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Enhancing European Space Access:
Fostering Innovation Ecosystems to Strengthen EU Space Capabilities

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Executive Summary

In an era marked by geopolitical instability, strategic uncertainties, and the rapid evolution of defense and space technologies, the urgency for the EU to establish robust and autonomous space capabilities has never been clearer. Against this backdrop, Europe faces both a challenge and a rare opportunity to redefine its role in the global space sector. The appointment of a new Commission, coupled with an unprecedented increase in the EU's defense budget, underscores the critical juncture at which Europe now stands—a moment ripe for transformative action.

Space has emerged as a critical domain, integral to military operations and civilian infrastructure alike. Secure communications, navigation, surveillance, and other space-enabled capabilities are indispensable for addressing emerging threats, from cyberattacks and anti-satellite systems to electronic warfare. NATO's recognition of space as a domain of military operations further highlights its growing strategic importance. For the EU, achieving autonomy in space is not just a matter of technological advancement but a cornerstone of European security and resilience.

Dependence on external actors, such as SpaceX, risks undermining Europe's strategic autonomy and economic resilience. To counteract this, the EU has a unique opportunity to transition from outdated cost-plus contracting models toward a performance-driven, innovation-focused ecosystem. By fostering collaboration across government, academia, and industry, the EU can accelerate the development of cutting-edge technologies and ensure the swift translation of research into operational capabilities.

Bold, forward-thinking measures are essential to capitalize on this momentum. Investing in dual-use technologies, integrating civilian and defense space initiatives, and enhancing space domain awareness are crucial steps toward a secure and sustainable presence in the increasingly contested space environment. This comprehensive approach will not only strengthen Europe's strategic posture but also position it as a global leader in technological innovation, capable of addressing the complex challenges of today's geopolitical landscape.

The decisions made at this pivotal moment will define Europe's trajectory in space for decades to come. By embracing this opportunity, the EU can secure its leadership in space capabilities, safeguard its strategic interests, and ensure its resilience in an era of profound global transformation.

Introduction

The pursuit of European strategic autonomy in space requires a reevaluation of European space capabilities, particularly in light of growing dependence on non-European entities like SpaceX. The concept of "space capability" can be usefully adapted from definitions of military capability, which emphasize achieving desired effects in a specific operational environment. For EU space capability should be understood as "*the ability to deliver functional outcomes in space operations, including launch systems, satellite networks, and communication technologies, aligned with EU strategic autonomy and defense policies.*" This definition shifts the focus from incremental improvements in existing platforms—such as Ariane—to achieving broader functional goals that support European independence in space.

Europe's position as a leader in commercial space launch services has eroded dramatically over the last decade. In 2014, Arianespace controlled approximately 60% of the global commercial launch market. However, by 2017, SpaceX had surpassed Arianespace, along with Russian competitors, to become the dominant player. The rapid ascent of SpaceX was driven by technological innovation, particularly the development of reusable rockets like the Falcon 9, which offer unparalleled cost efficiency and performance. In contrast, European efforts, such as the development of the Ariane 6, have struggled to keep pace, plagued by delays and high costs (Wang 2021).

The Ariane 6 program exemplifies the challenges facing Europe's space sector. Initially conceived in 2014, the rocket's design and production timelines have been sluggish compared to SpaceX's iterative approach. While the Ariane 6 aims to be "somewhat competitive" with the Falcon 9 under subsidized conditions, its costs per launch (€75–115 million) are significantly higher than the Falcon 9's $50 million baseline, or the $30 million projected for SpaceX's next-generation fully reusable Starship. Moreover, the payload capacities of Ariane 6 lag behind those of SpaceX's rockets, further exacerbating the competitiveness gap.

This growing disparity highlights a critical vulnerability for the EU. Dependence on SpaceX for commercial and strategic space launches undermines the EU's stated goals of strategic autonomy and robust defense capabilities. The creation of a "working group on the future of European launchers" in 2021, a joint initiative by France and Italy, signals recognition of this issue. However, any meaningful solution must go beyond incremental cost-cutting and

design adjustments. Europe's space launch sector faces structural challenges, including an overreliance on subsidies and a slower pace of innovation compared to agile competitors like SpaceX.

The divergent trajectories of SpaceX and Arianespace illustrate the impact of lean innovation models and agile development. SpaceX's reliance on reusable technologies and iterative testing has allowed it to drastically reduce costs and accelerate timelines. In contrast, Arianespace's slower development cycles and reliance on the cost-plus model have resulted in higher costs and diminished competitiveness. Europe can learn from SpaceX's model by adopting performance-based incentives and fostering a culture of experimentation and rapid iteration.

The Cost-Plus Model: History and Limitations

A critical examination of the cost-plus model highlights its limitations in incentivizing innovation and its role in the stagnation of Europe's space capabilities. A cost-plus contract ensures that contractors are reimbursed for all allowable expenses, with an additional payment to cover risks and provide incentives. While this model offers financial predictability for contractors, it often removes the pressure to minimize costs or accelerate innovation.

Historically, the cost-plus model gained prominence during World War I in the United States, where it was used to encourage wartime production by American businesses. During the mid-20th century, this model was instrumental in enabling fledgling technology companies to undertake large-scale research and development projects. Government institutions relied heavily on cost-plus contracts to fund innovative technologies that eventually created entirely new markets and economic sectors (Hofbauer and Sanders 2006, Makecha 2022).

However, the effectiveness of the cost-plus model has diminished in contemporary contexts. Critics argue that it prioritizes expenditure over performance, fostering inefficiencies and escalating costs. In the European space sector, this model has often resulted in slow development cycles and incremental advancements that fail to keep pace with the rapid innovation of competitors like SpaceX. For instance, the protracted timeline and high costs associated with the Ariane 6 program underscore the shortcomings of this approach. By emphasizing financial predictability over market-driven efficiency, the cost-plus model has hindered the EU's ability to compete in a global space economy that increasingly values agility, cost-effectiveness, and innovation (Zancan et al. 2024).

European Space Capabilities

The European space carrier capabilities are poised for significant advancements through initiatives like the *European Launcher Challenge* (ESA 2024b) and cutting-edge developments in reusable technologies such as the *Space Rider* (ESA 2024a). These efforts align with the EU´s recognition of space as a crucial domain, as outlined in the *EU Strategic Compass*, which underscores the strategic importance of autonomy in space access and has facilitated increased funding opportunities (EEAS 2022). However, despite these strides, the EU faces growing challenges in maintaining its competitive edge in the global space

race. Private entities, particularly SpaceX, continue to set new benchmarks in cost-efficiency and launch frequency with innovations like reusable rockets and the Starship program. While ESA's efforts, such as the Ariane 6 and Vega-C launchers, exemplify technical progress and reliability, the disparity in pace and scale highlights the difficulty of competing against private industry dynamics. Bridging this gap requires not only technological innovation but also streamlined processes, enhanced investment, and agile collaboration between public institutions and private companies to fully realize Europe's potential as a space power.

The *EU Space Strategy for Security* and *Defence and the European Space Programme* collectively represent the EU's commitment to leveraging space as a critical domain for societal, economic, and strategic purposes. Recognizing the growing geopolitical significance of space, the EU has established its strategy to safeguard space assets, enhance autonomy, and strengthen resilience against emerging threats. This strategy addresses key priorities, including developing a shared understanding of space threats, enhancing the protection of space systems, and fostering dual-use capabilities for both civilian and defense applications. Initiatives such as a proposed EU Space Law, enhanced space traffic management, and expanded surveillance capabilities underline the EU's proactive approach to ensuring the sustainability and security of its space endeavors (European Commission 2022).

Simultaneously, the *European Space Programme* drives innovation and economic growth by integrating flagship initiatives like *Copernicus*, a global leader in Earth observation; *Galileo*, a highly accurate satellite navigation system; and *EGNOS*, enhancing regional navigation reliability. With additional projects like the *Infrastructure for Resilience, Interconnectivity, and Security by Satellite* (IRIS²) for secure connectivity and space traffic management measures, the programme addresses both immediate and long-term challenges. Together, these strategies aim to foster a vibrant space ecosystem, reduce strategic dependencies, and position the EU as a global leader in space innovation and security. The EU's collaborative approach with stakeholders, including member states, ESA, and private sector actors, ensures a unified and impactful presence in space for the benefit of its citizens and global security (European Commission 2024).

IRIS² represents a landmark initiative by the EU to enhance secure satellite connectivity across its member states. Designed as a multi-orbital constellation of 290 satellites, IRIS² addresses critical challenges in security, connectivity, and technological resilience. Implemented through a public-private partnership, the program leverages contributions from leading satellite operators and subcontractors under the SpaceRISE consortium. With

its innovative use of Medium and Low Earth Orbit satellites, IRIS² will deliver secure connectivity for governments and high-speed broadband for businesses and citizens, particularly in underserved areas. This initiative underscores the commitment to technological sovereignty and strategic autonomy, driving innovation and strengthening global competitiveness in satellite communications.

IRIS² aligns seamlessly with the *EU Space Strategy for Security and Defence* by providing resilient and secure satellite connectivity to address the evolving threats in the space domain. Despite its strategic significance, IRIS² faces challenges of timing, scalability, and competition. By the time the system becomes operational in 2030, SpaceX's Starlink is expected to have deployed 12,000 satellites, far surpassing IRIS²'s planned 290 satellites. While IRIS² ensures sovereignty over critical communication infrastructure and avoids dependence on private providers like SpaceX, concerns about affordability and user accessibility persist. Europe's cautious approach to innovation and its complex stakeholder ecosystem have raised doubts about whether IRIS² can deliver on its promise. To succeed, the EU must balance security and innovation while overcoming structural and cultural barriers that hinder agility and competitiveness.

As an integral part of the European Space Programme, IRIS² aims to fortify Europe's leadership in secure satellite connectivity while fostering innovation and competitiveness. The initiative relies on a robust public-private partnership, pooling resources from European entities to establish a sovereign satellite communication system. However, delays, escalating costs, and fierce competition from private-sector giants like SpaceX challenge its feasibility. IRIS² must address critical issues, such as standardizing satellite and ground systems and making user terminals affordable for private and commercial users. The *European Space Programme's* goals of strategic autonomy and technological leadership depend on IRIS² overcoming these hurdles. Leveraging synergies with existing projects like *Galileo* and *Copernicus*, and fostering a culture of risk-taking and rapid iteration, will be pivotal in ensuring its success. IRIS²'s success will ultimately hinge on Europe's ability to adapt to a competitive global landscape and deliver secure, cost-effective solutions to meet its connectivity and security needs.

IRIS² presents a significant opportunity to enable industry innovation through its public-private partnership model, leveraging the expertise of European satellite operators and fostering collaboration among SMEs and start-ups. However, the program also risks falling into bureaucratic pitfalls that could stifle its potential. The complexity of managing numerous stakeholders and meeting diverse demands can lead to delays and

inefficiencies. Moreover, Europe’s traditionally cautious approach to innovation, coupled with slower decision-making and regulatory rigidity, may hinder the program's ability to compete with agile private-sector counterparts like SpaceX. To ensure IRIS² fuels industry innovation, the EU must adopt a more flexible, risk-tolerant culture, streamline its processes, and focus on fostering a dynamic ecosystem that encourages rapid iteration and market-driven solutions. Failure to address these challenges risks leaving IRIS² as a well-intentioned but overly constrained initiative unable to keep pace with global competitors (Jones 2024; European Commission 2024)

Space Capability Ecosystems: A Framework

To effectively compete in the global space industry, Europe must embrace an ecosystem-based approach that fosters innovation through interconnected networks of government, academia, and private industry. These ecosystems facilitate continuous feedback loops and collaboration, enabling the rapid development of advanced space capabilities. Key components of this framework include Universities as R&D Hubs, Industry-Government Consortia and the implementation of a Whole-of-Government Approach to space capabilities.

Universities play a central role in driving innovation by providing safe-to-fail environments for basic and applied research. These institutions bridge the gap between fundamental research and prototyping, allowing for the exploration of novel ideas without immediate commercial pressures. By fostering a culture of experimentation, universities serve as incubators for transformative technologies that can be transitioned to operational capabilities.

Innovations and new technological approaches that could be leveraged to create new space (carrier) capabilities and provide for access to space are manifold within the EU, mostly developed in European Universities. The EU showcases substantial innovative prowess on a global scale, as highlighted in the Global Innovation Index (GII) 2024 (ESA 2024). Multiple EU states rank prominently among the world's leading innovation economies, with countries such as e.g. Sweden placing in the global top five. Other EU members like Finland, the Netherlands, and Germany also secure high positions within the top 10. These rankings reflect robust innovation ecosystems driven by investments in R&D, technological advancements, and strong socioeconomic impact indicators. While EU states dominate the high-income group rankings, their consistent performance underscores the region's role as a global leader in fostering innovation through collaborative policies, infrastructure, and investment in cutting-edge technologies. This positions the EU as a critical hub for innovation in an increasingly competitive global landscape

Industry-government consortia align production capacities with research pipelines, creating platforms for the commercialization of ready-to-market products. These consortia enable the pooling of resources and expertise, reducing the risk associated with large-scale projects while accelerating the deployment of new technologies. By integrating industrial capabilities with academic research, consortia ensure a seamless transition from innovation to implementation.

A coordinated government strategy is essential to drive the development of space capability ecosystems. Centralized funding mechanisms, such as *Horizon Europe* and the *European Defence Fund*, provide the financial support needed to sustain long-term innovation efforts. Governments also serve as hubs for data collection and knowledge dissemination, facilitating collaboration across sectors and ensuring that research efforts align with strategic priorities. This whole-of-government approach promotes synergies between academia, industry, and public policy, creating a robust foundation for sustained innovation.

By adopting this ecosystem-based framework, Europe can leverage its existing strengths in research and development to create a dynamic and competitive space sector. This approach not only accelerates the pace of innovation but also ensures that technological advancements contribute directly to the EU's strategic autonomy and economic resilience.

Performance-Based Contracts: Mitigating Risks of Bureaucracy

Performance-based contracts (PBCs) offer a promising solution to mitigate the bureaucratic risks that could hinder the success of initiatives like IRIS². Unlike the traditional cost-plus model, which reimburses expenses with additional fees for profit and risk, PBCs align contractor incentives with measurable outcomes such as innovation, speed, and cost-efficiency. This alignment is particularly critical for IRIS², as it aims to compete with agile private-sector giants like SpaceX, which have set new benchmarks in satellite deployment and scalability.

The cost-plus model has historically contributed to inefficiencies, such as prolonged timelines and cost overruns, as evidenced by programs like Ariane 6. PBCs, on the other hand, encourage contractors to focus on performance milestones, fostering a culture of accountability and continuous improvement. For IRIS², PBCs could drive faster implementation of cutting-edge technologies, particularly in satellite and user terminal development, areas where Europe has lagged due to its cautious and risk-averse approach.

Additionally, PBCs can streamline collaboration within the SpaceRISE consortium and its diverse stakeholders by establishing clear, outcome-oriented goals. This approach reduces the risk of conflicting interests, which have been a concern given the multi-stakeholder nature of IRIS². By incentivizing results over expenditures, PBCs ensure that funding prioritizes innovation and market-driven solutions, crucial for IRIS²'s role in enhancing Europe's strategic autonomy and technological leadership.

In summary, adopting performance-based contracts for IRIS² can mitigate bureaucratic inefficiencies by emphasizing accountability, fostering innovation, and ensuring that resources directly contribute to achieving the program's ambitious goals in a competitive global space landscape.

Policy Recommendations: Transforming European Space Capabilities

The appointment of a new Commission and the unprecedented increase in the EU's defense budget provide a unique opportunity to enhance European space capabilities and strengthen strategic autonomy. To capitalize on this momentum, well-considered and collaborative policy actions are advisable to address existing inefficiencies and foster innovation. The following recommendations outline a comprehensive framework for achieving these goals:

- First, the EU should consider replacing the outdated cost-plus model with performance-based contracts that prioritize milestones, speed, and innovative outcomes. By aligning contractor incentives with technological advancements and market competitiveness, this approach could help ensure that financial resources are directed toward measurable progress and deliverables.
- Second, fostering innovation ecosystems is highly recommended. Establishing and funding university-led R&D clusters could bridge the gap between fundamental research and applied innovation. Supported by industrial consortia, these clusters might help create pipelines of ready-to-market technologies. Additionally, encouraging university spin-offs and startups could accelerate the commercialization of research, creating vibrant ecosystems that connect innovation with industry.
- Protecting high-risk, high-reward projects within academic and industrial environments would also be a valuable step. Governments could benefit from establishing iterative testing cycles with rapid feedback mechanisms to encourage experimentation and adaptability. This would nurture creative problem-solving and help ensure that Europe's space sector remains resilient to emerging challenges.
- The EU might also explore adopting successful models of technological integration, such as Israel's Unit 8200. By investing in government-led R&D hubs that actively incubate cutting-edge technologies, the EU could act as both a catalyst and a partner in innovation. These institutions could help integrate academic research into strategic capability development, enhancing Europe's technological sovereignty and competitiveness in the global space industry.
- With increased defense budgets, the EU is encouraged to direct resources toward initiatives that align with the *Strategic Compass* and the *Space Strategy for Security and Defence*. Suggested priorities include the development of dual-use technologies, reusable launch systems, and next-generation satellite constellations to reduce dependencies on external actors.

- Integrating defense and civilian space efforts would be equally important. Military and civilian programs should aim for alignment to maximize synergies, leveraging platforms like *Galileo*, *Copernicus*, and IRIS² to provide secure communications, navigation, and surveillance for both societal and defense needs.
- Investments in advanced surveillance systems, collaborative exercises, and a comprehensive Space Threat Response Architecture would strengthen the EU's ability to detect, characterize, and respond to risks in the space domain.
- Centralized governance could play a crucial role in streamlining decision-making and ensuring coherence across space-related initiatives. Establishing a unified oversight structure under the EU Space Programme Directorate would likely align efforts with the EU's strategic objectives and improve overall efficiency.
- Finally, clear performance metrics should be developed to track progress and maintain accountability. Indicators such as reduced time-to-market for technologies, increased EU market share in global launches, and enhanced operational readiness of space capabilities could provide transparency and adaptability.

By considering and adopting these policy recommendations, the EU has the opportunity to position itself as a global leader in space capabilities, leveraging its resources and innovation potential to secure a sustainable and competitive future in the increasingly contested space environment.

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