A LONG-TERM VISION FOR THE EUROPEAN SPACE SECTOR

WHY A EUROPEAN INDUSTRIAL STRATEGY FOR SPACE MATTERS

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Executive summary: why does Europe need to devise an Industrial Strategy for Space?

The absolute criticality of space as a key asset for the independent and informed decision-making and action-taking of European policymakers has long been recognised.

An industrial policy is therefore needed to ensure that the public authorities have an unrestricted and sovereign access to the space-based infrastructure they need in order to implement public policies and enable the expected services, with the required level of independence.

This means that the capabilities to design, develop, produce, deploy and exploit the infrastructure are consistently available in Europe and under the control of European entities.

Regrettably today, the sustainability of the European space industry is under threat, which obviously creates an ever-growing risk of losing key capabilities. This risk is further aggravated by the fact that current challenges and threats to the European space sector are very rarely seriously assessed - let alone addressed by European institutions.

Even though specific measures are needed and can be useful to deal with particular situations, those measures can only make sense and be fully efficient if they are part of a coherent and European-wide industrial policy, all the more as space is now considered a high stake for Europe's security and influence in the world.

Such a strategy shall first aim at tackling the issues of:

- The reduced size of the (accessible) demand for European space systems, compared to the other large space powers;
- The fragmentation and structuring of the European institutional demand in small and sometimes cumbersome lots to ensure a "fair return" of industrial activities;
- The dependence on critical technologies, materials and systems procured outside Europe;
- The drop of industry's profitability that hampers its capacity to make further investments and fully take its share of Public Private Partnerships (PPPs) opportunities.

Such a strategy must also address the inefficiencies in the research, technology and innovation domain by ensuring greater coordination between R&D and public policies that drive demand for space infrastructure and associated data and services.

Finally, and following the recommendations of the EU Space Strategy for Security and Defence, and the Report issued by Sauli Niinistö on Strengthening Europe's Civilian and Military Preparedness and Readiness, space also needs to be coordinated into a broader defence framework to ensure that Europe capitalises on its strategic assets and supports innovation to meet emerging security challenges.

Hence, with the ambition to build globally competitive and sovereign European space capabilities in a highly challenging international market, the strategy will contribute to guarantee the robustness and the excellence of European space industrial supply chains.

Context

Amid the current geopolitical and economic challenges, **it is increasingly vital for public authorities to ensure they have an unrestricted and sovereign access to the space-based infrastructure they need in order to implement public policies and enable the expected services**; because, as recognised by EU institutions, space is of strategic importance and a key element for independent decision-making and action[1]. It is therefore necessary **to ensure that Europe has a domestic industry that can continue to provide the required capabilities with the required level of independence all along the space value chain**; this means that the capabilities to design, develop, produce, deploy and exploit the infrastructure are consistently available in Europe and under the control of European entities.

The three high-level reports (i.e., by Enrico Letta, Mario Draghi, and Sauli Niinistö) that were issued to guide the work of the new European Commission, properly addressed the crucial role of public investment in driving the development of the space industry in Europe. They emphasised that space markets are inherently dependent on institutional funding and that a stronger, more coordinated European approach is necessary to ensure overall sustainability and the sector's competitiveness (this global trend in the space domain was also recently underlined in ESA's December 2024 Space Economy Report[2]). Additionally, the reports addressed the need for regulatory harmonisation, the role of space assets in security and defence, and the importance of ensuring strategic autonomy to limit dependence on foreign suppliers.

A successful European space industrial strategy must be grounded in a comprehensive analysis of the current state of the European space industry, which remains primarily institutional, with the commercial (B2B and B2C) sector playing only a marginal role at global scale. The lack of coordination in EU Member States' investments (combined with the shortcomings of ESA's geo-return principle) provokes market fragmentation and weakens Europe's ability to create a stable and predictable industrial demand for its industry, limits economies of scale and reduces industry competitiveness in global markets. In this context, the absence of a coherent, European-wide, industrial policy contributes to supply chain vulnerabilities and hampers long-term investment in key strategic capabilities that are essential for Europe's strategic autonomy and sovereignty.

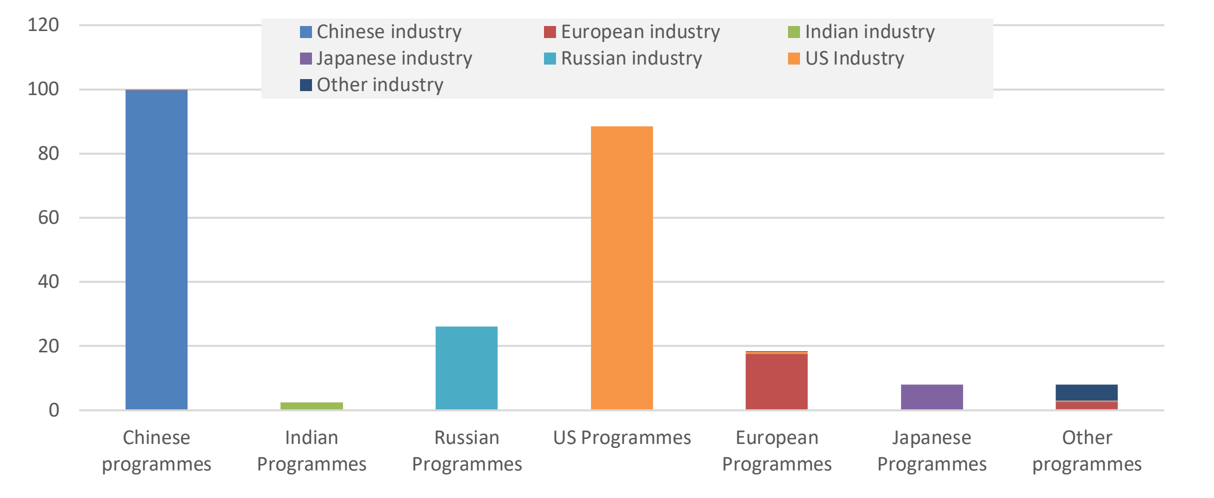
Without a joint and coordinated approach, European companies remain heavily exposed to external markets and their fluctuations where they face increasing competitive pressure from global space-faring nations with integrated and coordinated policies (especially from the US); today, no space-faring nation has achieved a "space power" status without a robust industrial strategy, based on domestic preference, to implement its space policy. Thus, for Europe to maintain its autonomy, it is imperative to conceive clear principles and ensure alignment of priorities and actions across all accessible policy instruments and at all policy levels.

[1] *Recent references include: "Space is critical for the strategic autonomy of the EU and its Member States. The functioning of economies, citizens and public policies increasingly relies on space-related services and data, including those in the field of security and defence. Space also contributes to achieving the EU's political agenda, enabling the digital and green transitions, and enhancing its resilience."* (Joint Communication "European Union Space Strategy for Security and Defence", JOIN(2023) 9), or "*whereas space capabilities have become indispensable not only because they make it possible to make autonomous assessments and decisions and take autonomous action but also because they are essential to EU and Member State civilian and military operations*" (European parliament Resolution "Strategic compass and EU space-based defence capabilities", 2022/2078(INI))

[2] *https://space-economy.esa.int/documents/b61btvmeaf6Tz2osXPu712bL0dwO3uqdOrFAwNTQ.pdf*

Global institutional spacecraft and launch services market for institutional programmes 2020-2024 (est. B$) by customer and supplier region

Source: Eurospace LEAT database



The chart above (source: Eurospace market estimates based on LEAT database and economic model) shows how institutional programmes are mostly devoid of global competition. Almost 100% of launch and spacecraft for government-funded programmes are procured domestically with strong enforcement. The sheer volume of activity accessible to US suppliers allows for much better industrial efficiency and enhanced competitiveness to win open commercial procurements.

Debunking "Competitiveness"

This chapter answers the question of the European Commission on how can it better supports the EU space industry to become globally competitive and resilient and what concrete steps are needed.

Placing "competitiveness" in a concrete market context

The current situation of European space industry as well as the industrial urge to move beyond merely "supporting competitiveness" narratives call for a clear focus on the actual needs of European space programmes, namely supporting European security, economic and social policies, securing supply chains for key capabilities and improving programme efficiency and profitability.

- Being "globally competitive" must assume that this term addresses the capability of European actors to win markets in global competition. However, the open demand for space systems is sporadic and limited in size compared to the large, captive demand organised around institutional programmes in other global space powers (e.g., in the US and China). Contrary to a widespread narrative promising the advent of a self-sustaining commercial space economy, domestic institutional demand still overwhelmingly drives market growth in the space domain;
- On top of that, international space procurement is heavily biased towards domestic procurement, leading to negative externalities for European players while creating advantages for European competitors;
- If the accessible demand for European geostationary satcom systems[3] is in rapid decline, the European space industry retains strong market shares in this market segment.

There is no doubt that the space commercial applications landscape has changed dramatically in less than a decade. In 2014, the European sector was embracing the transition from commercial satellite services to broadband access with solutions in GEO (investing massively in high throughput and flexible payloads) and in LEO (spear-headed by Oneweb and Airbus), while preparing the phasing out of Ariane5 in favour of a more versatile system (i.e., Ariane 6) to cover for both commercial and institutional launch demand. A decade later, the SpaceX steamroller has shattered these two market segments, with long-term impacts on the European space sector: Starlink has displaced the legacy satellite operators' offerings in the broadband segment, while the reusable Falcon 9 has drastically modified launch services economics[4].

In the meantime, the "newspace" trend has facilitated the emergence of many new start-ups in the space sector, including in Europe, promising a more competitive environment not only on legacy commercial markets but also on historic European institutional demand segments. However, the narrative of a commercially self-sustaining "newspace" economy has over-promised on political expectations and under-delivered on market results. In the absence of commercial success, ambitious "newspace" initiatives have long reversed from disruption to replication of the established public-private-partnership model: once prominent critics of institutionally dependent industries, the "newspace" ecosystem now vigorously calls for institutional budgets, government contracts and less domestic competition. As a result, even more players are now competing over the same scarce domestic demand: globally speaking, the demand for European space systems has shown limited growth in the period (1,6% CAGR) with the European industry posting consolidated sales worth 7,2B€ in

[3] *One key specificity of the European space industry's economic model was its dependence on the commercial GEO Satcom market as a way to counterbalance the limited size of the European domestic institutional market.*
[4] *Interestingly the two phenomena are intertwined, because it is thanks to the additional demand created by the Starlink system that Falcon 9 could create the economies of scale that now make the launcher extremely cost competitive.*

2014, up to 8,5B€ in 2023[5]. But in the period, with the dynamics of company creation and the wide availability of equity and grants for small and emerging players, the sector has gone through a rapid hiring spree (CAGR 4,5%) that results today in declining labour productivity, greater competition for R&D programmes, and overall deteriorating industrial efficiency. Moreover, the dwindling demand in the GEO segment has not met expectations and did not provide the revenues streams to amortise the investments in R&D, with key players now taking the full charge of these investments and taking the plunge on profits, as never seen before.

Ensure European competitiveness internationally

The key question regarding competitiveness is whether European actors are capable of providing the advanced technology systems that are necessary for Europe to achieve full independence. To bridge existing gaps, Europe should focus on:

- Identifying critical capability gaps requiring targeted R&I support and technological developments;
- Devising and implementing procurement approaches to support industrial sustainability and innovation and ensuring strategic public investment in key technologies and infrastructures to reduce external dependencies;
- Securing **a strong and sustainable commitment** from Member States to align the wide array of their procurement strategies (done through ESA and their national programmes) to support long-term industrial competitiveness and promote greater coordination.

A future space industrial strategy shall also encourage the commercialisation of new services, **in areas where credible viable markets have been identified:**

- The EU and MS indeed have an important role in creating sustainable business by nurturing a new market or business model, especially acting as anchor customers for the purchase of services. By creating a stable anchor demand, the EU and its MS can de-risk business cases and allow the emergence of secondary market opportunities with export and commercial customers.
    - Besides, the EU could also act as a “central purchasing body” (or by facilitating the setting up of such systems) as it would notably help by pooling the demand for space data and services across multiple national public authorities and streamline procurement processes, thus making it easier and more cost-effective for national public authorities to leverage space data.
- Taking into account possible risks of worldwide competitiveness, EU standardisation can act as a strong enabler for market uptake, by facilitating the largest possible adoption of European solutions;
- The funding of end-to-end demonstration missions have proven ability to foster innovation and early-testing capabilities in Europe: early demonstrators can open the way to commercial customers and export markets;

It is of paramount importance that the EU space industrial policy embraces the fact that commercial applications and export opportunities cannot create the stable and sizeable demand that the industrial space sector needs to thrive. Commercial markets and opportunities only exist in very few application segments, hardly covering the wider range of EU space policy needs.

[5] *Source: Eurospace facts & figures annual survey - these are in current economic conditions: while an accurate deflator for space systems production is not available, with current rates of inflation in recent years, in real term industry revenues could be seen as receding in the period.*

Challenges facing the EU Space Industry

This chapter answers the question of the European Commission on what does industry see as the biggest challenge facing European space companies in the next decade and beyond (next 15-20 years) and it can be addressed collectively

Despite a very strong position in the global commercial market and an expertise recognised globally, the whole European space value chain is disrupted and its sustainability is threatened by geopolitical, economic and industrial hurdles. The challenges the space industry faces could be summarised as follows:

- Geopolitical and regulation-related hurdles:
  - Supply chains' lack of resilience and continued dependence on critical technologies and systems;
  - Geopolitical instability with "traditional" partners threatening ongoing partnerships, while the absence of a clear strategy of international relations at EU level prevents exploring new collaborations;
  - EU "internal" fragmentation and limited consensus on a common strategy.
- Economic and industrial sustainability:
  - Security of supply within the shrinking open global markets;
  - Limited institutional (and fragmented) demand;
  - Shrinking commercial opportunities and intense price competition;
  - Drop in industry's productivity and profitability creating a cognitive dissonance with the "newspace" narrative.
- Bad/misleading market signals:
  - A so-called growing space economy which does not create opportunities for space infrastructure providers;
  - The focus on downstream applications (data/services) because of a lower barrier of entry favourable to "newspace" actors running the risk of disregarding or ignoring upstream capabilities, which are required to actually enable downstream services and which constitute the real, concrete, "hard power" component of any space power;
  - Commercial B2B and B2C business opportunities are not substitutes for institutional demand.

Geopolitical and regulation-related threats

In an increasingly polarised world, where national "protectionism" is on the rise, institutional space markets are largely captive to domestic players. European space actors face the critical challenge of securing a foothold in the limited and highly competitive open and export markets (see sub-chapter below entitled "meanwhile commercial business opportunities are less accessible to EU players"). USA is the largest global market for space systems, but provide only limited opportunities for European suppliers, putting them at a disadvantage due to regulatory barriers, procurement preferences, and unbridgeable price gaps. Moreover, Europe remains dependent from non-European countries for a number of critical components, technologies, equipment, and raw materials. This dependence could be "weaponised" to slow down European space projects and restrict their marketability.

Finally, an unregulated or low-regulated space environment represents a danger in the long-term for the European space industry. The Earth orbit is today populated by a large amount of space objects (whether they are operational satellites or space debris). The trend towards what looks like the pre-empting of the exploitation of the Low Earth Orbit by a few actors deploying their mega-constellations will eventually lead to a more congested, and contested, orbital environment for all players involved. The risks, notably in LEO, of increasing collision and interferences add to the complexity of decision-making processes for the proper identification of risk trajectories and the collective organisation of collision avoidance manoeuvres – thus the crucial need for sovereign SSA capabilities. Some countries (notably the USA) are already promoting their agenda for Space Traffic Management rules and standards; failure to act at the European level will eventually undermine European actors and threaten the sovereignty of the Union.

Economic and industrial threats

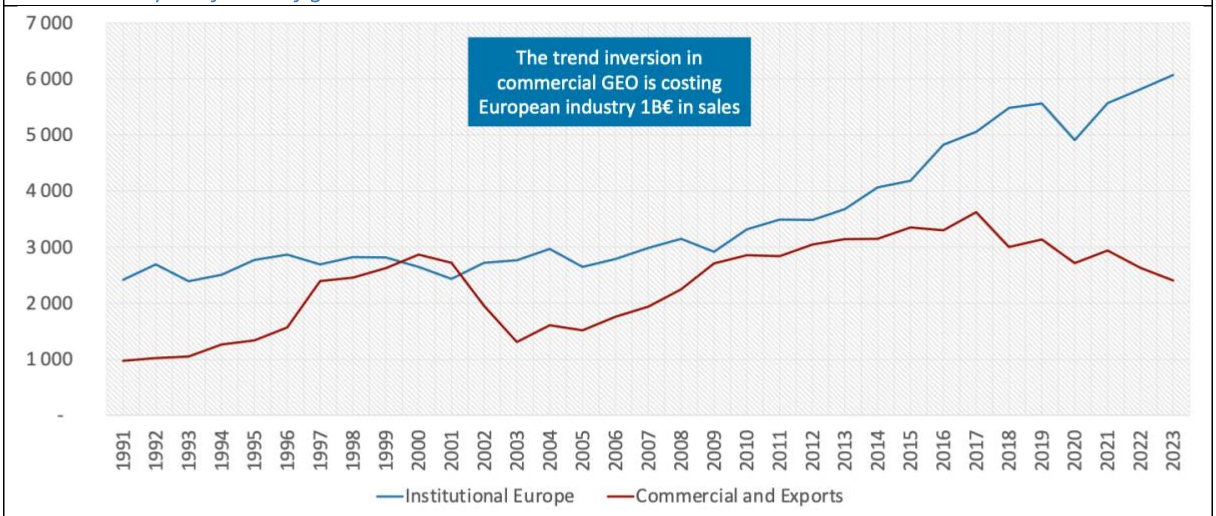
Commercial business opportunities are less and less accessible to EU players

Commercial business opportunities are becoming increasingly inaccessible to European players. In telecommunications systems, the importance of exports is particularly worth noting, representing alone 37% of the European space industry sales on the commercial market, and 42% of total exports.

Historic commercial customers and particularly GEO operators are restructuring[6], in response to declining profits and the declining demand for satellite television broadcasting services, by cutting investments and turning to new suppliers (especially as regional players opt for smaller satellites, as seen in the recent Thaicomsat/Astranis contract). Large industry players are also incurring significant restructuring costs.

The future of the commercial satellite communications business is very uncertain today. Price pressure outweighs volume increases (as seen in recent cases involving Mynaric and TESAT over optical terminals). Moreover, the institutional customers tendency to shift from Cost-Plus to Firm-Fixed-Price (FFP) contracts challenge established price making habits, as companies adjusting to these new contract models may have underestimated the costs.

European space industry sales by main market segment
Source Eurospace facts & figures



Since the early 2010s, the commercial segment has generated an average annual revenue in the order of 3B€, but in the scope of five years, it has declined by approximately 1B€. The trend is unlikely to be reversed in the medium term.

[6] *Only in the past 2 years Eutelsat acquired Oneweb, SES acquired O3B and Intelsat, Viasat acquired Inmarsat.*

Institutional demand remains limited

European companies must compete for a significantly smaller institutional demand and funding while they are also struggling to match price and innovation capabilities largely funded – for their domestic industries – by U.S. and Chinese government contracts. Contrary to what happens in all other space powers, and even though the European space budgets are slightly growing (even with ESA's budget growth concealing a significant underspending concern), the European space industry is compelled to be competitive on export and commercial markets in order to achieve a volume of activity necessary to ensure the "security of supply" and the critical activity mass to maintain its competences**, thereby submitting its sustainability to uncontrolled external factors**.

At Member States level, national space policies seem to focus more on nurturing their national industries with targeted capability-building programmes rather than on the joint efforts required to efficiently deploy shared European operational capabilities. If the overall effectiveness of the EU can stem from local capabilities when effectively coordinated, it is often overlooked that the development of overlapping critical functions among European states may undermine the development of a stable supply chain capable of meeting viable demand.

Incidentally, industry data shows that the European space sector is characterised by fragmentation and frequent capability duplications. For instance, Europe has over 40 satellite platform suppliers in the small to medium class, more than 10 prospective small to medium launch system suppliers, and more than 40 electric propulsion suppliers, targeting all possible electric propulsion technologies in the playbook. This highly fragmented landscape is prone to industrial inefficiencies and to difficulties in sustainability/resilience, in the frame of the comparatively low volumes of European accessible demand (particularly in the institutional segment).

Drop in industry's productivity and profitability

Corporate profit is used to support investment and innovation paving the way for the future. Hence, the industry sees profitability as a prerequisite to long term sustainability and an important contributor to one of the major objectives of the EU, which is to ensure the resilience of the European space industry and its presence on the international markets.

Profitability has become an issue in the European space sector, where many industrial actors are suffering from lower demand on their core Geostationary satellite market, which is however not compensated by growing demand in emerging segments. Moreover, the European space industry has more production capability than necessary to meet demand, leading to inefficiencies and increased competition within European market segments. This trend is compounded by the emergence of "newspace actors", supported by dedicated institutional instruments seeking to stimulate innovation by growing the number of space start-ups, without fully taking into account their need for long-term market sustainability (see below). The current low to negative profits situation progressively undermines investor and shareholder confidence, impairs the attraction and retention of talents, and reduces industry's ability to prepare the future.

This situation is worsened by:

- Stable to receding accessible markets, along with price pressure on existing segments, such as increased competition in launch services;
- A growing reliance on Fixed-Price-Firm (FFP) contracts for government programmes, bearing more risk for the supplier when development issues arise, which further squeeze profits;
- European overcapacity in some segments which further adds competitive pressure on vendors and may lead to overoptimistic price targets;

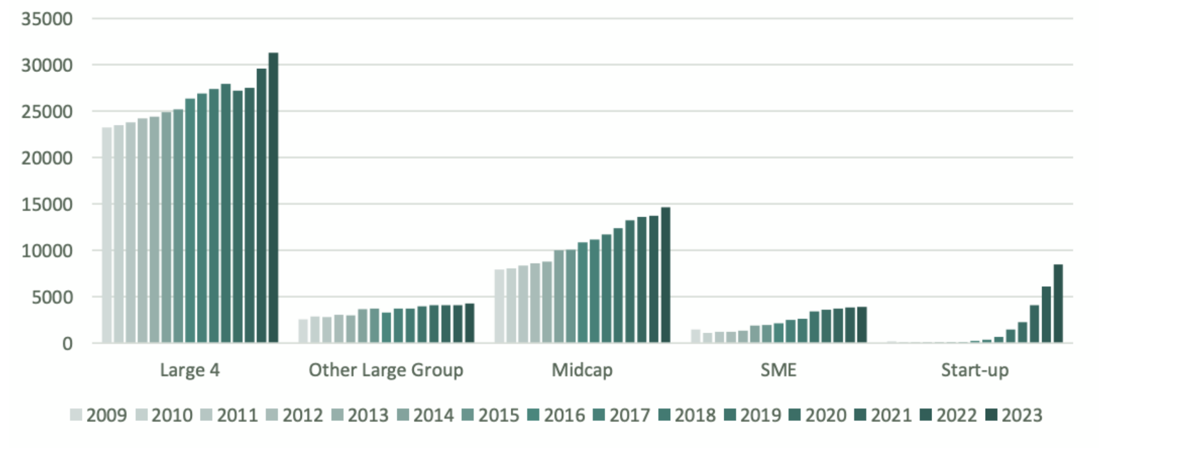
- The increasing complexity of space systems, and the sometimes-insufficient duration of preparation phases to analyse and mitigate potential risks;
- The increasing requirement for private sector to co-invest or co-fund the programmes even in the institutional domain (i.e., temptation for PPP schemes);
- Restructuring charges, reducing time to market.

The misperception created by a bubbling start-up environment

The sustained growth of the "new space" start-ups segment (representing today 14% of the European space sector workforce) is the main reason why European space industry employment has grown massively in the past 5 years. This has brought to the European space supply chain new industrial capabilities while promoting the notion of growth in the space sector and creating the flawed perception of a strong market dynamism.

Most of the new players in the space sector are characterised by the low maturity of their products and services, and the majority are still in pre-revenue phase. In order to cover their costs, they rely primarily on sustained investor trust, raising equity as they progress towards maturity. They also, increasingly, rely on dedicated institutional support programmes for research and development available at ESA, EU and national levels - with about 250M€ of cumulated institutional support in 2023, institutional programmes are estimated to represent the most of this industry segment's revenue. While sizeable, in absolute terms, the amount is vastly insufficient to sustain the segment, and without a sizeable growth of the market accessible to European players, even those able to roll-out a viable product or service, will face a very challenging environment[7].

European space industry employment by industry segment - evolution 2009-2023
Source: Eurospace facts and figures



It is interesting to note how the market opportunities targeted by most of the emerging space players are associated to the projection for exponential demand for (small) satellites and launch services, driven by the expected blooming of commercial space applications.

The high frequency of misleading market signals

The overwhelming presence - in the specialised press and at professional conferences - of messages touting the exponential growth of the "space economy" has created an environment for very high market expectations in the sector, influencing industrial and investment strategies, and European space policies. Regretfully, the

[7] *See the difficult situation of Mynaric who was enabled to transition from an R&D success story to industrialisation and is now facing bankruptcy. https://finance.yahoo.com/news/mynaric-announces-receipt-delisting-notice-151500200.html*

indicators provided by leading investment firms have not proven very useful for the predicting the future of space infrastructure markets.

The analysis of macroscopic trends performed at Eurospace, using metrics such as mass at launch and business opportunities provided by actual global demand for space systems (and the related launch services), **does not confirm the so-called "hyperscale moment" or a paradigm shift in space activity worldwide**. This is not due to a lack of growth in mass deployed to orbit (which is indeed growing exponentially since 2019) but rather because this growth is driven almost entirely by a single player: SpaceX, deploying its extensive Starlink constellation. Besides Starlink deployment, there are only two actual growth trends: the increasing Chinese investment in military programmes and China's recent commitment to human spaceflight (including the development of its own permanent space station). These two factors account for 99% of the growth observed in space activity, both in mass and value, over the past five years.

Of course, neither the expansion of Chinese space activities nor the deployment of Starlink offer any business opportunities for European space systems manufacturers.

The fallacy of "the growing space economy" is mainly due to biased assessments of space "value chains" serving the narrative of a subset of the financial community, mostly Private Equity investors and Venture Capital funds.

While the investor community has provided a significant influx of cash into the sector (more than 50B$ in equity in the decade, about 20% invested in European companies), and even in the light of a few exceptional success stories (like SpaceX or Blue Origin), we note that this investment has not created any significant additional demand for European space.

Even in the USA, the effectiveness of this investment is questionable: about half of the funds raised by US newcomers were drawn by 2 companies (i.e., SpaceX and Blue Origin) who have yet to produce dividends for their shareholders more than 20 years after being founded. A few others (i.e., Virgin Galactic, Astra, Rocket Lab, Planet Labs, Spire, Blacksky, Satellogic, Virgin Orbit, Momentus, Mynaric...) joined the Special Purpose Acquisition Company (SPAC) Initial Public Offering turmoil of 2020 and 2021 reaching unusually high enterprise valuations. However, after 4 years, none has yet reached a profitable state, and a few are cash-strapped when not bankrupt. It is yet to be demonstrated that this investment has sustained an economically sustainable paradigm shift for the space industry.

Addressing the challenges ahead

Markets

This chapter answers the question of the European Commission on how could EU procurement processes be improved to boost competitiveness & promote an "Industry made in Europe" in the space sector and what innovative procurement practices from defence industry could be adopted to the space industry.

As a preliminary remark, it is important to recognise that the current "competitiveness" narrative may overshadow the most urgent need to address the question of industry-sustained capacity to provide the required, reliable, cost-effective products to its European institutional customers.

Fostering a more efficient demand

To compensate, hopefully temporarily, the scarcity of public budgets for space, it is important to rationalise the efforts and ensure that, at least, the suppliers of the most critical capabilities have a sufficient volume of activity to sustain profits and to allow for evolution and improvements. In this frame, there is a need for all relevant institutional actors to join forces to devise and implement measures aiming in particular at fostering a more efficient and predictable demand by:

- Stabilising products and promoting outlets for European products;
- Increasing the recourse to recurring systems for operational missions, and developing and using standard interfaces;
- Encouraging the take up of space-based services by public authorities (for instance through norms and regulations, or a service-oriented policy), in order to create a sustainable primary institutional demand that will enable/accelerate the emergence of profitable secondary commercial markets.

It is therefore of prime necessity that the EU does its share of the effort by using the EU Space programme to implement a European space procurement policy that takes four parameters into account:

- The space strategies of our direct competitors: each country has its own specificities but the objective of independence, or even domination, is commonly shared by the largest space powers;
- The nature of space programmes, that are by nature long-term, complex and risky;
- The guarantee of continuity and quality of the services (when entered in operational phases), which must become a key criterion in addition to cost and "value for money";
- The need to empower the full supply chain, rewarding SMEs and midcaps alongside larger primes.

An EU space procurement policy should also take into account the situation of limited competition in the space sector which is characterised by a paradoxical situation:

- On the one hand, European institutions seek the multiplicity of potential sources to guarantee a minimum level of competition for their large programme procurements;
- On the other hand, in a limited and relatively flat market where major long-term procurements are scarce, the industry, in an attempt to achieve the critical mass required to bid for large procurements and secure the workload to preserve its critical skills, performs vertical and horizontal integration;
- In the meantime, the expression of national priorities supports the elaboration of complex procurement schemes, often aiming at securing targeted national returns.

Industry recognises the benefits of a healthy competition and the importance for its institutional customers to have at their disposal multiple providers; but there is a need to acknowledge that **maintaining several**

economically sustainable sources (i.e. profitable ones) comes at a cost that institutions will have to bear, in particular if no other outlets than the European institutional ones exist for the systems considered.

Address fragmentation of the demand

Even though procurement processes cannot inherently boost competitiveness, they can contribute to a healthier sectoral development.

Unfortunately, in the space sector, large operational programme procurements (e.g., Galileo, Copernicus, IRIS2) have often been influenced by national considerations that extend far beyond the objective of securing the best solution for Europe. Instead, these processes frequently prioritise ensuring a “fair” distribution of procurement among specific countries. This creates complex tender regulations that significantly constrain the structure of the offers with conflicting objectives, namely the quest for the best offer (technically and financially) and the achievement of a variety of industrial policy goals.

If this situation can be understood from a political point of view, European public stakeholders must also acknowledge that this approach does not favour the proper expression of competitive forces in European institutional procurements.

The first concrete step consists in assessing the impact of the variety of procurement rules for space systems in Europe (at national level, ESA and EU levels), and consider their impact on the marketplace fragmentation, which results in supply-chain fragmentation. Hereunder is a number of suggestions from industry:

- Ensure that institutional programmes stimulating industry innovation and competitiveness are dimensioned proportionally to the target markets that can reasonably be expected, and that it reflects the diverse capabilities of Europe’s full supply chain;
- Remove unnecessary barriers, such as the ones based on the age or size of the industrial actors, which prevent them from selling their products or having a fair access to the market:
    - At the same time, it is also important that mechanisms are put in place to support smaller entities to obtain the required level of security accreditation, and the financial capacity to address critical or large-scale programmes. There is also the need to protect these smaller entities from foreign takeovers, especially if they were supported by public investment.
- Service procurement:
    - Procurements for operational or pre-operational services could be applicable for activities with a certain predictability of commercial success. Anchor tenancy is considered an interesting approach to financially de-risk investment and development, and lead the way to operational services (there will however still remain a need for public support for future developments/riskier technological acquisitions).
- Offer business opportunities:
    - For start-ups that are scaling, as much as for more mature companies, support instruments must be complemented by actual business opportunities for their products and/or services.
- Rewarding at fair levels the risks borne by the European space industry:
    - Profit is used for self-investment and innovation and key to attract and/or sustain the motivation of investors and shareholders. There is, among other, a need for rewarding subcontracting in order to incentivise the involvement of the whole supply chain.

Technological sovereignty

Securing critical supply chains means promoting a good understanding of capabilities, readiness and dependence situations (both critical and non-critical), of European interdependencies within the supply chain and ensuring European technological sovereignty over its domestic market.

Europe's dependence on the supply of a number of components is indeed detrimental both to European autonomy and to the competitiveness of the European space industry. It is a well-known situation that, on a number of critical technology areas, European programmes are **fully dependent on a single supplier outside Europe**. The issue of non-dependence is a therefore a subject of concern among the EU, ESA, EDA and the space industry, all gathered inside the "Joint Task Force" on critical technologies, where, in theory, systematic assessments of the situation are made to ensure the coordination of the dependence reduction. Unfortunately, despite numerous alerts by industry, the JTF continues to have serious flaws, both in the consultation process (which actively prevents the collection and consolidation of supply chain inputs at industry level; it even prevents communicating the information properly to the relevant stakeholders) as well as in its scope (as it continues to only address the dependence to low-level building blocks, and to not embrace the service/system levels as well).

The necessary imports to make European spacecrafts (and launchers) functional are very often **subject to US export regulations** (i.e., International Traffic in Arms Regulations – ITAR) often creating procurement delays and putting the European space industry in a situation of additional dependence in the short term. They also limit the export of European systems to countries approved by the USA, and are thus submitted to political considerations out of European control.

It is thus necessary for the European public entities as well as the European space industry to ensure in the future that the technological non-dependence and the security of supply is fully covered. The **need to replace or update existing technologies and products**, the **challenge to develop new ones** and the **difficulty to maintain critical skills** on a market with long programme cycles and highly fluctuating orders are as many challenges to be dealt with in the short/medium term.

Moreover, space supply chain performance is critical to the success and profitability of space projects: delays in delivery, low performances and quality issues can cause increase of costs and schedule drifts.

Devise and implement an ambitious and efficient R&I Strategy, supporting the objectives of the industrial policy for space

This chapter answers the question of the European Commission on which key technologies or missions should be prioritised for development in the mid-and long-term.

As the space industry is one of the most research-intensive sectors in Europe (notably due to the high technological constraints of space systems), space technology and product development require important investments in industrial equipment (including test equipment), software, design & modelling tools and protocols development & maintenance, not to mention the scientific and technological competences required within industry, agencies, research centres and laboratories.

In 2025 and beyond, European equipments are expected to support new challenges for space markets, in particular:

- Shorter lead times;
- Adaptability to swift market evolutions;
- Production in larger series or batches (e.g., for COTS equipment), with global quality control;

- Higher potential for re-use, considering common interfaces, standard designs and applicability across a variety of systems, missions and applications;
- New requirements and regulations supporting sustainability, lower environmental impact, resilience, autonomy, reparability.

A Research & Innovation Strategy is one of the key pillars of a much-needed technology strategy, itself part of the future European Industrial Strategy for space. In this context, the objective for the European space industry is that the R&I Strategy contributes to ensure the on-time availability of needed/advanced technologies focusing on ground and/or flight demonstrations rather than renewal of technological building blocks approach – with the appropriate maturity and performance, the required level of non-dependence, and at competitive conditions – for risk mitigated implementation in the European institutional programmes, and in the commercial programmes where industry faces an increasingly harsh competition.

The quality of the European public support to R&D in space should be measured by key characteristics:

- Consistency and predictability: an ambitious and efficient R&D strategy – aiming at supporting European industry competitiveness, at maintaining the technological readiness for the EU-owned operational infrastructures and at preparing the development of the new components of the EU space programme – has to ensure consistency among the various sources of funding for space R&D at national, multinational and EU level;
- Persistence: the European space sector needs the presence of a stable, reliable, efficient, and persistent (i.e., long- term) investment plan to support any serious ambition;
- Balanced positioning in the global ecosystem: technological and component-level non-dependency shall be pursued to enhance European autonomy. At the same time, Europe should find niche key infrastructure and capabilities that are much sought-after and therefore valuable on the global market (e.g., SSA, high-revisit/high-resolution Earth Observation, LEO PNT).

Serving a number of technology priorities

In the short to mid-term

EU Space R&D should first and foremost strengthen the areas in which the European space industry is already well positioned. It is also key to identify the enabling technologies that will become essential or even critical, e.g.:

- Efficient and affordable access to, in and from space;
- Increased support to the evaluation of new mission concepts towards a European flagship program (IoT, connected cars, servers in space, quantum communication, cybersecurity...)
- Active antennas;
- Integrated photonics;
- On-board computing, also using AI;
- Fusion of Space surveillance data (radar/optics/RF) including fusing space-based and ground-based origins;
- Digitalisation;
- Higher level of satellites autonomy;
- Active cooling in space;
- Solar generators;
- Ultra-Deep Sub-Micron technology for efficient FPGA and ASIC solutions and System-in-Package;

- Smart structure skins (resilience to debris and aggressions);

Within a 10-year frame

The major priorities identified for the next 10 years are:

- A more sustained investment in European sovereign capabilities to reduce the gap with Europe's main competitors. This would also enable regular IOD/IOV missions that are vital to increase the readiness of European solutions;
- Affordable, robust and sustainable access to space, building on cooperation and European interdependence to achieve fully independent orbital access for all European programmes;
- Space Situational Awareness via ground and space-based SST-enhanced sensor network, improved and interoperable database and added value services;
- Modernisation and expansion of Copernicus & Galileo constellations and services;
- Governmental satcom added-value services for different use cases;
- Multi-layered (GEO, MEO, LEO, VLEO) satcom constellations and enabling technologies (propulsion, structures, cyber, intersatellite links, orchestration traffic distribution etc.), paving the way to the future interconnection of missions in space;
- Building significant European capabilities for in-orbit related operations, recognising the potential of adverse use of these capabilities and the need to protect European infrastructures and interests in space (market-driven servicing, in-orbit manufacturing and assembling, self-protection, debris removal, reusable in-orbit vehicles, in-orbit repair, observation and mitigation of threats);
- Reducing costs and speeding up production times for mass-produced satellites with new, more digital and faster production and testing methods;
- Up-to-speed ground segment operations with technology innovation and maturation allowing to handle high data rate with stronger security requirements and develop *Software as a Service* (SaaS) with an open and flexible architecture available on cloud;
- Cybersecure space supply chains (i.e. in a large number of products and services including chip components and modules/sub-systems used in satellites and other payloads, applications, communication, backend systems and cloud platforms, on the ground and in space).

Reconcile European ambition and space leadership

This chapter answers the question of the European Commission on how can Europe reconcile its ambition for space leadership.

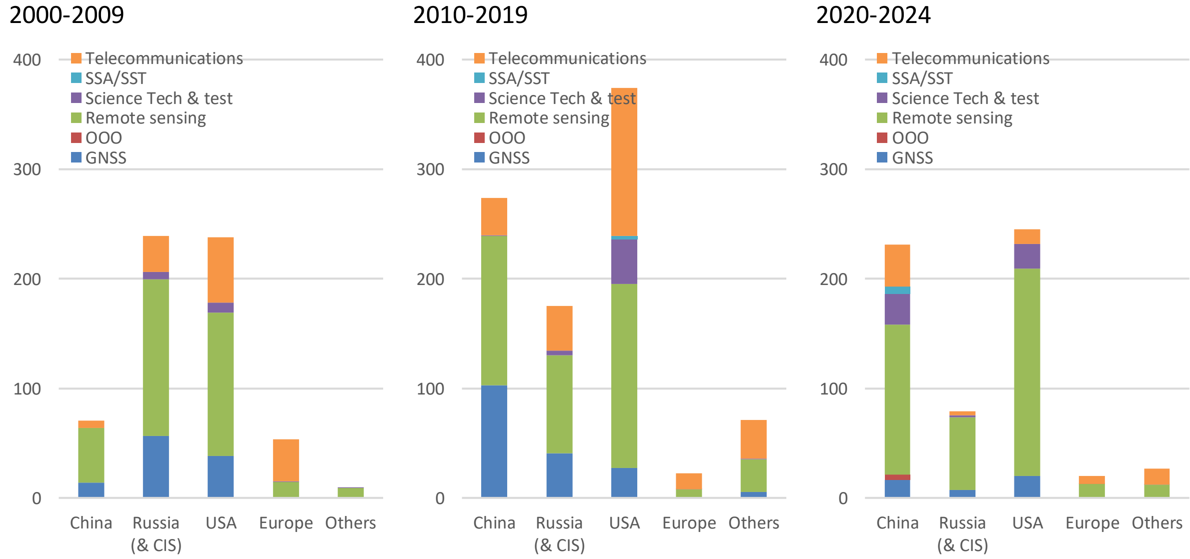
Today, Europe is a second-rate space power falling behind the three space superpowers (i.e., the USA, China and Russia) in particular in the domains of access to space and "sovereign applications" (situation assessment and control, intelligence, early warning etc.), even if European space actors have demonstrated their ability to deliver world-class operational systems in most capabilities.

Europe has, in the past, achieved a unique area of "leadership" in space by hosting the preferred launch services operator for commercial customers and missions that dominated for over two decades the commercial launch services landscape with Ariane 4, Ariane 5 and Vega. European manufacturers also secured a competitive position in the commercial geostationary satellite market, at times achieving nearly 50% global market share. However, this segment is now in decline, with demand shrinking and little prospect for recovery.

The industry considers that Europe continues to occupy a "leading" position with excellent performances in space science and in a number of operational capabilities (in meteorology for example, or in environmental monitoring with Copernicus) that provide vital services to the EU's 450 million citizens and many more in the rest of the world. These successes should not be overshadowed by the fascination with the Starlink mega-constellation that delivers high-speed internet to 6 million people worldwide. Let us build our future European capabilities in space on the excellence of European realisations.

Obviously, one of the most significant obstacles in the defence-related aspect of space leadership lies in the comparatively limited public investment in military space capabilities, a sector that supports probably more than half of the space capabilities in the USA, China, and Russia. This underinvestment has placed Europe at a disadvantage in sovereign applications such as intelligence, Space Situational Traffic and Space Domain Awareness.

Mass launched (tons) on behalf of military programmes worldwide, by customer region, decade and application



The capability gap between European military/strategic space assets and those of the other space powers is very wide. Critical capabilities available from space systems include among others: tactical observation supporting projection of forces and intelligence (including economic), early warning for missile attacks, border protection, maritime domain surveillance, aerial domain surveillance, orbital domain surveillance, signal intelligence, global communications. All these capabilities are widely developed in the USA and (probably to a lesser extent) in China and Russia. Considering the constant shifts in international relations, Europe shall start embracing the possibility of bridging the capability gap with the other space powers.

A second obstacle identified by Industry to leverage a strong EU position and leadership is linked to Member States nearly exclusive focus on nurturing their national industry rather than increasing and improving operational capabilities at European level. Cooperation between institutional customers must be recognised at once as the appropriate dimension to guarantee the “foundations” of any space policy (safeguarding capabilities, strengthening the resilience, competitiveness, and reliability of the industry, and enhancing technological non-dependence, as all major space powers are doing). This approach must be European, not national. In concrete terms, this means, for Member States (which indeed keep their competence in space policy), to start coordinating among themselves in order to define if and how they want to make use of their competence to contribute to the objectives of a common (EU and Member States) European space policy, not to abandon their national sovereignty but to reinforce collective European sovereignty.