terms of material recyclability and separation efficiency, making it a more cost-effective and scalable alternative to conventional approaches.

With growing interest across sectors and a wide range of emerging applications, photocatalytic reactors could be instrumental in unlocking hydrogen's potential—particularly for high-energy industries like aerospace, where the need for clean, scalable solutions is increasingly urgent.

SPACE APPLICATION
Designed to meet the unique demands of space exploration, the state-of-the-art Redeem Photo-reactor and Flow-Reactor are engineered to operate effectively in microgravity environments. Featuring precise control and adaptable configurations, these systems enable the on-site production of essential compounds such as pharmaceuticals and propellants—crucial for supporting long-duration missions and emerging space-based industries. Their compact design maximises space efficiency while ensuring operational reliability and safety for crewed missions.

TERRESTRIAL APPLICATION
Redeem Solar Technologies is developing a new technology that produces solar hydrogen. It uses channel plate reactors packed with a specially designed photocatalyst and equipped with membrane sheets for immediate hydrogen purification. As part of this project, Redeem, together with Hycenta, RHP, and TU Wien, are exploring the feasibility of using its solar hydrogen reactor and catalyst technology to supply green hydrogen to the aerospace sector.

KEY BENEFITS
- Integrated, All-in-One Design:
  Combines photovoltaic cell, electrolyser, and purification unit into a single compact system operating at ambient temperature—eliminating the need for batteries, converters, or specialised metallurgy.
- Versatile and Adaptive Hydrogen Production:
  Capable of producing green hydrogen from multiple sources—including fresh, waste, and salt water, ammonia, and LOHC—by simply changing the photocatalyst.
- Modular, Scalable, and Redundant:
  The flexible design supports various applications and ensures system reliability through scalable and redundant configurations.
- Custom Catalysts and Space-Grade Engineering:
  Utilises tailored catalysts and reactor design optimised using mechanical simulations, pressure/temperature modelling, and weight reduction techniques developed for satellite systems.
- Precision Manufacturing with Enhanced Efficiency:
  Incorporates advanced channel plates that fulfil a mixing function, manufactured using high-precision aerospace machining for improved chemical reaction performance.

ESA INVOLVEMENT
Redeem Solar Technologies has been supported by the ESA Technology Broker Austria and incubated at ESA BIC Austria.

"Green hydrogen production is a key challenge for mastering the sustainable energy transition – Redeem's technology is extremely promising in that respect," says Dr. Susanne Katzler-Fuchs, CEO of Brimatech (ESA Technology Broker Austria).

BRIDGING SPACE AND MEDICINE USING IMAGING TECHNOLOGY

Supported by ESA Technology Broker Belgium – Verhaert

COUNTRY
Belgium

Overview
Belgian SME Caeleste has been instrumental in advancing imaging sensor technology that serves both space exploration and medical diagnostics. By leveraging expertise in radiation-hardened electronics and high-resolution imaging, the company has developed custom Complementary Metal–Oxide–Semiconductor (CMOS) sensors that meet the stringent demands of both sectors. This dual applicability underscores the symbiotic relationship between space technology and terrestrial healthcare innovations.

SPACE APPLICATION
In the realm of space exploration, electronic components are subjected to extreme conditions, including high levels of radiation that can impair functionality. Caeleste has addressed this challenge by designing radiation-hardened (rad-hard) CMOS image sensors capable of withstanding such harsh environments. These sensors have been successfully deployed in various space missions, ensuring reliable performance in applications like deep-space imaging and particle detection. The company's collaboration with entities such as the European Southern Observatory (ESO) and ESA highlights its pivotal role in advancing space-grade imaging technologies.

TERRESTRIAL APPLICATION
The technological advancements achieved for space applications have been effectively translated into medical imaging solutions. For instance, Caeleste partnered with Carestream Dental to develop a new generation of X-ray sensors tailored for 3D dental imaging, specifically computed tomography (CT) scans. These sensors, benefiting from wafer-scale manufacturing and radiation-hard design, provide high-resolution images essential for accurate diagnostics.
Additionally, Caeleste's expertise in low-noise charge sensing circuits, initially developed for infrared space imaging, has been instrumental in creating advanced sensors for brain-computer interfaces. Collaborating with the Californian medical technology start-up Paradromics, Caeleste contributed to the development of sensors that allow for high-density electrode implantation in the brain without causing thermal damage, thereby enhancing neural signal acquisition.

KEY BENEFITS
- Cross-Sector Innovation: Caeleste's work exemplifies how advancements in space technology can directly benefit medical diagnostics, leading to improved patient outcomes.
- Radiation-Hardened Design: The development of rad-hard sensors ensures reliability in both space missions and medical imaging, where exposure to radiation is a common factor.
- High-Resolution Imaging: The company's sensors provide superior image quality, crucial for detailed analysis in both astronomical observations and medical diagnostics.
- Scalable Manufacturing: Wafer-scale sensor production enables the creation of large-area detectors, reducing costs and improving accessibility for medical applications.
- Enhanced Neural Interfaces: The adaptation of space-grade sensing technology to neural applications paves the way for more effective brain-computer interfaces, with potential benefits for patients with neurological conditions.

ESA INVOLVEMENT
ESA has played a significant role in supporting Caeleste's technological advancements.
Through its Technology Transfer and Patent Office, ESA facilitated Caeleste's participation in a Demonstrator Project aimed at developing radiation-hardened pixels and sensors. ESA's collaboration with Caeleste, alongside support from Verhaert, the ESA Technology Transfer Broker for Belgium, has been crucial in transitioning space-grade imaging technologies to practical medical applications.

PHOTON PRECISION, HUMAN IMPACT: HOW SPACE IMAGING IS GUIDING THE BLIND

Supported by ESA Technology Broker Czech Republic – Technology Centre Prague

COUNTRY
Czech Republic

OVERVIEW
Svarovsky, s.r.o., a leading European manufacturer of white canes for the visually impaired, has collaborated with the Czech Space Research Center to adapt space-grade sensor technology for assistive devices. By integrating Single Photon Avalanche Diode (SPAD) sensors—originally developed for space applications—into white canes, they aim to enhance spatial awareness for blind users through tactile or auditory feedback.

SPACE APPLICATION
The SPAD sensor technology was initially employed in the European Laser Timing project, part of the ESA Atomic Clock Ensemble in Space (ACES) experiment. In this context, SPAD sensors detect the precise moment a photon, emitted by a laser, impacts the sensor. This high-resolution timing capability allows for extremely accurate distance measurements, essential for various space research applications.

TERRESTRIAL APPLICATION
Leveraging the precision of SPAD sensors, Svarovsky, s.r.o. has developed a device that can be integrated into the handle of a white cane. This device enables users to perceive their surroundings through acoustic signals or vibrations, thereby improving their ability to navigate environments safely and independently.

KEY BENEFITS
- Enhanced Spatial Awareness: Provides real-time feedback to users about their immediate environment.
- Improved Safety: Helps users detect obstacles and navigate more securely.
- Space-to-Earth Technology Transfer: Demonstrates the practical application of space-developed technologies in everyday life.
- Support for the Visually Impaired: Offers a significant improvement in the quality of life for blind individuals.

ESA INVOLVEMENT
The project was identified and supported by the Technology Centre Prague, the ESA Technology Broker for Czech Republic. It received €60,000 in funding from the ESA Spark Funding programme, facilitating the adaptation of SPAD sensor technology from space research to the assistive device for the visually impaired.

MICROBE-FREE FARMING: HOW SPACE TECH IS FEEDING CITIES

Supported by ESA Technology Broker Germany – Eura and Cesah

COUNTRY
Germany

OVERVIEW
AGXX is an innovative antimicrobial coating technology developed by Heraeus Precious Metals. Originally designed to maintain sterile environments aboard the International Space Station (ISS), AGXX has now been adapted for terrestrial use in vertical farming systems. This technology offers a sustainable solution to microbial contamination, enhancing food safety and crop yields in urban agriculture.

SPACE APPLICATION
In the confined and sensitive environment of the ISS, controlling microbial growth is crucial. AGXX was developed to prevent microorganisms from attaching to surfaces, thereby maintaining sterility and reducing the need for frequent disinfection. Unlike conventional antimicrobial technologies that release metal ions, AGXX operates through a redox reaction and microelectric field effects, ensuring long-lasting efficacy without harmful emissions

TERRESTRIAL APPLICATION
The AGXX technology has been successfully integrated into vertical farming modules by the German company Aponix. These modules, made from high-performance plastic (PA6), benefit from AGXX's antimicrobial properties, which protect against bacteria, viruses, and biofilm formation. Field trials conducted by the University of Geisenheim are assessing the impact of AGXX on plant germination, development, and overall growth, aiming to enhance hygiene and efficiency in urban farming practices.

KEY BENEFITS
- Broad-Spectrum Antimicrobial Action: Effective against over 130 microorganisms, including silver-resistant E. coli strains.
- Sustainable Mechanism: Operates without releasing harmful substances, relying on a catalytic reaction and microelectric fields.
- Long-Lasting Protection: Demonstrates high chemical and thermal resistance, ensuring durability in various applications.
- Enhanced Food Safety: Reduces microbial contamination in vertical farming, contributing to safer food production.
- Regulatory Compliance: Meets current biocide regulations, offering a legally compliant antimicrobial solution.

ESA INVOLVEMENT
The collaboration between Aponix and Heraeus Precious Metals was supported by the ESA Technology Broker for Germany. This initiative was further backed by ESA's Spark Funding programme, aimed at accelerating the time to market of new products and services.

FROM SPACE RESEARCH COMES REMOVABLE AND RECYCLABLE ADHESIVE FLOORS

Supported by ESA Technology Broker Italy – STAM

COUNTRY
Italy

OVERVIEW
Artigo, a company within the Mondo Group, has partnered with Inovalab, a spin-off from the University of Padua, to develop innovative flooring solutions inspired by space research. This collaboration, supported by STAM, the European Space Agency's (ESA) technology broker for Italy, aims to create removable and recyclable adhesive floors using bio-based materials. The initiative focuses on sustainability and circular economy principles, targeting applications in large-surface environments like airports, hospitals, and schools.

SPACE APPLICATION
Inovalab has a decade-long history of developing electrothermal solutions for the aerospace sector, particularly in high-quality metal component joining through controlled heat supply. These technologies, initially designed for space applications, have demonstrated potential for adaptation to terrestrial uses, showcasing the versatility and transferability of space-derived innovations.

TERRESTRIAL APPLICATION
The project introduces a flooring system that employs adhesives composed of up to 95% bio-based materials. These adhesives facilitate a heat-activated debonding process, allowing for easy removal and recycling of flooring materials. Through devulcanization, the coatings can be regenerated into secondary raw materials, significantly reducing environmental impact and promoting sustainable practices in the flooring industry.

KEY BENEFITS
- Sustainability: Utilizes bio-based, non-toxic adhesives, aligning with eco-friendly building practices.
- Recyclability: Heat-activated debonding enables efficient recycling and material regeneration.
- Environmental Impact: Artigo estimates annual CO_2 savings between 100 to 200 tons through the adoption of this technology.
- Versatility: Applicable to various large-surface environments, enhancing the adaptability of flooring solutions.
- Innovation Transfer: Demonstrates effective technology transfer from space research to everyday applications.

ESA INVOLVEMENT
The ESA Broker in Italy STAM, has played a pivotal role in facilitating this collaboration by bridging the gap between space research and commercial applications.

ENHANCING RADIATION SAFETY USING SPACE TECHNOLOGY

Supported by ESA Technology Broker Hungary – Design Terminal

COUNTRY
Hungary

OVERVIEW
The RadNanoMed+ project was undertaken by 27G Technology and supported by the ESA Technology Broker in Hungary. The main product, the RadNano dosimeter, is a fully semiconductor-based instrument designed to sense and monitor the radiation environment locally. The project aims to extend the use of RadNano from space applications to medical and other non-space domains.

SPACE APPLICATION
The RadNano dosimeter was originally developed for tracking radiation exposure of electronic systems onboard satellites over the entire lifetime of the mission. It features ultra-low power consumption, a large measurable radiation range, and configurable alarms. The device has been validated through numerous tests, including irradiation tests and sensitivity characterisation, ensuring its reliability in critical space environments.

TERRESTRIAL APPLICATION
The project investigated the potential of RadNano technology across several terrestrial applications in the medical field, demonstrating its versatility and value in radiation monitoring. In hospitals, it can streamline nuclear waste handling by automatically indicating when a container can be safely emptied, saving valuable time for healthcare professionals. It also enables accurate tracking of patient radiation exposure, including post-CT scans, and supports radiotherapy by providing precise field measurements. Additionally, RadNano offers a critical safety tool for medical staff by continuously monitoring their radiation exposure levels.

KEY BENEFITS
The RadNano dosimeter offers several key benefits:

- Increased safety: By minimising radiation exposure for nuclear medicine staff and patients, it enhances safety margins and reduces potential illnesses and injuries.
- Early alerts: The device can provide early alerts in case of equipment malfunction, ensuring better control of radiation fields.
- Efficiency in nuclear waste management: It automates the monitoring of nuclear waste, saving significant time for medical experts.
- Sterilisation: The dosimeter can be easily sterilised for surgeries, improving the efficiency and availability of medical centres

ESA INVOLVEMENT
The ESA Technology Broker Hungary, Design Terminal, supported this project through the ESA Spark Funding initiative where 27G Technologies received funding to adapt the technology for the medical use cases.

PRECISION IMAGING POWERED BY SPACE

Supported by ESA Spark Funding Ireland – Tyndall National Institute

COUNTRY
Ireland

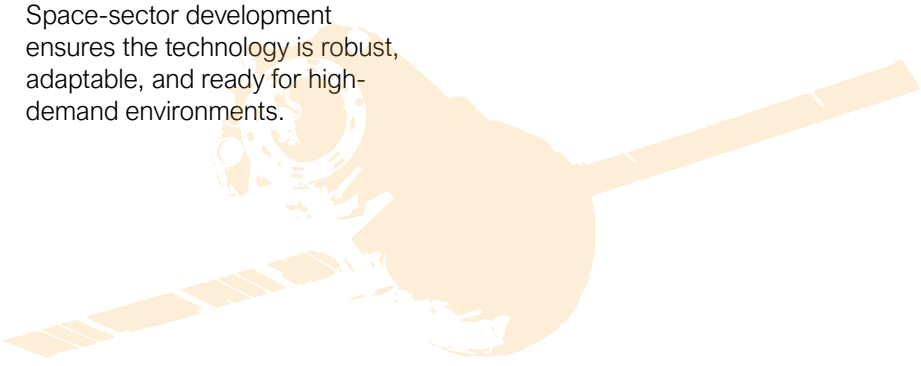
OVERVIEW
PixQuanta is an innovative sensor company developing proprietary technology for enhanced 3D imaging. Their solutions enable lower-dose medical X-rays, safer LiDAR systems for autonomous vehicles, and improved imaging performance—all at minimal cost. While applicable across several high-impact sectors, PixQuanta is leveraging space as a powerful framework to develop robust, high-performance sensor technologies that can scale across diverse markets, from healthcare to automotive to aerospace.

SPACE APPLICATION
In space, 3D imaging plays a critical role in activities such as spacecraft rendezvous and docking, where accurate mapping of objects in real time is essential. PixQuanta's sensor technology is highly suited for these operations, offering precise object identification and depth perception in complex, dynamic environments and has received funding from ESA for the technology development. Their approach enables advanced imaging capabilities that meet the demanding requirements of in-orbit manoeuvring and navigation.

TERRESTRIAL APPLICATION
PixQuanta's sensor innovations have strong relevance on Earth as well. Their technology is enabling safer LiDAR systems for autonomous vehicles, offering superior object detection at lower costs. In the medical field, their sensors support low-dose X-ray imaging, reducing radiation exposure for patients while maintaining high-quality diagnostic images. These applications highlight the company's potential to transform industries where safety, performance, and efficiency are critical.

KEY BENEFITS
- High-Performance 3D Imaging: Delivers accurate depth mapping essential for both space navigation and terrestrial applications like LiDAR and medical diagnostics.
- Low Radiation Medical Imaging: Enables safer diagnostics by reducing X-ray dose without compromising image quality.
- Cost-Efficiency: Designed to offer high-tech performance at a competitive cost across all application areas.
- Multi-Market Relevance: Applicable in space, healthcare, automotive, and more—maximising market potential.
- Scalable Innovation Framework: Space-sector development ensures the technology is robust, adaptable, and ready for high-demand environments.

ESA INVOLVEMENT
PixQuanta joined the ESA Business Incubation Centre (ESA BIC) programme in early 2019 and subsequently also received ESA Spark Funding to accelerate the transfer of the space technology into various non-space markets including targeting a share of the $1.5 billion global 3D sensor market.



SOUND PRECISION: SPACE-GRADE SENSORS TRANSFORM PAINT DISPENSING TECHNOLOGY

Supported by ESA Technology Broker The Netherlands – SBIC Noordwijk

COUNTRY
The Netherlands

OVERVIEW
Dutch sensor specialist Resoniks, known for its advanced acoustic sensing technologies developed in the space sector, has successfully adapted its solution for industrial use in partnership with Fast & Fluid Management, a global leader in paint dispensing systems. The collaboration demonstrates how high-precision, non-invasive acoustic technology—originally used to detect defects in spacecraft components—can bring efficiency, sustainability, and innovation to everyday commercial processes like paint dispensing.

SPACE APPLICATION
Resoniks' technology was originally developed and validated within the ESA Business Incubation Centre (ESA BIC)to ensure the integrity of spacecraft components. By using acoustic waves and AI-powered signal processing, Resoniks created a method to detect microfractures and material degradation in high-precision aerospace parts. These sensors can non-invasively scan materials and provide real-time data for critical quality control, essential for space missions where reliability is paramount.

TERRESTRIAL APPLICATION
In the terrestrial sector, Fast & Fluid sought a better way to measure liquid paint levels in their dispensers—traditional methods like mechanical sensors or manual inspection were either imprecise or costly. Resoniks' adapted sensor system sends acoustic waves through the dispenser wall to determine fill levels based on changes in resonance. This allowed for a non-contact, real-time monitoring solution integrated directly into Fast & Fluid's machines—eliminating contamination risk, improving dispensing accuracy, and reducing system complexity.

KEY BENEFITS
- Non-invasive & contamination-free: Acoustic waves measure fill levels externally, avoiding contact with paint.
- Real-time monitoring: Ensures continuous, instant feedback during dispenser operation.
- High precision & reliability: Significantly more accurate than manual or visual inspection methods.
- Cost and resource efficiency: Only one sensor per container needed, reducing hardware and integration costs.
- Scalable innovation: Potential applications in other industries like food, chemicals, and pharmaceuticals.

ESA INVOLVEMENT
The technology transfer was facilitated by the ESA Technology Broker in the Netherlands, who matched Fast & Fluid's industrial need with Resoniks' space-developed technology. Following a series of facilitated meetings, a feasibility study, and a two-phase proof of concept, a joint development agreement was finalised in September 2024. ESA's support through its broker network and BIC programme played a key role in enabling this successful adaptation, and continues to assist Resoniks in expanding into new markets.

MINING THE FUTURE: SPACE-INSPIRED TECH TARGETS EARTH'S CRITICAL RESOURCES

Supported by ESA Technology Broker Poland – Absiskey and Technology Park Krakow

COUNTRY
Poland

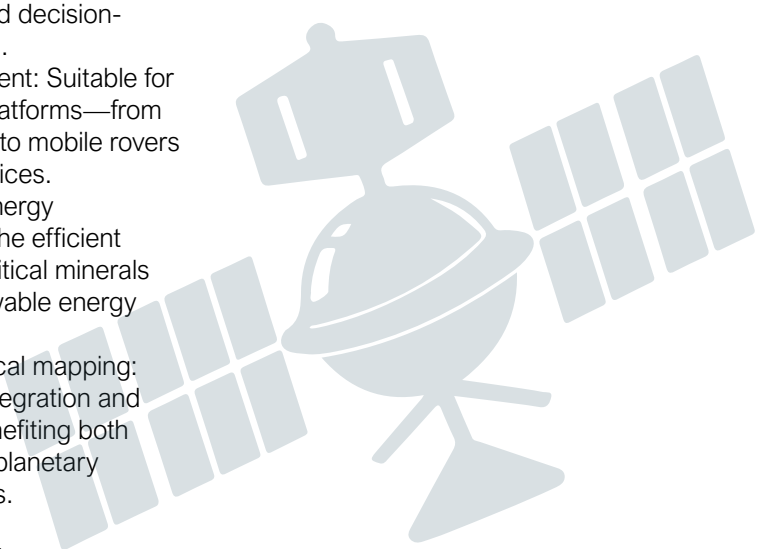
OVERVIEW
MIRORES Mining Data Services, a Polish start-up, is transforming mineral exploration using advanced far-infrared (far-IR) spectrometry technology. Originally developed for planetary missions, this cutting-edge tool is now being adapted for terrestrial use through the European Space Agency's (ESA) Spark Funding programme. MIRORES' latest innovation, the IRIS spectrometer, offers real-time, in-situ analysis of critical minerals, supporting the global transition towards a net-zero carbon economy.

SPACE APPLICATION
MIRORES' technology was initially designed for space exploration, particularly for detecting sulphide and oxide minerals on celestial bodies such as the Moon and Mars. The spectrometer's ability to operate in the 20–35 µm wavelength range—previously underutilised due to atmospheric limitations on Earth—makes it ideal for planetary surface analysis. Its primary applications include contributing to space missions by collecting, integrating, and interpreting geological data to optimise surface mapping and exploration strategies.

TERRESTRIAL APPLICATION
With support from ESA Spark Funding, MIRORES is adapting its far-IR spectrometer for use in terrestrial environments including conveyor belt systems, portable handheld units, and mobile exploration rovers. These adaptations are designed to enable accurate, efficient, and non-destructive detection of mineral resources in the field. The compact and rugged IRIS spectrometer can be deployed in laboratories, directly on site, or integrated into field equipment—providing geologists and engineers with immediate, high-precision data for real-time decision-making during exploration.

KEY BENEFITS
- Real-time, in-situ analysis: Enables immediate assessment of mineral compositions, supporting faster and more informed decision-making in the field.
- Versatile deployment: Suitable for a wide range of platforms—from laboratory setups to mobile rovers and handheld devices.
- Supports clean energy goals: Facilitates the efficient identification of critical minerals required for renewable energy technologies.
- Improved geological mapping: Enhances data integration and interpretation, benefiting both Earth-based and planetary geological surveys.

ESA INVOLVEMENT
MIRORES has received significant support from ESA through both the ESA Business Incubation Centre (ESA BIC) Poland and the ESA Spark Funding programme. ESA BIC Poland provided vital incubation support, while ESA Spark enabled the transition of MIRORES' space-origin technology into practical Earth-based applications. These initiatives highlight ESA's role in bridging the gap between cutting-edge space technologies and real-world commercial solutions.



HOW THE ESA MARKETPLACE IS BOOSTING EUROPEAN SPACE BUSINESS

In this special feature, we bring together two of the driving forces behind one of Europe's most ambitious space commercialisation efforts: Gianluigi Baldesi, Head of the Ventures and Financing Office at the European Space Agency (ESA), and Kais Barmawi, space commercialisation expert, working hands-on with companies through the ESA Marketplace. The programme aims to boost Europe's most innovative space ventures by tackling the critical barriers to growth. In this candid conversation, they unpack the origins, mechanics, and early successes of the initiative that's helping scale the next generation of European space leaders.

Kais Barmawi: Gianluigi, let's start at the beginning. The ESA Marketplace is making waves, but how did this all begin? What was the motivation?

Gianluigi Baldesi: The idea came from a collective effort. We engaged with industry players, top leading investors, national delegations, and ESA colleagues across domains. What came out of those conversations was clear: companies in Europe are developing great space tech, but after that initial phase of maturing their technology, they hit a wall. A wall not on the technology, but on the business side. We needed a programme that could help them break through it.

In the photo: Rachel Muller, Krystalia Antoniadou, David Lefeuvre, Adriana Lucas, Gianluigi Baldesi, Monica Mezzadri, Kais Barmawi

Kais: So, what are those walls exactly?

> **"The goal was always to act as a catalyst for private investment."**

Gianluigi: There are three major hurdles when it comes to growing your business in the space industry. First, once companies develop and mature their technology, they enter a brutal commercial arena. It's fiercely competitive and, frankly, unforgiving, especially for new ventures competing against legacy companies from around the world. Second, it's a risk-averse environment. Space is expensive, and no one working in space likes to put their money on things that might not work. As for the non-space businesses looking to adopt space solutions, they more often than not tend to stick with what they know. If you're a newcomer in the space domain and your product and service is without heritage, you're seen as a risk—and established supply chains aren't easily swayed. Third, and perhaps most crucial pain point for growing companies: capital. Scaling up in space is expensive. You need serious and sustainable revenue, as well as funding, which that cannot just public money. You need to attract private capital, too.

Kais: Right. And that's where the Marketplace steps in.

Gianluigi: Exactly. We built the ESA Marketplace to directly address those three barriers. It's not just one more technology development programme. As a matter of fact, we don't do any technology development! The Marketplace is a multi-dimensional tool to support companies build credibility, connect with partners, and draw both public and private investment into the most promising space ventures in Europe.

Kais Barmawi, Gianluigi Baldesi

Kais: Let's talk about what the programme offers. The ESA Marketplace is designed to accelerate space companies that already have a mature product or service—typically at TRL 7 or higher—and help them grow into sustainable businesses. It's about unlocking opportunities in three key areas:

1. Enhancing visibility and credibility. Through collaboration with ESA, companies gain technical validation and reputational trust. The programme supports demonstrations, showcases their performance, and facilitates knowledge-sharing within ESA—creating potential for adoption in ESA missions.
2. Boosting customer acquisition. Marketplace participants receive support in launching new services and expanding their commercial reach. The goal is to open doors for strategic partnerships and push beyond national markets to reach European and global customers.
3. Accelerating time-to-market. By helping companies validate their technology in operational environments (reaching TRL 9) and find commercial partners faster, the programme shortens the timeline from tested innovation to fully deployed product or service.

Gianluigi: These are targeted, high-impact actions. We're not just talking theory—we're enabling real commercial progress.

Kais: Exactly. The programme is designed to make a tangible difference for Europe's most promising space innovators. And now, we're seeing those benefits come to life.

Gianluigi: I would say so! We kicked off the first contract at the beginning of 2024. Fast forward to today, we've got nearly 20 activities ongoing. All tech domains represented.

Kais: It's been quite a ride!

Gianluigi: And the numbers are speaking for themselves. With just €19 million in ESA investment, we've seen over €38 million in industry deal flow. That's serious leverage. .

Kais: Plus, more than 40% of contracted companies have raised private capital shortly our contract signature — collectively over €190 million. So, the hypothesis is working.

Gianluigi: The goal is to act as a catalyst for private investment. And let's not forget—we're doing this in partnership with the ESA Investor Network. It's a real ecosystem play.

Kais: I truly believe it's just the beginning. Some of the first contracts are now showing real success in the market. That's what we're most excited about.

Gianluigi: Agreed. It took vision and collaboration to launch the ESA Marketplace. But what we're seeing now? It's proof that the model works. The future looks promising for European space scale-ups.

DRIVING EUROPE'S SPACE AMBITIONS THROUGH COMMERCIALISATION, ONE CONSTELLATION AT A TIME

INTERVIEW WITH BENOÎT DEPER, CEO OF AEROSPACELAB

Benoît Deper, CEO of Aerospacelab, recently sat down for an interview with Kais Barmawi, a space commercialisation expert, to discuss his company's pivotal role in advancing Europe's space industry. In collaboration with the European Space Agency (ESA), Aerospacelab is pushing the boundaries of commercialisation, innovation, and global competitiveness. In this interview, Benoît shares insights into this partnership, the broader implications for the European space sector, and what's on the horizon with his Megafactory, taking shapes in the heart of Charleroi, Belgium.

Kais Barmawi: Benoît, thank you for joining us. To start, could you tell us a bit about how Aerospacelab's collaboration with the European Space Agency came to be?

Benoît Deper: For sure! Aerospacelab has always believed in the power of collaboration, especially when it comes to fostering innovation in space technology. Our partnership with ESA's Commercialisation, Industry and Competitiveness Directorate is a natural extension of that philosophy. For sure! We have worked with ESA since the early days, and the agency has always been a great support, trusting us for our first contracts, and providing technical support throughout our journey. We worked with ESA first on small studies, later on full spacecraft developments, and since a couple of years we developed a great relationship with the Commercialisation Department, that supported commercial partnerships with companies like Xona Space Systems and Vyoma, through their ESA Marketplace in ScaleUp Programme.

I believe this collaboration aligns perfectly with ESA's broader vision under Strategy 2040, which emphasises economic growth, scientific advancement, and technological autonomy for Europe. Aerospacelab is proud to contribute to that mission by leveraging our expertise in high-performance, cost-effective satellite platforms.

Kais: That's fascinating. Could you elaborate on the types of projects you're supporting with ESA?

Benoît: Absolutely. One area we're particularly focused on is improving competitiveness for both institutional and commercial players in the space sector. For

example, through our involvement in the European Commission's Copernicus Contributing Missions, we're contributing with our first multispectral satellite (nicknamed SPIP) to support the activities of the Copernicus Services. This kind of new initiatives is critical, as it allows emerging European space companies to take part in the largest Earth Observation programme on the planet and allows stakeholders to access a larger variety of data, enabling them to make better informed decisions on topics such as security, policy, and climate change monitoring.

Another exciting example of our collaboration with ESA would be this time on the commercial level. Supported by ESA through the ESA Marketplace, Aerospacelab is working with Xona Space Systems on their PULSAR IOV mission – a mission that leverages our VSP-150 platform and marks the 7th mission relying on it, now adapted to a new type of application—positioning, navigation, and timing (PNT). This specific project represents our first contract supported by the ESA marketplace, securing Aerospacelab's presence on the U.S. market as well as the first Aerospacelab satellite assembled in our U.S. factory, showcasing our capacity to expand internationally.

Equally exciting is our work with Vyoma on the "New Flamingo Second Generation" mission, which uses our smaller VSP-50 platform to address Space Situational Awareness by monitoring and characterising space debris. As our first German customer, Vyoma emphasises Aerospacelab's expanding international reach and demonstrates the adaptability of the VSP-50 to yet another challenging mission profile.
We're also continuously adapting our capabilities to support innovative applications for satellite constellations across areas such as Earth observation, telecommunications, and navigation. Our goal is to ensure that these technologies are not just cutting-edge but also scalable and viable within the market.

Kais: The recent ESA industry event – CM25 – in the Netherlands seems to have been a significant milestone. What were some of the highlights for you?

Benoît: Indeed, we had a team onsite. We are looking forward to some of the new programmes (or evolutions of programmes) that ESA is proposing; if implemented correctly, some of them have a real opportunity to reshape Europe's space future.
One of the main highlights was the preview of the upcoming Council Meeting at Ministerial Level (CM25), set to take place later this year in Germany which will be pivotal in setting the strategic trajectory for Europe's space ambitions over the next decade.

Kais: Géraldine Naja, ESA's Director of Commercialisation, Industry and Competitiveness, has spoken about the importance of industry collaboration. How does Aerospacelab embody that principle?

Benoît: Géraldine couldn't be more right. Collaboration is essential for the long-term growth and sustainability of the space industry. At Aerospacelab, we see ourselves as a connector within the ecosystem—bringing together technology developers, institutional stakeholders, and commercial entities to create impactful solutions.

For example, we're working on projects that integrate innovative satellite technology with applications in areas like climate monitoring and disaster management. These are challenges that no single organisation can solve alone, and that's where collaboration makes all the difference. That and agility to deliver in a timely manner.

Kais: What are your thoughts on Europe's position in the global space market?

Benoît: There are good projects in the books, and room for progress in terms of how we should accelerate


40
Hawaii
Kauai
Oahu
Niihau
Gardner-I.
Necker-I.
French Frigate
Hawaii-Iⁿ
Phönix-Iⁿ
Gardner-I.
Hull-I.
Sydney-I.
Enderbury-I.
Tokelau-Iⁿ
Manihiki-Iⁿ
Gilbert-
Ellice-
Samoa-Iⁿ
Palmerston-Iⁿ
Cook-Iⁿ
Rarotonga
Mangaia
Tonga-Iⁿ
Fidschi-(Viti) Iⁿ
Rotuma (Br.)
Niue
Christmas I.
Jarvis-I.
Fanning
New York
Howland
Baker
Südlicher Wendekreis
Haymet Klippen
Danger Iⁿ
Nassau
Atafu
Nukunono
Fakaofu
Vaitupu
Nukufetau
Funafuti
Uea
Tutuila
Rose-I.
Manua-Iⁿ
Schjetman-Riff
Mitiero
Atiu
Beveridge-Rf
Tukopia
Fataka
Duff-Gr.
Motuiti
Vavau Gr.
Tofua
Late
Butaritari
Apamama
Tapeteuea
Arorai
Mille-Iⁿ
Nanomea
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Rakahanga
Manahiki
Tongareva
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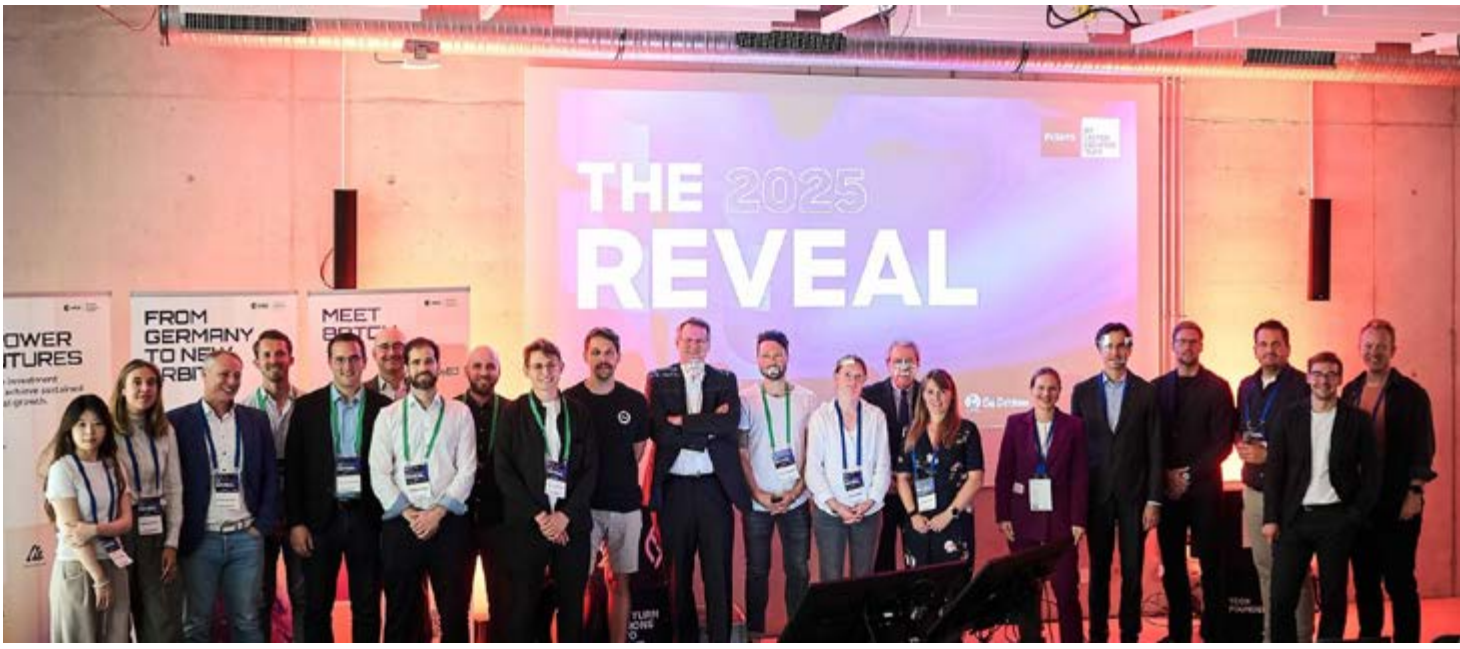


The 1st ESA Business Accelerator Germany Demo Day

funding instead of regulations to enable speeding things up. Europe's delay in space sovereignty is no longer a shy secret discussed at a low voice, we're accountable of what need to be done, and this need to invest and grow our capabilities are now being addressed upfront. We're now at a turning point. With growing competition all around the world, it's crucial for Europe to double down, at least, on commercialisation and technological autonomy.

That's why partnerships like ours with ESA are so important. They help ensure that Europe remains not just competitive but a global trailblazer in the space industry and that's why we are building the Megafactory, to meet that need for an industrial tool allowing to scale up.

Kais: Lastly, what's next for Aerospacelab as you look to the future?
Benoît: There's a lot to be excited about! In the short term, we're focused on making meaningful contributions to CM25 and ensuring that our projects align with Europe's strategic priorities.

Looking further ahead, as a satellite manufacturer with scaling capabilities that are now powered by our three factories, plus the Megafactory coming up next year, we're exploring new frontiers in satellite constellations. Our ultimate goal is to continue driving innovation while creating tangible benefits for society—whether it's improving connectivity, protecting the environment, or advancing scientific research.

As the conversation wraps up, one thing is clear: Aerospacelab is not just shaping the future of space technology—it's crafting tools and solutions to enable Europe's role in the global space market. With leaders like Benoît Deper at the helm, it's all about taking actions and standing up to the challenge today, not tomorrow.

POWERING GERMANY'S NEW SPACE PIONEERS

Europe's new space scale-ups scene is thriving, with a new accelerator programme funded by ESA and DLR supporting promising German ventures. The programme bridges the gap between early-stage incubation and profitable space companies, ultimately enabling scale-ups to become investment ready and achieve sustained commercial growth.

Europe's vibrant new space start-up scene is gaining significant momentum, and a new accelerator programme funded by the European Space Agency (ESA) and German Space Agency at DLR is set to launch its most promising ventures toward the next stage of growth. This initiative acts as a crucial catalyst, bridging the gap between early-stage start-ups and the substantial opportunities offered by ESA ScaleUp Programme.

> **"While space competencies are distributed across Germany, Munich stands out as a particularly vibrant ecosystem, playing host to a significant number of New Space scale-ups"**

The ESA Business Accelerator Germany is a testament to collaborative partnerships: Europe's largest entrepreneurship ecosystem, UnternehmerTUM, is teaming up with TUM Venture Labs—an integrated network supporting deep-tech start-ups with domain-specific expertise—and operative VC and innovation capital partner acitoflux. In collaboration with ESA, DLR and experts across national and European ecosystems, this alliance is designed to drive the commercialisation strategies and fundraising success of participating scale-ups. The initiative is closely aligned with the efforts of ESA's Venture and Financing Office, which plays a key role in supporting the growth of New Space ventures through investment readiness and private capital engagement.

The first cohort participating in the programme is representing a wide spectrum of technologies in the German New Space sector. Their capabilities range from enhancing in-space situational awareness – a critical aspect of ensuring the safety and sustainability of space operations – to developing key components for future space vehicles, or providing access to space with innovative hybrid propulsion launch systems. Others are unlocking the potential of space-derived data, transforming it into actionable insights for a diverse array of industries back on Earth.

Blackwave (Taufkirchen) produces advanced, lightweight carbon fibre composite components for space, including high-performance pressure vessels.

deltaVision (Munich) develops advanced fluid control systems for the space sector, focusing on cryogenic and high-pressure components like valves, regulators, pumps, and motors.

HyImpulse (Neuenstadt) develops hybrid propulsion systems and launch vehicles for small satellites, aiming for affordable and sustainable access to space with their paraffin-based fuel technology.

Morpheus Space (Dresden) develops highly efficient and scalable electric propulsion systems for satellites, enabling precise in-orbit manoeuvring and extending mission lifespans.

LiveEO (Berlin) leverages satellite data and artificial intelligence to provide real-time Earth observation insights for infrastructure monitoring and risk analysis across various industries.

Vyoma (Munich) develops advanced space traffic management and space situational awareness services, utilising ground-based and future space-based sensors with AI to ensure safe and automated satellite operations.

While space competencies are distributed across Germany, Munich stands out as a particularly vibrant ecosystem, playing host to a significant number of New Space scale-ups. This concentration of talent and innovation creates a fertile ground for collaboration and growth with large corporate, universities and research institutions. At the same time, other key locations such as Hamburg, Stuttgart and

Heilbronn are directly supported through the consortium consisting of UnternehmerTUM, TUM Venture Labs and acitoflux to enable a strong network across Germany.

Crucially, this accelerator serves as a vital link in the support system for space entrepreneurs in Germany. It builds upon the solid foundation laid by the well-established and successful network of ESA Business Incubation Centres (ESA BICs) spread across the nation. By providing targeted support and guidance to more mature scale-ups, the accelerator helps overcome critical obstacles such as limited access to industry partners, gaps in funding and investor readiness, and a lack of strategic mentorship needed to navigate complex market entry, scaling operations, and securing long-term growth.

The increasing maturity of these German scale-ups is attracting significant attention from the financial community. Generalist- and Growth VCs, Private Equity Funds, Asset Managers, and Banks are recognising New Space as a valuable asset domain, leveraging the investments made at earlier stages. This influx of private capital will further fuel the growth and market expansion of these pioneering companies.

Looking ahead, this accelerator programme could serve as a blueprint for structurally supporting the next generation of new space companies across Europe. By fostering collaboration, providing targeted support on demand, and facilitating access to industry partners and investors, initiatives like this are instrumental in unlocking the full potential of space commercialisation and ensuring Europe remains at the forefront of space innovation.

THE WORLD'S FIRST SPACE TECH DATABASE

Two years ago, in a global first, Dealroom.co launched a pioneering open-access database dedicated to mapping the world's space tech start-ups and innovation. Developed in collaboration with the European Space Agency (ESA) and Fondazione E. Amaldi, the platform provides reliable, real-time insights into a fast-evolving sector and shines a light on high-growth, investment-ready companies.

A GROWING UNIVERSE OF SPACE TECH INNOVATION

Since its launch, the database has doubled in coverage and grown to feature over 4,200 verified space tech start-ups and track more than 8,000 funding rounds worldwide. It has become a trusted resource and meeting point for the entire space tech ecosystem — from start-ups and investors to researchers and policymakers.

At its core is a purpose-built space tech taxonomy, created together with ESA, enabling users to explore start-ups working on everything from stratospheric balloons to semiconductors for space, and applications impacting industries like healthcare, education, and agriculture.

EUROPEAN SPACE TECH: A SECTOR HITTING ITS STRIDE

Space innovation in Europe has accelerated dramatically in recent years, as part of the broader shift from government-dominated programs to a dynamic, commercially driven "New Space" economy. Once the exclusive domain of state agencies, the European space sector now boasts a vibrant ecosystem of start-ups, scaleups, investors, with critical enablers like ESA.

We know from the database that in 2021, European space tech investment peaked at $2.5 billion, driven by major funding rounds like OneWeb's. While 2022 and 2023 lacked those headline-grabbing megarounds, 2023 marked the most active year on record for European upstream space tech, with a record number of deals and sustained momentum into 2024.

The ecosystem today counts over 3,000 space tech start-ups and scaleups across Europe, with innovation hubs in Harwell, Toulouse, and Munich continuing to nurture some of the continent's most promising companies — including OneWeb, ICEYE, Isar Aerospace, Kineis, and Orbex Space.

GLOBAL AND EUROPEAN MOMENTUM

The global space sector, valued at over $469 billion in 2021 — up from $180 billion in 2005 — is forecast to grow by up to 11% per annum through 2030, with commercial ventures now making up 77% of the market.

Globally, over $44 billion has been invested in space tech start-ups operating in upstream activities (developing products for, or operating in, space), with investment activity peaking in 2021. Even as market conditions evolved, the resilience of the sector has been clear: 2023's heightened activity in Europe and strong early figures from 2024 demonstrate a deepening investor appetite and long-term confidence in space tech's commercial potential.

THE ROLE OF EUROPEAN INSTITUTIONAL ENABLERS

Space is a key priority for the European Union and central to Europe's strategic independence in an increasingly volatile world. The role played by institutions ESA and the European Commission, through initiatives like the ESA Marketplace and the Commission's CASSINI initiative — have become highly significant. These efforts focus on supporting the growth of new ventures across the ecosystem by nurturing space businesses through supporting the development of disruptive technologies to underpin innovative commercial products and services in the space market.

BUILT FOR THE COMMUNITY, AND SHAPED BY IT

What makes this platform truly unique is its community-led evolution. Over the past two years, feedback from founders, investors, researchers, and agencies has helped Dealroom.co shape new features and refine the platform's taxonomy. It is more than a database — it's a tool for transparency, collaboration, and growth in one of the world's most dynamic industries.

Explore the Space Tech start-up ecosystem.

ABOUT THE ESA PHI-LABNET

Roberto Cossu, Acting Head of ESA Innovation Services Section

The ESA Phi-LabNET is a network of Phi-Labs implemented in the ESA Participating States, which aims at bridging the gap between the research and the commercial world and channelling research efforts into concrete commercial space products and applications.

The Phi-LabNET leverages the collaboration between ESA, industry and academia to create a test bed, where the outcomes of research activities are exposed to industry needs, so that their market potential can be rigorously assessed, creating solutions with commercial benefits for the Economic Operators, whilst contributing to the Phi-Lab's internal knowledge.

Ten (10) Phi-Labs are part of the ESA Phi-LabNET. Each Phi-Lab has a specific theme, to bring the necessary focus to research proposals, and aims at becoming a centre of expertise, recognised at European and worldwide level.

- **AT:** ESA Phi-Lab Austria - Industrial innovation for the upstream domain
- **CH:** ESA Phi-Lab ESDI - Use-inspired research for space-focused deep-tech innovation
- **ES:** ESA Phi-Lab Spain - Space technologies and their application to boost climate resilience
- **FI:** ESA Phi-Lab Finland - Sensors, GIS computing and geospatial services
- **GB:** ESA Phi-Lab United Kingdom - Space-enabled sustainability technologies
- **IE:** ESA Phi-Lab Ireland - Next generation space-optimised hardware
- **NL:** ESA Phi-Lab Netherlands - Earth Observation, critical PNT infrastructure, secure satellite communication
- **NO:** ESA Phi-Lab Norway - Cutting-edge technology based on space capabilities to meet Arctic needs
- **PL:** ESA Phi-Lab Poland - Robotic and Artificial Intelligence for autonomy
- **SE:** ESA Phi-Lab Sweden – Artificial Intelligence and Edge Learning

AUSTRIA

You are the first Phi-Lab in the ESA Phi-LabNET, and you have already selected several Research Projects. Can you briefly describe them and the approach you use to support their needs?

Yes, we are the first Phi-Lab founded in Europe and started our activities in April 2024. Our focus within the ESA Phi-LabNET is industrial innovation for the upstream domain to catalyse industrialisation in the New Space sector. Within the first year we have contracted 4 projects:

R-Space GmbH is an Austrian deep-tech company specialising in digital transformation within the aerospace sector. Their project focuses on developing a Digital Twin for Space Applications. This addresses both operational efficiency and mission safety in increasingly complex orbital environments. The digital twin approach contributes directly to industrialisation by offering scalable, software-driven infrastructure. Gate Space Innovation GmbH applies automotive sector principles—like modularity and cost-efficient mass production—to space propulsion. Their project introduces a modular space propulsion platform based on automotive-grade building blocks. This transfer of know-how accelerates industrial readiness and significantly lowers production barriers in propulsion manufacturing.

Quantum Technology Laboratories GmbH (QT Labs) is a Vienna-based quantum-tech start-up with strong academic roots. Their project develops a Post-Processing Product for Satellite-Based Quantum Key Distribution (QKD), enabling secure encryption for future space-based communication infrastructures. The QKD processing chain is essential for translating scientific research into industrial-grade cybersecurity solutions for space missions.

Peak Technology GmbH is a high-performance composite manufacturer with roots in Formula 1 and aviation. Their project advances Composite Overwrapped Pressure Vessels (COPV) manufacturing, critical for space propulsion and life-support systems. The innovation lies in next-gen lightweight composite structures, with immediate impact on scalability and space system integration.

In addition, we support the projects through tailored, hands-on assistance in the areas of business development, technology, intellectual property (IP), and sustainability. Our team works closely with each project to develop customised strategies that support the industrialisation focus. This holistic approach ensures that innovative concepts are not only technically feasible but also commercially viable and future-proof.

What are the main needs that you are addressing to boost the industrialisation of research activities?

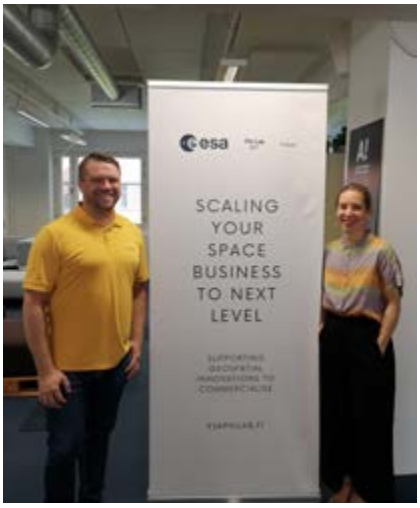
To boost the industrialisation of research activities, we are addressing several key needs through the establishment of the Vienna Space Hub. This new ecosystem provides a dedicated

physical and strategic environment where space-focused start-ups, established companies, and research institutions can closely collaborate. The co-location of actors fosters informal exchange and accelerates joint development. The planned, integrated MakerSpace offers rapid prototyping capabilities, allowing faster iteration from concept to hardware. Furthermore, access to a growing network of international partners ensures that innovation is aligned with global markets. By building this interconnected infrastructure, we enable a seamless transition from research to industrial application, reducing barriers and enhancing the scalability of breakthrough space upstream technologies.

FINLAND

Phi-Lab Finland is focusing on Sensors and Geospatial innovation. Which are the applications and services that will benefit from Phi-Lab activities and the innovative solutions in this domain?

Phi-Lab Finland's wide expertise in earth observation, navigation,



satellite systems and advanced analytics combined with UBI Global TOP3 ranked university business incubation and acceleration know-how, offers a unique perspective to developing new and state-of-the-art geospatial business success stories. The Finnish Phi-Lab is focused on commercial space data verticals, which include innovative sensor and signal concepts, sensor technology development, the innovative utilisation of navigation signals, the downstream application of existing Earth Observation (EO) data, disruptive data processing technologies, as well as pioneering business concepts and new market areas.

Phi-Lab Finland's focus on core EO and positioning technologies including advanced analytics enables finding new approaches to common problems around the Europe, including biodiversity loss, climate change and new EU regulations.
The deep involvement of the Phi-Labs experts to digital water research, small satellite development, space communication, precise positioning and location-based innovations also enables contacting many fields of expertise within a small group of people, which can speed up also the development cycles in multifield research topics.

IRELAND

Phi-Lab Ireland is managed by Irish Manufacturing Research (IMR). You are a new entity within the ESA Commercialisation Network. Why did you decide to offer your knowledge and expertise for the development of ESA Phi-LabNET? Which is your offer?

Ireland has an emergent space sector with a lot of innovative activity happening around the country. The Medtech sector in Ireland was in a similar position a few decades ago and the ICT sector a few decades before that. Each of these have proven to be enormously valuable for the Irish economy and we want to enable the space sector to take a similar position of prominence in the annals of Irish industry.

How do you believe your expertise in advance manufacturing will leverage ESA's know-how in this subject?
IMR has, over the last decade, grown to become a beacon for Advanced Manufacturing in Ireland, with capabilities across all aspects of both current and emerging technologies in this space. We specialise in enabling companies to scale production of existing products and de-risk investments in new product and process paradigms. When coupled with ESA's expertise in the needs of the global space industry, this can unlock the enormous potential of the "New Space" economy.

NETHERLANDS

Phi-Lab Netherlands addresses topics related to Earth Observation (EO), critical Positioning, Navigation & Timing (PNT) infrastructure and secure satellite communication, which are quite broad and diverse. What are the critical areas to be addressed? And how is the Phi-Lab supporting these sectors?

Phi-Lab Netherlands is dedicated to boost research for the commercialisation of downstream services and technology for a safer and resilient society. Situated on the NL Space Campus in Noordwijk that also houses ESA/ESTEC and EUSPA/GRC, the lab concentrates on EO, PNT, Secure Satellite Communication, and the common capabilities that underpin these. The emphasis lies in combining technological components with advanced data-driven elements within each specific domain. The topics align closely with the missions outlined in the Dutch Long-Term Space Agenda. This agenda identifies six missions for the national space ambition, including enhancing safety through space applications, addressing climate and environmental challenges, and leveraging satellite data to tackle societal issues.

Operating within a robust Dutch space ecosystem, the Phi-Lab in the Netherlands collaborates with leading academic institutions, including TU Delft, University of Twente, Leiden University, and Radboud University, as well as prominent research organisations like TNO, NLR, and SRON and the Dutch industry. This networked approach facilitates the accelerated translation of research into practical applications. Through this collaborative framework, the lab supports projects that have the potential to make significant contributions to the commercial space sector and address critical societal challenges. Phi-Lab Netherlands offers seed funding for research activities, mentorship and guidance along with access to technical facilities, workspace on campus and the afore-mentioned network of experts.

NORWAY

Phi-Lab Norway puts the focus on the Arctic needs. Why is the Arctic region so important and which are the priority areas that will be addressed by the Phi-Lab activities? You have already selected some Research Projects. Can you briefly describe what they are about?

The Arctic region holds unique strategic importance for the space industry for several key reasons due to the geographical location: Ideal Location for Satellite Ground Stations; Natural Testbed for Harsh Conditions; Crucial for Earth Observation and Climate Monitoring; Strategic and Security Significance.
The Arctic is the furthest north you can live and operate in the world. This harsh, challenging and weather-exposed area is an excellent test arena for new products and services to validate their resilience. If the product works here, it will work anywhere. The Arctic and Antarctic regions are the most attractive places in the world to read data from the satellites, and the Arctic is the home to the world-leading satellites services operator KSAT. In addition, there are several strong Earth Observation (EO) environments in this region such as NORCE, UiT, The Arctic University of Norway, Akvaplan niva, Norwegian Polar Institute, The Norwegian Meteorological Institute

and Norinnova. These are also the partners behind the ESA Phi-Lab Norway.

The region is also at the centre of attention within the geopolitical discussions and a very important area transportation between the continents.

IceView is the first project to receive support from Arctic Phi-Lab and is led by the Norwegian Geotechnical Institute (NGI). The project aims to develop a satellite-based solution for continuous mapping of landfast sea ice in the Arctic using InSAR technology. With partners including the Alfred Wegener Institute and the Norwegian Ice Service, IceView will support both long-term environmental monitoring on Svalbard and provide operational services to industries working in or near coastal ice zones.

POLAND

Poland shows a lot of capabilities and skills in robotics and automation. What are the key areas of development that you are envisaging?

We are envisioning the development of an autonomy stack for planetary exploration rovers. Our goal is to equip these robots with capabilities that minimise the need for human intervention during missions. To achieve a high level of autonomy, we must enhance perception, planning, and control algorithms. Our approach combines classical, fully explainable methods with machine learning techniques, allowing us to ensure the safety and security of the proposed solution.

Additionally, we are providing infrastructure within our analogue testing facility—a 700 m² lunar yard equipped with a motion capture system, star projection system, and 3D reconstruction tools. The entire mission can be simulated from a dedicated mission control centre.

And what is your strategy to leverage these capabilities to boost the competitiveness and success of the companies accessing the Phi-Lab?
Our strategy is to empower Polish space companies to develop, test and mature robotic and automation technologies that can be applied both in space and on Earth (e.g., precision automation, AI-driven control systems). Phi-Lab Poland plans to establish and facilitate access to local simulation environments where companies can prototype and validate robotic solutions under space-analogue conditions.

We support projects that address space-sector challenges while also having clear terrestrial applications. Our strategy will be aligned with ESA missions and industry needs and will include mentoring and industry matchmaking. As part of this, we aim to connect start-ups and SMEs with established ESA partners, research centres and other industry players to form long-term project consortia or supply chain partnerships focused on space robotics, autonomy, and AI.

Phi-Lab Poland will also promote skills development by collaborating with universities, ESA BICs, ESA Technology Brokers and other research institutions to build a pipeline of robotics and autonomy talent directly linked to companies within the Phi-Lab Poland ecosystem.

In the long term, Phi-Lab Poland will accelerate the growth of globally competitive Polish space-tech companies, as well as spin-offs of robotic technologies in high-value terrestrial sectors. Through our initiative, we aim to increase participation in ESA and EU robotics-related tenders and missions. We also plan to establish a dedicated hub for intelligent, autonomous space robotic systems at the Kąkolewo Campus, helping companies enhance their competitiveness and achieve lasting success.

SPAIN

The topic of Phi-Lab Spain is: space technologies to boost climate resilience. Which are the key factors that will drive our capability to be resilient to climate changes and what are the critical points that we shall urgently address?

At the Phi-Lab Spain, located in Barcelona, we work to position space technologies as a key enabler in enhancing climate resilience. Nowadays, industry and researchers have access to increasingly frequent and detailed high-resolution Earth Observation (EO) data, reliable satellite communications for real-time data transmission and PNT (Position, Navigation and Timing) services that can support accurate geolocation and timestamping of observations. Furthermore, the integration of EO data with AI-based analytics supports the development of predictive models and early warning systems. Open data, such as that provided by the Copernicus programme, plays a vital role in democratising access to space-derived insights. However, there are still critical areas to address, in particular, accelerating the transition from data to action, and facilitating the practical use of space technologies through ubiquitous connectivity and persistent observations.

In the future, specific constellations will likely be launched to address resilience challenges. How does this fit with your Phi-Lab activities?
Regarding future constellations, these missions are closely aligned with Phi-Lab Spain's innovation agenda. Advancements in sensor technologies, new mission concepts, and the rapid prototyping of EO-based services will enable the generation of scientifically grounded insights to support emerging climate adaptation needs. At Phi-Lab Spain, we also focus on supporting and de-risking research projects with high commercial potential that can contribute to the integration of current and future satellite constellations. In addition, we collaborate with industry and research institutions to promote use cases and ensure that both current and future satellite infrastructures are effectively addressing real-world climate resilience challenges.

SWEDEN

Phi-Lab Sweden is going to focus on AI and Edge Learning. Which aspects, areas and applications do you see where AI & Edge Learning can be a game changer technology?

AI and Edge Learning have started to revolutionise earth observation, remote sensing, and the broader space sector by enabling real-time data processing, enhancing image analysis, and integrating data from multiple sources. These technologies can significantly improve object detection and tracking, climate monitoring, and more generally data analysis.

Onboard processing allows AI models to handle data directly on satellites, reducing the need for extensive data transmission. This is crucial for autonomous operations and optimising onboard resources. Federated learning, synthetic

data generation, and predictive maintenance are other areas where AI and Edge Learning can make a substantial impact. Phi-Lab Sweden focuses on the commercialisation of space technology innovations, with a particular emphasis on artificial intelligence and edge learning. As part of ESA's broader Phi-LabNET, we work to strengthen Europe's competitiveness in the global space sector. These advancements promise to make the space sector more responsive, efficient, and sustainable.

How will Phi-Lab Sweden support selected applicants?
Phi-Lab Sweden is hosted by RISE Research Institutes of Sweden (RISE). RISE has over 75 dedicated AI researchers, more than 200 ongoing AI projects, and a network

of over 500 colleagues in the RISE AI network. RISE collaborates with several European digitalisation and AI initiatives, such as European Digital Innovations Hubs (EDIH) and Testing and Experimentation Facilities (TEFs), and is involved in competence building with regional partners, receiving input from industry and the public sector for future research and technology development.

RISE will be the primary support organisation for selected applicants, providing access to state-of-the-art test and demo facilities. RISE is hosting the Digital Earth Sweden platform in collaboration with the Swedish National Space Agency, with funding from the Swedish Innovation Agency, Vinnova, and in partnership with other key stakeholders.

The focus of Digital Earth Sweden is to promote the use of Copernicus data and work with data handling and AI-methods. Additionally, thanks to the strong consortium supporting Phi-Lab Sweden, on applicant's request, projects can utilise advanced testbeds for rocket technology at the Swedish Space Cooperation (SSC), thermo-vacuum and space environment test facilities at the Swedish Institute of Space Physics (IRF) and the Royal Institute of Technology (KTH), as well as specialised equipment like KTH's 5G centrifuge and IRF's space instrument development capabilities.

Collaboration with incubators like ESA BIC and a network of space experts further enhances support for applicants through coaching and advisory services.

SWITZERLAND

The Phi-Lab is part of the European Space Deep-Tech Innovation Centre (ESDI) which ESA is running in collaboration with you. What are the particular challenges of deep-tech that you face, and how do you address them with the Phi-Lab?

Deep-tech innovation often requires long development cycles, complex integration, and high-risk tolerance - making it challenging to fund with conventional funding mechanisms. At Phi-Lab Switzerland, we focus on early-stage R&D that is often too early or unconventional for traditional funding yet offers promising pathways to future ESA missions and commercial use. Our milestone-based funding model and emphasis on collaborative R&D allow teams to "fail forward," derisk ideas, and accelerate maturity through structured experimentation.

How does the Phi-Lab benefit from being embedded within ESDI, and what unique opportunities does this collaboration provide?
Being embedded in ESDI provides Phi-Lab Switzerland with unparalleled access to the country's dense innovation landscape. ESDI is located at Park Innovaare, home to numerous technology companies and start-ups, and situated at the Paul Scherrer Institute - Switzerland's largest research institute for natural and engineering sciences - which is part of the ETH Domain, alongside institutions such as ETH Zurich and EPFL. This unique environment not only connects us directly to cutting-edge research and a vibrant start-up ecosystem, but also fosters daily exchange across disciplines, sectors, and maturity levels - from fundamental science to industrial application. It enables us to act as an interface between ESA, Swiss science, and industrial deep-tech, catalysing high-impact collaborations. ESDI also serves as a testbed for "new" innovation models, allowing us to develop and refine approaches that could later be scaled across the ESA Phi-LabNET.

Phi-Lab Switzerland used a very detailed approach to select the topics and prepare the Open Calls. Can you share with us your Phi-Lab model? What is so specific in your approach?
At Phi-Lab Switzerland, our model is shaped by the principle of identifying "technology conundrums worth solving" - challenges that are underexplored, highly technical, and yet potentially transformative

if solved – *or* – when solved. We combine structured scouting with deep stakeholder engagement through pre-calls (our "Call for Conundrums"), workshops, and roadshows across Switzerland, while actively collaborating with Swiss academia, industry, and ESA programmes. Our focus is on neglected, interdisciplinary topics where a focused research effort could unlock step-change capabilities. We apply an approach in which we are valuing not only technical novelty but also a team's alignment with user needs and execution potential.

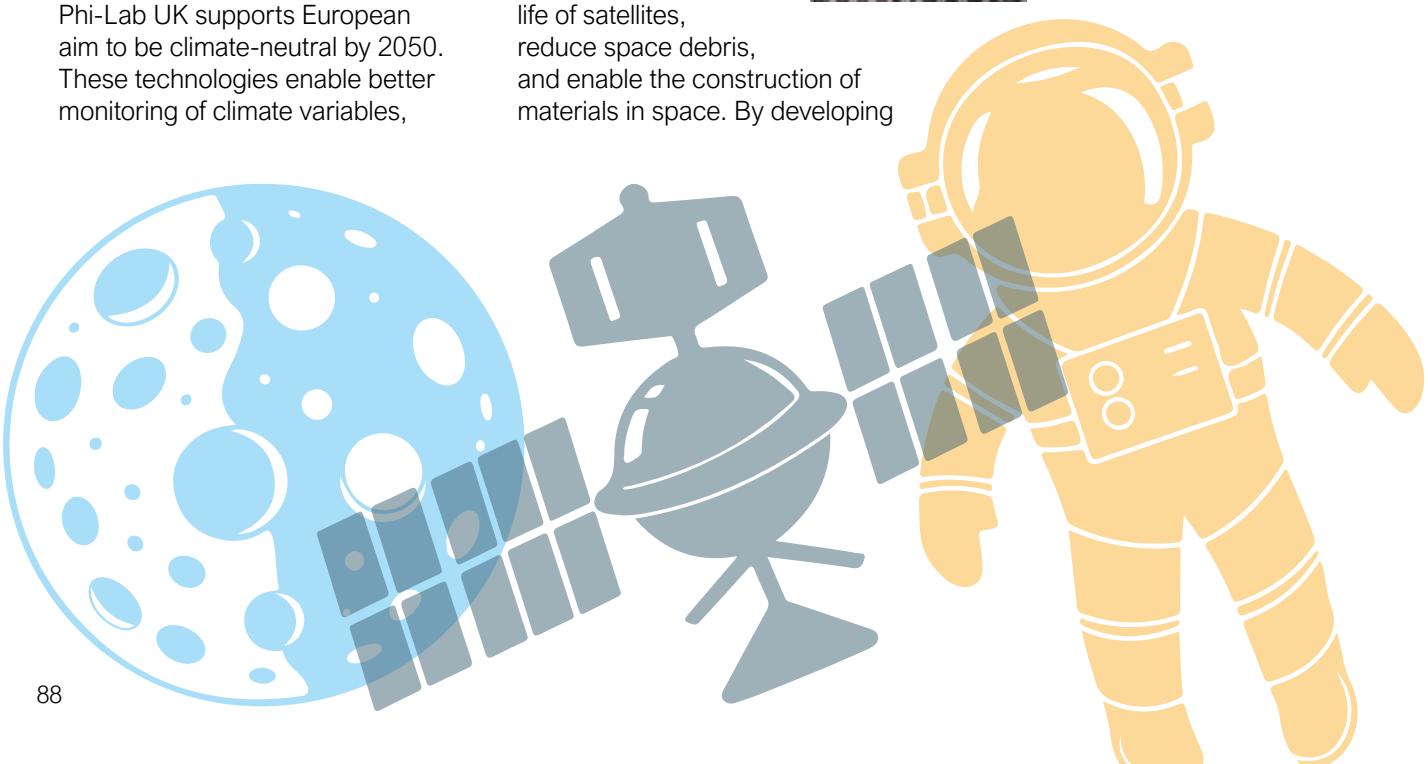
UNITED KINGDOM

Phi-Lab United Kingdom (UK) is focusing on Space enabled sustainability technologies. Which are the most important aspects that will permit to reduce the impact of human activities and improve their sustainability? And how can space technology be an "enabler" in this process?

The Phi-Lab UK is dedicated to advancing technologies that address space and environmental sustainability. Key aspects include:

- Addressing environmental sustainability issues such as climate change monitoring and disaster response management by supporting developments of, for example, new remote sensing technologies, miniaturised high-performance instrumentation, calibration algorithms and data services. By enhancing Earth Observation capabilities, the Phi-Lab UK supports European aim to be climate-neutral by 2050. These technologies enable better monitoring of climate variables, extreme weather, and natural disasters, providing crucial data for informed decision-making and investment in sustainable practices.
- Supporting advancements in space sustainability areas such as in-orbit servicing, debris removal, space-based solar power, and space manufacturing. These technologies extend the economic life of satellites, reduce space debris, and enable the construction of materials in space. By developing capabilities for rendez-vous and proximity operations, refuelling and assembly, the Phi-Lab UK contributes to a sustainable space environment.

These initiatives collectively aim to exploit space technologies to promote sustainability in space and on Earth, ensuring that human activities are conducted in a manner that minimises its impact and promotes long-term sustainability.



ESA LAUNCHES CENTRE OF EXCELLENCE IN SWITZERLAND TO ADVANCE DEEP-TECH INNOVATION IN SPACE

On 27th of May 2025, the European Space Agency (ESA) marked a milestone with the opening of the European Space Deep-Tech Innovation Centre (ESDI)—its first presence in Switzerland. Developed in partnership with the Paul Scherrer Institute (PSI), the new centre of excellence is based at Switzerland Innovation Park Innovaare in Villigen.

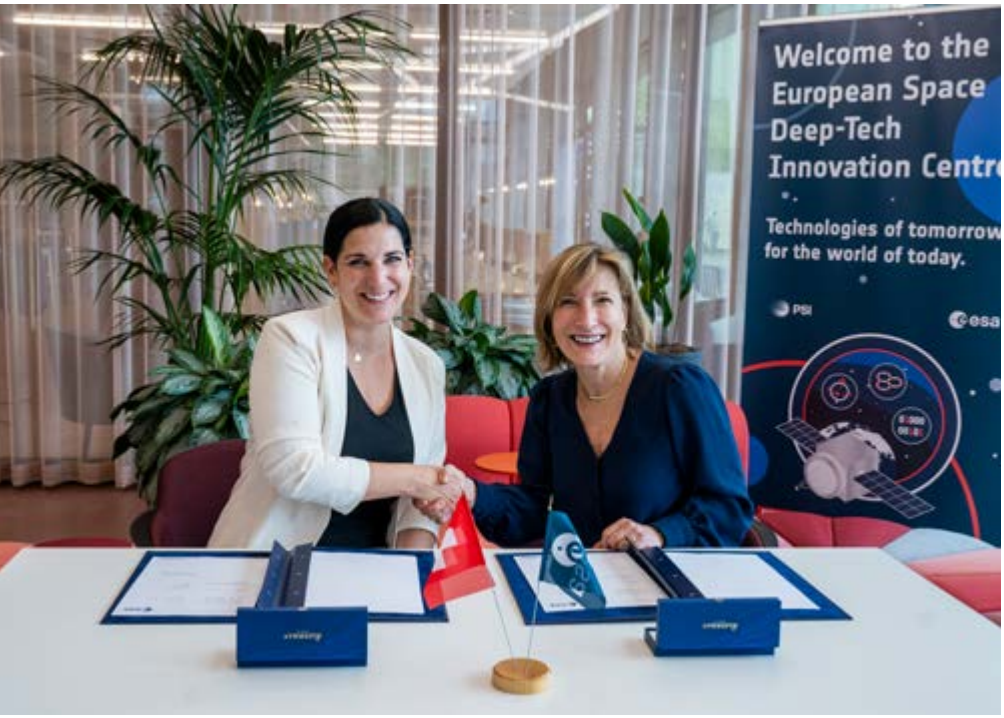
The inauguration, attended by Dr Josef Aschbacher (ESA Director General), Prof. Dr Martina Hirayama (State Secretary, State Secretariat for Education, Research and Innovation, SERI, Switzerland), Pascale Bruderer (Vice-President, ETH Board), and Martina Bircher (Cantonal Government, Aargau), highlights ESA's focus on Deep-Technology as a driver of Europe's future in space. It also underlines the role of Deep-Tech in shaping the future of space exploration and supporting Europe's growth. Switzerland, recognised for its strength in robotics, quantum computing, artificial intelligence, nanotechnology, and biotechnology, is well positioned for this initiative. ESDI brings together ESA's space expertise and the Swiss research and technology ecosystem, supporting the development of technologies for the next generation of space exploration.
Located near PSI, which hosts some of Europe's most advanced research infrastructure, ESDI accelerates the development and application of Deep-Technologies for space missions and broader societal benefit. Key focus areas include quantum technologies, advanced data handling and processing, and materials science.

Josef Aschbacher, ESA Director General © Paul Scherrer Institut PSI/Mahir Dzambegovic

ESDI is more than a centre of excellence; it builds talent, supports industrial transformation, and encourages practical innovation. By partnering with universities, start-ups, and research institutions, ESDI helps address skills gaps, supports job creation, and integrates space solutions into Europe's economy.

As ESA's presence in Switzerland expands, opportunities increase to integrate Swiss innovation into ESA programmes and connect ESA with Swiss talent, infrastructure, and ideas.

ESDI: ADVANCING DEEP-TECH FOR SPACE AND ESA'S 2040 STRATEGY
In today's evolving space landscape, innovation is essential. As Europe pursues bold goals for 2040, Deep-Tech is central to turning ambitions into action.



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Deep-Tech, grounded in advanced scientific discovery and high-impact potential, is central to ESA's roadmap. Deploying satellite-based methane monitoring, freshwater analytics, and resilient space infrastructure requires the highest standards of science and technology.

To remain competitive and resilient, Europe must lead in Deep-Tech. ESA's 2040 strategy places Deep-Tech at the centre of Europe's space future.

THE MISSION OF ESDI

ESDI is more than a centre of excellence; it serves as a launchpad for turning scientific excellence into commercial outcomes.

ESDI focuses on use-inspired research, balancing basic research and applied development. Rather than advancing theory alone, ESDI bridges research and industry by developing technologies with practical applications. This ensures innovations are commercially relevant and meet the needs of the space sector and beyond.

By focusing on research with tangible goals, ESDI supports Europe's Deep-Tech ecosystem and reinforces technological sovereignty. Its platforms for research—covering advanced materials, quantum technologies, and data science—address ESA's needs and create technologies such as quantum sensors and new materials for spacecraft. The first platform, ESA Phi-Lab Switzerland, is now operational within PSI's organisational framework.

"The inauguration of the European Space Deep-Tech Innovation Centre, ESA's first presence in Switzerland, is a testimonial to ESA's and Switzerland's joint commitment to push innovation and drive economic growth in the deep tech sector. ESDI will contribute to strengthening the European deep tech ecosystem and promoting Swiss expertise and leadership in this domain." Josef Aschbacher, Director General of ESA

OVERCOMING THE CHALLENGES UNIQUE TO DEEP-TECH

1. High-Risk, High-Impact R&D

Deep-Tech is challenging, costly, and risky, yet its potential for space is significant. This innovation depends on access to world-class research infrastructure. ESDI benefits from integration with the Swiss ETH Domain, providing facilities and academic talent for advanced research that redefines what's possible.

2. Accelerating Deep-Tech Commercialisation

Commercialising Deep-Tech from concept to product can take over a decade and requires capital, partnerships, and shared vision. ESDI builds long-term relationships between researchers, governments, investors, and industry to reduce risk and improve outcomes.

3. A Hub for Interdisciplinary Collaboration

Deep-Tech advances through interdisciplinary collaboration. At ESDI, physicists, data scientists,

engineers, policymakers, and entrepreneurs work together. This ecosystem encourages innovation through collaboration, co-creation, and cross-sector engagement.

LOOKING AHEAD

By placing Deep-Tech at the centre of Europe's space innovation strategy, ESDI strengthens ESA's capabilities and Europe's role in the global space economy. As Europe pursues its 2040 goals, ESDI is positioned to support industrial transformation, scientific advancement, and collaboration.

ESDI creates an environment where academic excellence, innovation, and commercialisation are integrated. By connecting universities, research institutions, and industry, ESDI enables collaboration, knowledge exchange, and technology development. Its work bridges space and non-space Deep-Tech research, accelerates commercialisation, and supports new businesses based on cutting-edge science.
In this way, ESDI is more than just a research centre; it's a lever for Europe's future. It connects science and industry, turning today's bold ideas into tomorrow's space solutions.

ESA'S COMMITMENT TO DEVELOPING ESDI IS BUILT ON FOUR PILLARS:

1. Accelerate Deep-Tech Innovation: Establish and operate platforms for use-inspired research like the Phi-Lab Switzerland that accelerate Deep-Tech together with the local and European ecosystems.

2. Strengthen Industrial Capacity: Forge strategic alliances between research institutions, industry, and end users to enhance Europe's technological autonomy, unlock new markets, and drive economic growth.

Johann Richard, Aude de Clercq

3. Drive Commercialisation: Mobilise investment through the ESA Investor Network and partnerships, ensuring that Deep-Tech breakthroughs reach global markets faster.

4. Draw on Switzerland's Excellence: Transform ESDI into a permanent hub of ESA in Switzerland to tap world-class facilities at the Paul Scherrer Institute, the ETH Domain, and the larger Swiss Deep-Tech ecosystem—attracting top talent and reinforcing Europe's research infrastructure to the benefit of ESA and its Member States.

> **"ESDI establishes and operates platforms for deep-tech research in the fields of quantum, data and materials that unlock new markets and commercial opportunities, making tomorrow's technologies available for today's world"**

HOW ESA IS POWERING SPACE INNOVATION IN EUROPE

Every year, the European Space Agency develops a wealth of breakthrough technologies—innovations that make Europe's ambitious space missions possible. From advanced communications systems to robotics, propulsion and Earth observation tools, ESA's work spans the full breadth of the space sector. What's less known is that many of these technologies are protected and shared through a growing portfolio of patents—an often-overlooked but vital part of Europe's space innovation ecosystem.

A STRATEGIC PORTFOLIO

ESA files between 10 and 20 patents a year, building a portfolio that now includes more than 530 patents and patent applications. These are managed by ESA's Patents Group, which ensures that the Agency's intellectual property is both protected and put to good use.

The logic is simple: securing patents helps prevent others from claiming credit or misusing ESA's work, while giving European companies the ability to use that technology—often free of charge. It's a way of preserving value, encouraging collaboration, and making sure that the investments made in ESA research can benefit European industry.

Riccardo de Gaudenzi

PRACTICAL INNOVATION: FROM SATELLITES TO WRISTWATCHES

ESA's patent catalogue is broad, reflecting the diversity of its missions and capabilities. It includes innovations in radio-frequency systems, robotics, optics, propulsion, structural engineering, and more. But these aren't just ideas on paper—they're technologies with real-world impact.

One of the most prominent examples is ESA's contribution to the DVB-S2 standard. Originally developed from a patented modulation technique by ESA's Riccardo de Gaudenzi, this technology is now central to satellite television broadcasting around the world. It's used not only for HDTV and internet access, but also in professional satellite data transfer, and has been adopted by multiple space agencies for telemetry systems.

Then there's the PARIS system (Passive Reflectometry and Interferometry System), invented by ESA engineer Manuel Martín-Neira. By capturing reflected signals from navigation satellites, it allows for Earth observation in a completely new way. This approach—known as satellite reflectometry—is now used in missions by NASA, UK-DMC, and private companies like Spire Global, helping to track everything from soil moisture to ocean winds.

Even timekeeping has been reimagined. In collaboration

Manuel Martín Neira

with ESA, watchmaker Omega developed the Skywalker X-33, a space-ready watch based on a patented invention by astronaut Jean-François Clervoy. It helps astronauts track mission events down to the second, with custom alarms and countdowns. More recently, the collaboration produced the Marstimer, capable of displaying time on both Earth and Mars—developed under ESA patents by engineers Jorge Vago and Pantelis Poulakis. It even includes a solar compass that works on both planets.

WHY PATENTS MATTER IN SPACE

Space is a high-risk, high-investment field. Protecting innovation isn't just good practice—it's essential. Without patent protection, valuable solutions could be lost, misused, or commercially exploited without return. By securing and managing its intellectual

property, ESA ensures that these advances can be safely shared, built upon, and integrated into commercial products.
And it's not just about protection. ESA's patents are available in a public online catalogue, allowing companies across ESA's 22 Member States to access and license the technology. For non-European or non-space uses, a separate licensing model applies, with royalties supporting further innovation.

This openness makes ESA's patent portfolio a powerful tool for technology transfer—helping ideas move from lab benches and mission teams into the hands of entrepreneurs and engineers.

TURNING IDEAS INTO BUSINESS

ESA doesn't just file patents and walk away. Through initiatives like the Open Space Innovation Platform (OSIP) and the ScaleUp programme, it actively encourages companies to explore and commercialise its technologies.

OSIP provides early-stage funding for fresh ideas, while ScaleUp focuses on helping businesses—especially SMEs and start-ups—bring ESA-developed technologies to market. Whether it's supporting feasibility studies, guiding product development, or connecting innovators with investors, the goal is the same: to turn space-born ideas into commercially viable solutions.
ESA's work with the European Patent Office (EPO) and the European Space Policy Institute (ESPI) has further helped to map out technology trends and the role of intellectual property in Europe's space ecosystem, offering insights that guide policy and strategy across the sector.

AN OPEN INVITATION TO INNOVATE

ESA's patent portfolio isn't a closed archive—it's an open invitation. Whether you're working on communications, Earth observation, propulsion systems, or even wearable tech, these patents offer a head start: tested, validated, and ready to be adapted for commercial use.
To see what's available and explore how ESA can support your project, visit the ESA Patents Online Catalogue and learn more about the ScaleUp programme.
Innovation in space doesn't happen in isolation. ESA's patents are proof of what's possible when research, protection, and collaboration come together—and they're waiting for industry to take the next step.

HOW PATENTS HELP US ANTICIPATE WHAT'S NEXT IN TECHNOLOGY

We often think of patents as the final stage in an innovation's journey—proof that a new idea has been secured and locked away for future use. But take a step back, and you'll see something far more interesting: a pattern. Across thousands of patent applications, there's a story unfolding about where technology is heading, and who is leading the way.

For those working in strategic planning, policymaking or R&D investment, patents aren't just legal tools. They're signals—clues about what might be around the corner. That's why the European Space Agency (ESA), in collaboration with the European Patent Office (EPO) and the European Space Policy Institute (ESPI), has been looking closely at the role of patent data in technology foresight.

NOT JUST LEGAL PROTECTION—A WINDOW INTO TOMORROW

ESA has long understood the value of protecting its inventions. With over 500 patents in its portfolio, the Agency actively supports innovation in the space sector. But its interest goes beyond its own intellectual property. In recent years, ESA has joined forces with the EPO and ESPI to better understand how patents can guide us toward the technologies of the future.

The EPO's Technology Insight Reports (formerly known as Patent Insight Reports) are central to this effort. These reports focus on what the EPO calls "future and emerging technologies"—fields that haven't yet produced large numbers of patents, but which hold enormous potential. The goal is to understand not just what exists, but what's beginning to take shape.

MAPPING SIGNALS—AND SILENCES

The true strength of patent analysis lies not only in tracking what is being developed, but also in revealing what isn't. In other words, it allows us to identify neglected areas—those topics or challenges that aren't currently receiving significant attention from innovators. This can be just as revealing as spotting fast-growing trends.

By comparing the technological challenges ahead with the volume and focus of patent activity, analysts can highlight gaps in innovation. Are there vital areas in climate adaptation, in-orbit servicing, or deep-space navigation that are receiving less attention than they should? Are entire subfields being overlooked? This kind of gap analysis gives technology foresight a sharper edge, enabling decision-makers to target resources and funding where they are most needed. It's a way to ensure that strategic innovation isn't just reactive, but also proactive—consciously addressing what the market and research communities may be missing.

A TOOL FOR STRATEGY, NOT JUST STATISTICS

Behind the scenes, the EPO's methodology blends smart classification strategies, citation mapping, and the analysis of patent families to build clear, structured pictures of emerging fields. It's a rigorous yet adaptable approach—one that doesn't require specialist legal knowledge to apply. And because the methodology is freely available, research organisations, national space agencies, and policy institutes across Europe can use it for their own foresight work.

ESA Patents Team: Nuria Hernández Alfageme, Mercedes Sánchez Álvarez

For ESA, this kind of structured analysis offers clear value. Space technologies are long-term, high-risk and capital-intensive. Understanding which fields are advancing rapidly—and which aren't—is essential when setting priorities, allocating funding, and identifying opportunities for collaboration or intervention.

TURNING INSIGHT INTO ACTION

This collaboration with the EPO and ESPI marks a shift in how we think about patents—not just as records of ownership, but as strategic indicators of momentum, direction, and opportunity. For Europe's space ambitions, and for the broader innovation ecosystem, this perspective is increasingly important.

Patent data won't tell you everything, but it will tell you a great deal—if you know how to read it. In a world where change is constant and competition is global, having the tools to spot both the activity and the absences may well be what sets the leaders apart.

The ESA Commercialisation Networks