



ESRE Position Paper on the EU Space Strategy on R&I for the next

European Framework Programme FP10

Provided by ESRE

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EXECUTIVE SUMMARY AND KEY MESSAGES

The European Union (EU) is poised at a defining moment for its space sector as it enters the next Multiannual Financial Framework (MFF) for 2028-2034. Amid a backdrop of geopolitical shifts, demographic changes, and rapid technological advancements, the EU's strategic autonomy and global influence in space are increasingly challenged. This document, presented by the European Space Research Establishments (ESRE), outlines a series of strategic recommendations designed to bolster the EU's space capabilities in response to these multifaceted challenges.

As the EU faces competition from agile and innovative global players, it is imperative that the EU adopts new methodologies that reflect the dynamic nature of the modern space industry. These include embracing agile management practices and enhancing space testing infrastructures necessary to support both current space missions and future exploratory endeavours. The rise of small satellites, constellations of them and the congestion of Low Earth Orbit (LEO) necessitate robust space traffic management and advanced situational awareness to ensure sustainable space operations.

Further complicating the strategic landscape are the critical dependencies on key technologies and materials, highlighted by recent global crises. These dependencies underscore the need for the EU to significantly invest in research and development, including dual-use technologies, that can serve both civil and defence objectives. This strategic pivot will not only enhance the EU's defensive capabilities but also its commercial competitiveness and technological sovereignty.

To address these challenges, ESRE recommends a comprehensive strategy that includes:

- 1. **Supporting Low TRL Research for repopulating future COTS Technologies:** Boosting funding for research that develops adaptable technologies critical for future space endeavours.*
- 2. **Fostering Technological Advancement through Space Exploration:** Leveraging space exploration to drive the development of cutting-edge technologies with applications in both scientific discovery and broader societal benefits.*
- 3. **Strengthening operational research for Space Traffic Management:** Developing cutting-edge technologies to manage the growing traffic and debris in space.*
- 4. **Developing and Integrating Dual-Use Technologies:** Enhancing the synergy between civil and defence sectors to optimize resource use and strategic flexibility.*
- 5. **Strengthen Space Technology and Research Infrastructures (STRI):** Supporting the operation and upgrade of STRI facilities, also through the creation of integrated network of test capabilities.*

SETTING THE SCENE

The next Multiannual Financial Framework marks a critical phase for the European Union as it navigates a complex matrix of internal and external pressures that threaten its strategic autonomy and influence in space. The backdrop is one of geopolitical tension, demographic shifts, and significant technological evolution in the space sector. The decline in the EU's share of the global GDP and the aging population poses considerable challenges to maintaining its competitive edge.

The space sector, a vital component of the EU's strategic capabilities, is at a crossroads. Traditional European space launch platforms face increasing competition from innovative and cost-effective solutions like SpaceX's reusable launch technology, which has set new standards in the industry. The rise of new low-cost players in the market, such as India, along with the growing popularity of small satellites and the congestion of LEO, add layers of complexity to the EU's strategic planning. These developments necessitate a robust response to ensure safe and sustainable space operations, highlighting the need for enhanced space traffic management and situational awareness.

Moreover, recent crises, such as the COVID-19 pandemic, have exposed the EU's critical dependencies on key technologies and raw materials often controlled by external entities. This reliance poses a significant risk to the European space sector's autonomy and resilience. To mitigate these vulnerabilities, the EU must bolster its research and development efforts, focusing on securing independent access to essential components and materials. Such a strategic pivot is vital not only for enhancing the EU's commercial competitiveness but also for ensuring its long-term economic and technological sovereignty.

In addition, the increasing security concerns pose both a threat and an opportunity for the European Space sector. Besides to possible military threats, the growing congestion of space, particularly in LEO, increases the risk of accidental collisions that could damage or destroy critical European space assets. This heightened risk environment necessitates the development of robust Space Situational Awareness (SSA) and Space Traffic Management (STM) capabilities, which have both civilian and defense applications, thus presenting an opportunity for fostering dual-use technologies.

In response to these multifaceted challenges, the EU must strategically invest in cutting-edge technologies, foster specific public-private partnerships for research, and enhance the synergy between civil and defence space activities to maintain its leadership and ensure a resilient and prosperous future in the increasingly competitive global space arena.

ON THE INTERVENTION MODES AND TYPES OF ACTION

INNOVATION AND NEW SPACE DYNAMICS

The global space industry is undergoing a transformative shift, largely driven by the entry of New Space actors like SpaceX. These entities have revolutionized space access through innovative approaches like reusable launch technology and agile project management. While these developments pose a challenge to traditional European approaches, they also present an opportunity for the EU to accelerate innovation and enhance its competitiveness in the space sector.

- **Current State:** The EU has traditionally focused on large-scale, long-term space projects with established methodologies and standards. However, the success of New Space actors highlights the need for more agile, adaptable, and cost-effective approaches to space development and deployment.
- **Strategic Imperative:** To maintain leadership in the space sector, the EU must strategically adapt its approach to embrace innovation and accelerate the pace of technology development and validation. This requires a shift in both technological and policy frameworks.

Recommendations:

1. **Expand Flight Opportunities for In-Orbit Demonstration and Validation (IOD/IOV):** *The EU should increase funding and opportunities for scientific experiments in existing IOD/IOV initiatives, like IRIS². This will enable the rapid testing and validation of emerging technologies, accelerating their integration into operational systems.*
2. **Consider Dedicated Research and Technology IOD/IOV Missions:** *Establishing missions or programmes specifically focused on technology IOD/IOV would provide a platform for validating promising technologies, reducing risks associated with their adoption, and fostering a culture of innovation.*
3. **Consider Public-Private Partnerships for Research:** *The EU should explore new avenues for collaboration between the European Commission and the European upstream research sector. Such dedicated partnerships can focus on technology development, knowledge exchange, and infrastructure sharing, with the ultimate endeavour to ensure a better transfer of upstream research to the EU private sector, especially to its start-ups and new space actors.*

SUPPORT FOR LOW TRL RESEARCH TO PREPARE FUTURE COTS TECHNOLOGIES

Recognizing that innovation ultimately stems from prior low Technology Readiness Level (TRL) research, there is a pressing need to support such research to ensure a steady pipeline of novel, adaptable technologies for the future.

- **Current Challenges:** The allocation of public funding for space-related R&I reveals a concerning trend that has persisted across multiple funding cycles. While the overall budget for space research has increased from €1.34 billion in FP7 to €3 billion in Horizon Europe, the distribution of these funds raises concerns. There has been a disproportionate growth in funding directed towards private actors, increasing from €199 million in FP7 to €554 million in Horizon Europe. Meanwhile, funding for Research and Technology Organizations (RTOs) and universities has remained relatively stagnant or even decreased in certain areas.
This trend is particularly evident in the decline of funding allocated to space science, which plummeted from €143 million in FP7 to a mere €26 million in Horizon Europe. Additionally, this depletion in EC funding is not compensated by the European Space Agency (ESA): ESA lags behind NASA in terms of investment in scientific programmes and technological support, even in percentage, further emphasizing the need for increased EU funding in these critical areas.
The underfunding of low TRL research and associated IOD/IOV missions threatens the long-term innovation potential of the European space sector. Without adequate investment in fundamental research and early-stage technology development, the pipeline for future breakthroughs and commercial applications will dwindle. This will not only hinder the development of cutting-edge technologies but also undermine Europe's ability to compete in the rapidly evolving global space landscape.
- **Strategic Response:** To address this imbalance and foster a vibrant innovation ecosystem, the EU must re-balance its funding priorities. A significant increase in investment in low TRL research is essential to rejuvenate the pipeline for Commercial Off-The-Shelf (COTS) technologies, which are fundamental to maintaining the EU's competitive edge in space technology.

Recommendations:

1. **Enhance Funding for Low to Mid TRL (TRL 2 – 5) Research:** *To ensure a funding scheme which supports the entire R&I chain from low to high TRLs, significantly boost the budget allocated to research initiatives focused on developing ground-breaking space technologies. This increase should aim to establish a more balanced ratio between funding for space programs/infrastructure and low TRL research (with associated IOD/IOV missions), potentially targeting an allocation of at least 10% of the overall space-related public funding towards low TRL activities.*
2. **Repopulate COTS Technologies:** *Strategically focus on replenishing COTS technologies through dedicated research and development initiatives. This effort should be prioritized to ensure that European space endeavours have access to a sustainable and continuously evolving pool of cutting-edge technologies.*

SPACE EXPLORATION AS A LEVERAGE FOR SPACE SCIENCE AND AS AN EDUCATIONAL TOOL

Space exploration offers the opportunity to advance technological frontiers in several domains, such as miniature instruments, in-situ resource utilisation (ISRU), innovative materials operating in harsh environment and radiation shielding, with a clear return in non-space areas. Besides, they are strictly related and serve as a powerful tool to support space science and may result in a strong incentive for youngsters to engage in the European space sector, including and especially in space science, thus acting as a crucial educational tool that inspires future generations of scientists and engineers.

In Horizon Europe Working Programme, a continuous reduction of funding opportunities for space exploration and space science projects occurred.

- **Opportunity:** Leveraging exploration and space science also to stimulate interest and develop careers in space technology and research.

Recommendations:

- **Integrate Space Exploration and Space Science for Education:** *Enhance support for space exploration programmes that can serve as booster for space science and a catalyst for educational and career opportunities in the space industry.*

SPACE SITUATIONAL AWARENESS AND TRAFFIC MANAGEMENT

With the expected surge in satellite deployments, particularly in Low Earth Orbit (LEO), the EU faces critical challenges in managing space traffic and ensuring the long-term sustainability of space operations.

- **Overview:** The rapid increase in space activities has led to concerns over potential collisions and space debris, which threaten operational safety and sustainability.
- **Need for Action:** Effective management systems are essential to mitigate these risks and protect the integrity of space infrastructures.

Recommendations:

- **Develop research for SST and SSA Systems:** *Invest in cutting-edge technologies and in system modelling for space surveillance and tracking (SST) and space situational awareness (SSA).*
- **Implement Regulatory Frameworks:** *Establish comprehensive international norms and regulations to govern space traffic and enhance collaborative efforts for debris mitigation.*
- **Innovate Debris Management Solutions:** *Promote research into debris removal technologies, development of satellites equipped with end-of-life disposal capabilities, design for demise.*

SYNERGIES BETWEEN SPACE AND DEFENSE

The intersection of space technology with defence capabilities is increasingly prominent, reflecting the strategic importance of space in both European and international security frameworks. In this context, the European Commission might favour the exploitation of fundamental research (low TRL) that is not downstream-driven into high-TRL technologies with significant defence potential.

The Commission should also keep on its effort for achieving a European non-dependence on critical space technologies, a fundamental step to safeguard European assets and is key for Europe security.

- **Overview:** Space technologies play pivotal roles in communication, navigation, and surveillance, serving both civilian and military applications. The EU's Horizon Europe programme primarily supports civil research and innovation, while the European Defence Fund (EDF) focuses on defence-related R&D. While this separation ensures clear objectives and efficient implementation, it can also create missed opportunities for cross-fertilization and technology transfer.
- **Strategic Integration:** Recognizing the potential of dual-use technologies, the EU has launched a consultation on how to better articulate Horizon Europe and EDF funding. ESRE supports the proposal of leveraging existing instruments and pipelines without merging or confusing the two funding instruments. This approach, building on years of experience and lessons learned from Horizon Europe and EDF, allows for the cross-fertilization of defence by civil R&D while preserving a dedicated funding source for purely civilian research, ensuring the continued development of technologies with broader societal benefits.

Recommendations:

1. **Support research and development of technologies with potential Dual-Use:** *The EU should actively support the development of technologies that can serve both civilian and defence applications, optimizing resource use and strategic flexibility. This can be achieved through collaborative projects that bring together stakeholders from both sectors, drawing inspiration from initiatives like the Joint Task Force on Critical Space Technologies.*
2. **Strengthen Collaborative Civil and defence Initiatives:** *The EU should actively foster collaboration between Horizon Europe and the European Defence Fund (EDF) through identifying complementarities and favouring pipelines between the two programmes, while ensuring clear guidelines and addressing IPR and security concerns.*
3. **Improve Access to Funding for Dual-Use Technologies:** *The EU should explore aligning regulations of Horizon Europe with those of the European Investment Bank (EIB) and other financial institutions to facilitate access to private equity funds for dual-use technologies. This could unlock additional financial support and accelerate the development of critical technologies.*

DEVELOPMENT AND SUPPORT OF SPACE TECHNOLOGY AND RESEARCH INFRASTRUCTURES

Space Technology and Research Infrastructures (STRI such as hot and cold wind tunnels, acoustic characterization facilities, space propulsion test benches, space exploration facilities, satellites qualification labs) are the backbone of a successful space R&I system. By bridging the gap between early-stage research and the final development of space technologies, these facilities are crucial for ensuring the reliability, safety, and performance of European space missions.

Robust and well-integrated STRIs are not only essential for the continued success and growth of the European space sector but also a prerequisite for realizing ambitious flagship projects that will propel Europe to the forefront of space exploration and technology. By investing in these infrastructures, the

EU can foster a culture of innovation, accelerate technology development, and ensure the competitiveness and resilience of its space industry for years to come.

The EU needs to ensure that their STRIs can support both current operational requirements and ambitious flagship projects that push the boundaries of space exploration and technology.

- **Current Challenges:** The European space sector faces several challenges related to testing infrastructure:
 - **Aging and underfinanced facilities:** Many existing test facilities are aging and may not be fully equipped to handle the demands of new technologies and increasingly complex missions. In addition, they are most of the time indirectly supported through research projects that are just using them, and not *per se*, i.e., to develop their own capacity. This limits the ability to test and validate innovative solutions that could revolutionize the space sector.
 - **Insufficient Integration:** The integration of test capabilities remains fragmented, leading to duplication of effort and missed opportunities for collaboration. This hinders the efficient utilization of resources and slows down the innovation process.
 - **Poor Awareness of Testing Capabilities:** A lack of awareness regarding the availability and capabilities of existing test infrastructure can hinder innovation and lead to underutilization of valuable resources. This can discourage new entrants and limit the potential for ground-breaking discoveries.
- **Future Needs:** As the space environment becomes more contested, commercially vibrant, and open to new players from diverse sectors, the EU needs to strategically invest in its testing infrastructure to support both current operational requirements and ambitious flagship projects. This investment should focus on:
 - **Modernization and Upgrades:** Existing facilities need to be modernized and equipped with the latest digital technologies to support the development and validation of cutting-edge space systems, including those required for ambitious flagship projects.
 - **Increased Integration:** Creating a more interconnected network of test facilities will facilitate collaboration, knowledge sharing, and efficient utilization of resources across different sectors. This is essential for maximizing the impact of flagship projects and ensuring a coordinated approach to testing and validation.
 - **Enhanced Visibility and Access:** Raising awareness of the available test capabilities and providing easier access to these facilities for both established players and new entrants will foster innovation and accelerate the development of new technologies. This is crucial for attracting new talent and ideas to support ambitious projects.

Recommendations:

1. *Invest in Space Ground Testing Infrastructures: The EU should prioritize support and funding for the modernization and upgrade of existing test facilities, especially toward a high digitalization level, as well as the support to the development of new, specialized infrastructures where gaps exist. This investment should cover a wide range of testing capabilities, from environmental to component testing. This will create a robust foundation for supporting ambitious flagship projects that push the boundaries of space technology.*

2. ***Promote Collaborative Use of Test Infrastructures:*** Encourage and facilitate the sharing of test facilities across different sectors and organizations to maximize their utilization and create a collaborative environment that fosters research. This could involve creating a centralized database of available capabilities, encourage standardized testing protocols.
3. ***Include Test infrastructures in the Development of Ambitious Flagship Projects:*** The EU should consider launching ambitious, high-profile space projects, such as next-generation reusable launch vehicles, human exploration missions in-orbit servicing technologies or major contributions to space-based public infrastructure. Whenever ambitious projects are implemented, they should serve as a catalyst for developing new test infrastructure, pushing the boundaries of European space capabilities, and inspiring public support for space exploration and innovation.

CONCLUSION

Implementing these strategic recommendations is essential for the European Union to navigate the evolving space landscape and maintain its leadership in space research and innovation. By embracing agility, prioritizing fundamental research, leveraging space exploration, ensuring sustainability, fostering civil-defence synergies, and strengthening space infrastructure, the EU can not only overcome current challenges but also drive economic growth and technological advancements. These initiatives will enhance Europe's strategic autonomy, create a more resilient space sector, and ensure the EU remains at the forefront of space exploration and innovation in the years to come.

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Contact Information for ESRE, the Association of European Space Research Establishments

Mrs. Renáta Balážová – ESRE Secretary

Email: info@esre-space.org