



**Executive
Summary**

European Space Strategy in a Global Context

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EUROPEAN SPACE STRATEGY - A UNIQUE APPROACH TO SPACE

Europe – the Member States, the EU, the European Space Agency (ESA), the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) – is one of the most experienced actors in the international space arena and operates a highly regarded space programme.

Remarkably, Europe’s successes in space have not been guided by a single unified European space strategy, but rather by a tangle of different and inherently contending space strategies that reflect the rather complex interplay of the distinct constituencies composing the triangular structure of the European space governance:

- The strategy of ESA, an intergovernmental organisation, which over the past 40 years has taken the lead in promoting European cooperation “in space research and technology and their space applications” and carrying out the major European space endeavours, though lacking political clout.
- The space strategy of the EU, which has only recently started to position itself as an additional and effective space player, demonstrating the willingness – and also the legitimacy – to assert political leadership in promoting advancing space activities in Europe.
- the different strategies of the member states of both organisations which, despite a common basis do not exactly coincide.

Each player in this composition has its own specific competences and interests. Notwithstanding the institutional mismatch among the strategic interests of the various actors, important convergences and a set of common objectives have progressively consolidated, as eventually reflected in the “**Joint EU/ESA Statement on the shared vision and goals for Europe in space**” adopted on 26 October 2016:

Overall Ambition	The overarching ambition stated in the document is that “ Europe remains a world-class actor in space and a partner of choice on the international scene. ” By 2030, Europe should be able to fully benefit from its space solutions to implement policies, to strengthen European values and security, improve knowledge and foster prosperity”.					
Strategic pillars	The three strategic pillars on the way towards the overarching ambition are: <table border="1" data-bbox="379 1375 1382 1776"> <tr> <td data-bbox="379 1375 703 1776"> <p>To maximize the integration of space into European society and economy, by increasing the use of space to support public policies, providing solutions to the big societal challenges and strengthening civil-security synergies</p> </td> <td data-bbox="703 1375 1046 1776"> <p>To foster a globally competitive European space sector, by supporting research, innovation, entrepreneurship for growth and jobs across all Member States, and seizing larger shares of global markets.</p> </td> <td data-bbox="1046 1375 1382 1776"> <p>To ensure European autonomy in accessing and using space in a safe and secure environment, and in particular consolidate and protect its infrastructures, including against cyber threats.</p> </td> </tr> </table>			<p>To maximize the integration of space into European society and economy, by increasing the use of space to support public policies, providing solutions to the big societal challenges and strengthening civil-security synergies</p>	<p>To foster a globally competitive European space sector, by supporting research, innovation, entrepreneurship for growth and jobs across all Member States, and seizing larger shares of global markets.</p>	<p>To ensure European autonomy in accessing and using space in a safe and secure environment, and in particular consolidate and protect its infrastructures, including against cyber threats.</p>
<p>To maximize the integration of space into European society and economy, by increasing the use of space to support public policies, providing solutions to the big societal challenges and strengthening civil-security synergies</p>	<p>To foster a globally competitive European space sector, by supporting research, innovation, entrepreneurship for growth and jobs across all Member States, and seizing larger shares of global markets.</p>	<p>To ensure European autonomy in accessing and using space in a safe and secure environment, and in particular consolidate and protect its infrastructures, including against cyber threats.</p>				
Essential foundations	These three pillars are underpinned by the “ solid foundation of excellence in science, technology and applications, expressed through an environment of outstanding education and skills and a thorough knowledge base”.					

Figure 1: Core components of the European space strategy emerging from the 2016 Joint EU/ESA Statement

The overarching vision and three strategic pillars are the by-product of a specific approach to space that makes Europe a *unicum* in the international arena. Unlike all the other space faring nations for which strategic autonomy and prestige considerations have been the primary justifications for public expenditures, European public investments in space have been primarily subject to the logic of economic return, being conceived as an enabler of economic growth and job creation in Europe, fostering its innovation potential, supporting scientific progress and responding to public policy objectives.

The pillars of the strategy also reflect a unique situation worldwide. When benchmarking Europe with other major spacefaring nations, clear structural differences come to the fore. The most important is that **Europe lacks a significant and continuous level of public demand in space infrastructure and services:**

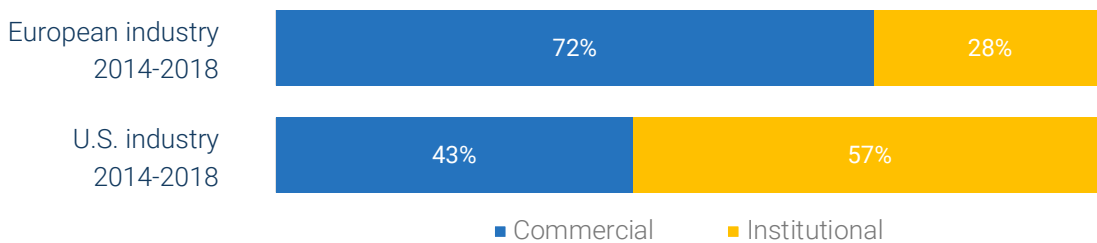


Figure 2: Distribution by market of the spacecraft mass produced by European and U.S. industries

Notwithstanding – or exactly because – the limited institutional demand and higher exposure to the hazards of commercial markets, **the European space sector has emerged as an undisputed worldwide leader for its efficiency and competitiveness.** The space sector is one of the few industrial sectors where Europe remains extremely competitive with respect to the United States, Russia, China, Japan or India.

With only 4% of the global space workforce (corresponding to approx. 45,000 jobs in Europe), **Europe is the 4th space manufacturing power worldwide** and provides about 15% of worldwide spacecraft production. Specifically, the European space industry has produced 17% of the global satellite industry output and launched about 16% of the space infrastructures in 2018.

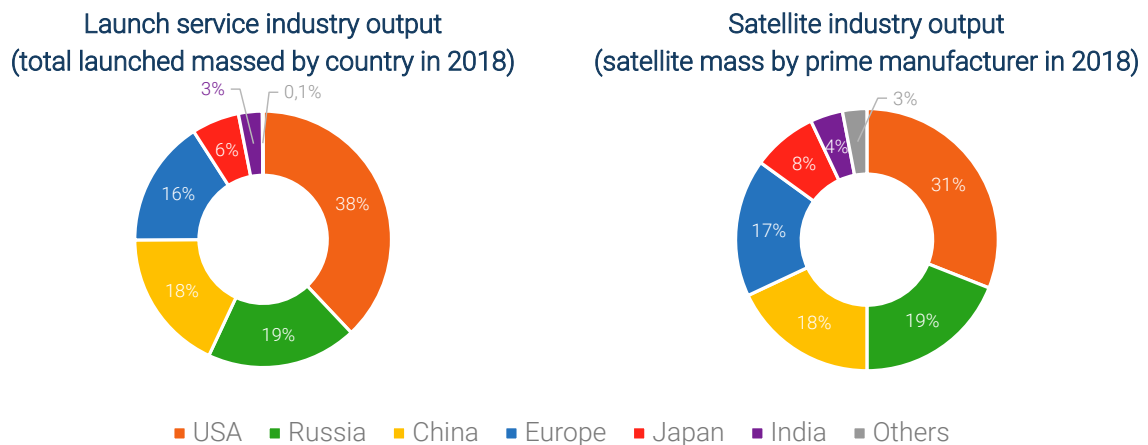


Figure 3: Industry output of the major space actors worldwide (source: ESPI database)

What is perhaps even more remarkable is that the dominant position Europe enjoys on global markets has been achieved at very effective budgetary conditions: the European budget, which represents only 12% of global space expenditures, is indeed suggesting that “the European way” to the space sector development has been, so far, highly successful. However, the space sector is undergoing profound transformations that may question the long-term viability of this European way and the successful fulfilment of the objectives set forth in the space strategy.

INTERNATIONAL TRENDS IN THE SPACE SECTOR

The global space sector is undergoing profound transformations impacting both the positioning of Europe in the international space arena and the fulfilment of the objectives set forth in its space strategy.

A rapidly expanding space sector

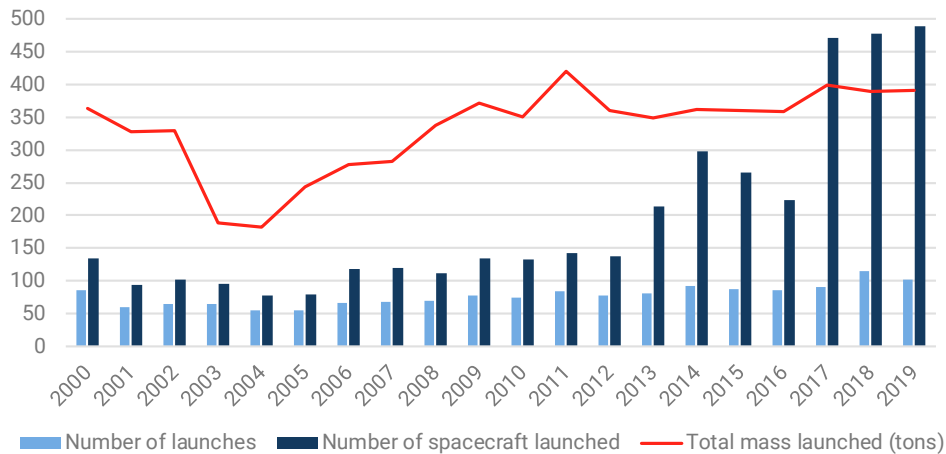


Figure 4: Evolution of space activity since 2000 (Source: ESPI Database)

The expansion of actors and activities

The number of countries undertaking space activities has moved from being a very exclusive club to a much wider group of developed and developing countries, with very diverse capabilities.¹ A clear indication of this is the growth in the number of countries with a satellite in orbit, which in only a decade has increased from 50 in 2008 to 82 in 2018.

A Growing and diversifying space economy...

While governments continue to represent the main source of funding for space, over the past few years private funding has also tremendously grown, “with unprecedented private capital flows in the space sector from angel and venture capital investments”.²

...driven by a new sectorial dynamic

Usually referred to as *NewSpace*, the term generally indicates a commercially driven approach to space, marked by ambitious undertakings aiming to capture space markets with innovative schemes and business models. In this new ecosystem, private actors are playing a more prominent role, pursuing the eventual goal of conducting space business independently from governments.

The evolving role of public agencies

The progressive rise of the private sector has entailed a transformation of the role of public agencies. Indeed, even if early-stage R&D, technology maturation and space science remain their realm, other phases of space missions are now increasingly delegated to private actors. Instead of directly subsidising industry, space agencies continue to support the private sector through their participation in funding rounds, the establishment of anchor customers contracts, or the development of joint initiatives.

¹ OECD, 2019.

² *ibid*

A disruptive technological context

Change of paradigm in space technology production

Breakthroughs in hardware and spacecraft design (incl. advances in commercial-of-the-shelf (COTS) approach), have shifted the production paradigm towards affordable and miniaturised space systems, while preserving and expanding capabilities and unlocking new services and application areas.

Integration of broader breakthrough technologies in the space sector

Although some space system technologies are endemic to the space sector (e.g. propulsion systems), advancements throughout the space sector are also largely enabled by universal technological developments. In recent years, some of these new concepts are being increasingly integrated to space, adding to the emergence of new services and their applications

A more challenging operational and geopolitical environment

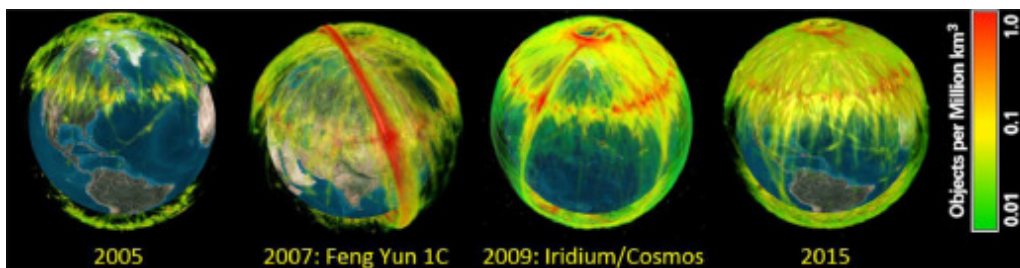


Figure 5: Evolution of space population spatial density, 2005 – 2015 (Source: D. Oltrogge)

Increasing congestion and risks of collisions and interferences

Increase in spaceflight has produced more complex and dynamic orbital traffic, particularly in LEO region and both in terms of functional objects as well as space debris. This congestion of the space environment naturally creates a number of risks for space operations - particularly concerning collision and interference hazards. The consequences of a collision between two objects in space can be dramatic.

Growing geopolitical tensions extending into the space environment

Developments in the space sector do not take place in isolation from the broader international context. Less stability and reduced transparency affect space-related activities and generate worrisome prospects for peaceful international coexistence in the space domain. The intensity of military space activities sees a resurgence in several forms, including dual-use. In addition to established space powers reconsidering their doctrines, new countries have been launching their pioneering military space efforts.

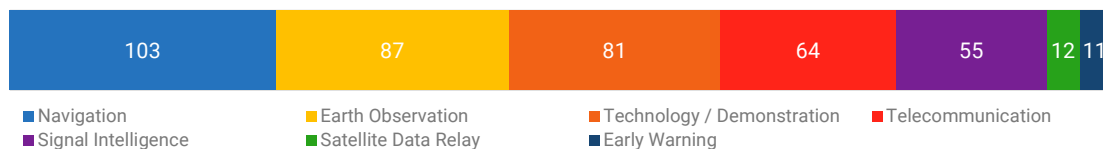


Figure 6: Military and dual use payloads 2010 - 2019 by mission category (Source: ESPI Database)

Ambivalent space governance developments

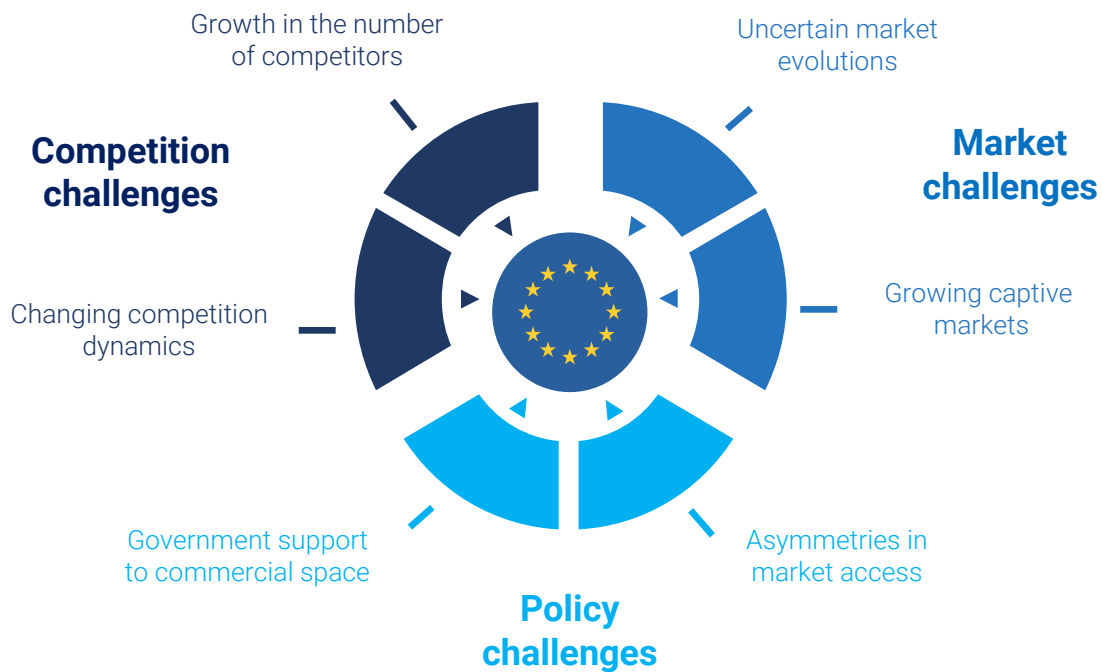
The governance of space activities has difficulties keeping up with technological developments and characteristics of the global space sector. The current international legal framework based on the legacy of UN space treaties, individual national regulatory frameworks and increasingly common soft law instruments does not provide a universal set of common rules for engagement in space.

CHALLENGES FOR EUROPE

The unfolding transformations of the global space sector are bound to have important implications for the strategic objectives set forth in the European space strategy. Two objectives are in particular put at stake due to their inherently international dimension, namely Europe's ability to

- Foster a globally competitive and innovative space industry
- Access and use space in a safe and secure manner

International Challenges to Europe's competitiveness



Main observations:

- **Growth in the number of competitors.** Europe is already faced with strong international competition, but new competitors are in fact arising due to the greater involvement of the private sector in space activities and the emergence of New Space, the rise of new "spacefaring" nations bringing new ambitions in space, and the return on the commercial markets of actors that had been previously inactive. The evolution of space policy strategies in major countries reflect as a common denominator the willingness to capture share of the international market.
- **Changing Competition Dynamics.** The emergence of new private actors with ambitious strategies that give prevalence to market disruption (including large ICT firms) is a non-negligible competitive threat for well-established traditional space industries in Europe. In the absence of adaptation to these new technological developments and, more broadly, sectorial trends, the principal risks are that:
 - European institutions will not be able to adequately support their industry and research communities to retain and grow their positions in the global space sector, with this possibly resulting in the failure to create new markets and lead them by the European industry.
 - "Traditional space" companies may see a progressively reduced importance, with some disappearing completely.
 - Much of the supply chain may be captured by a few, large non-European players and some might disappear completely.

- **Uncertain Market Evolutions.** The unfolding technological (r)evolution brings about disruption of traditional business models. The profound transformation of the global telecommunications sector, which has traditionally been instrumental in sustaining the entire European space industry, is now having uncertain ripple effects along the entire value chain. There have been changes in the user demand with the emergence of new connectivity requirements increasingly urging satellite operators to align with the concept of universal access. Perhaps the largest change currently affecting satcom is the major shift from watching broadcast and satellite broadcast television to watching non-linear television over the Internet.
- **Growing captive markets** According to ASD-Eurospace, only the 36% of the total space activity worldwide in the past two decades is represented by open markets, i.e. markets that can be served by international competed contracts. The 64% (in mass) is represented by institutional captive markets. These “captive” markets are a source of concern for European industry because: a) they cannot be accessed by European satellite manufactures or launch service providers and b) they create a negative externality to the “open” commercial markets at the detriment of European industry.
- **Asymmetries in market access.** All institutional missions of the United States, Russia, China, Japan and India – which represent the largest portion of the total market – have been satisfied by domestic suppliers, on the basis of strict procurement rules. Hence, by default they have precluded any competition from European suppliers. Conversely, the European institutional market – whose size is already more limited compared to U.S., Russian and Chinese ones – has been often open to competitive bids. Europe is indeed the only major spacefaring actor for which a “domestic preference clause” for institutional missions is not systematically implemented. As a result of these diverging dynamics, Europe struggles to penetrate foreign institutional and commercial markets.
- **Use of economic diplomacy.** Foreign competitors are increasingly adopting aggressive market penetration strategies to support the competitiveness of their industry by favouring space exports. Together with price dumping and unfair price competition through national subsidies, trade policy and economic diplomacy have become important instruments that major countries have turned into in order to support and expand the positions of their national space industry worldwide. This active involvement of governments in space economic diplomacy play a substantial role in the performance of their domestic industry on the commercial markets and directly challenge the position gained by the European space industry.

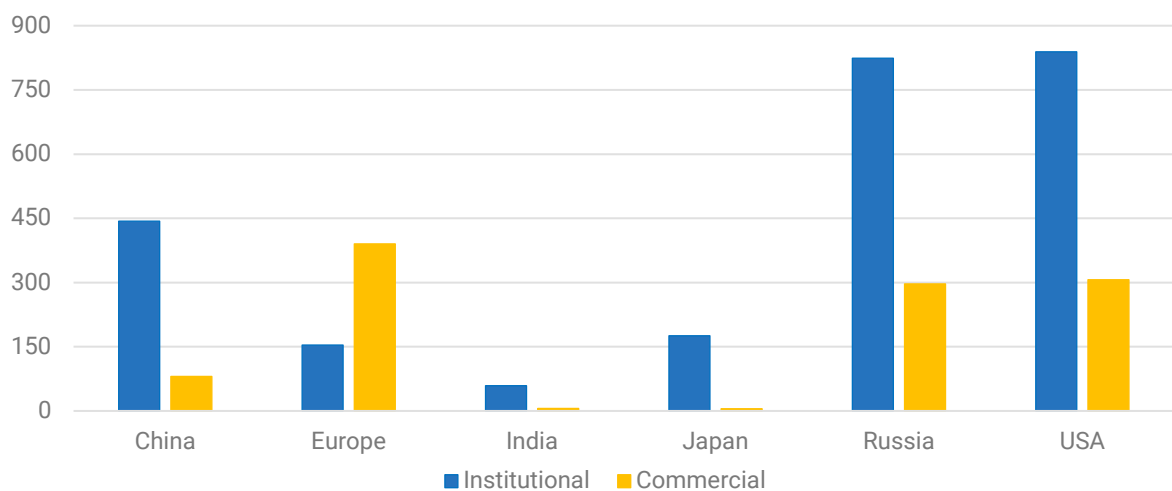


Figure 7: Captive and commercial launches in mass (metric tons) by launch country (2010-2019)
(Source: ESPI database)

International challenges in accessing and using space safely and securely



Main observations:

- **Low compliance with international standards and best practises.** Among the tools to prevent the escalation of collision risks, the principal one has been the definition and implementation of a set of principles outlining how space systems should be designed, operated and disposed of to mitigate their impact on the space environment. A distinct challenge relates to problematic adherence to post-mission disposal guidelines put in place through international frameworks (e.g. by the IADC or UN COPUOS). The level of compliance with international guidelines for space debris mitigation is still rather low. Experts also estimate that the overall level of compliance could be negatively affected by the skyrocketing number of CubeSats launched every year.
- **Ineffective International approach to SSA / STM.** A first challenge concerns the capacity to monitor a higher number of objects, at least those that pose a serious threat to safety of space operations. Another challenge is related to the limited accuracy of current SST data and the resulting uncertainty of conjunction analyses and collision risk evaluations. On top of these technical challenges, the effectiveness of SST capabilities is further limited by difficulties to process data into actionable information for all. Also, in the case of a collision risk between two operating satellites, the coordination between operators may also be a source of problems, as it is still predominantly based on manual and increasingly obsolete processes involving e-mail exchange
- **Rising threats to European space infrastructure security.** Because of the substantial, continuous and long-term investment in the space infrastructure, and the deepening integration of space systems and services provided by them in other sectors, the European space strategy attaches consideration to the capacity to protect assets against threats in space. European space infrastructure may become the target of deliberate attacks to physically harm the system, to permanently degrade or temporarily disrupt its capabilities or to intercept confidential information. Whereas kinetic attacks to European systems remain unlikely, cyber-attacks are perceived as a clear and present threat. Indeed, in recent

years, cyber-attacks to both terrestrial and space systems have become ever more frequent, with an increasing number of targets and motivations, and perpetrated by a growing number of actors.

- **Changing international postures in space defence.** Major governments are reconsidering their doctrines and adopting more muscular postures in the space domain. The major space powers are:
 - Starting to address space as an operational warfighting domain alongside land, air and sea: As a consequence, space increasingly appears as an arena of future conflict.
 - Reorganizing their armed forces to better address and integrate the space domain: Overall, it is the whole spectrum of space defence activities, from research, development and acquisition to operation and command that is concerned, following new national doctrines and objectives.
 - Developing offensive and defensive capabilities as part of space security and deterrence strategies: Major space powers are advancing technologies to disrupt space systems (e.g. kinetic or energy weapons, RPO, electronic and cyber) but also exploring new approaches to reinforce the resilience of their critical space infrastructure.
- **Security of supply and supply chain insecurity.** While a capable actor in the space domain, Europe still need to externally source certain components that are not available within European boundaries to foreign suppliers. In addition to most visible foreign dependence on EEE components, there are many other technical domains where Europe relies on foreign sources for meeting critical needs, including, for instance, advanced materials, equipment, processes, and modelling tools. Ultimately, the current situation for Europe means remaining at the mercy of external forces and accepting a higher level of vulnerability with regard to both security of supply (unrestricted access to required technologies, products, services or information) and supply chain security (control of security throughout the programme lifecycle).
- **Reduced political autonomy.** Europe's lack of autonomy may impact its freedom of action and ultimately restrict its capability to decide when and under what conditions to develop its space programme. In addition, by maintaining the status quo Europe may not enjoy the autonomy to freely choose its partners, due to possible external pressures. By the same token, the continued reliance on third party assets might deter third partners from proposing joint initiatives with Europe, because of Europe's need beforehand to secure a green light from foreign authorities. Equally important, dependence on the political will of external actors harms its prestige and bargaining power on the international stage, making European diplomatic efforts, its potential to influence others, and the exercise of soft power, less effective. What is at stake here is the long-term possibility for Europe to promote its position as a leader in space and strengthen its role as a global actor.

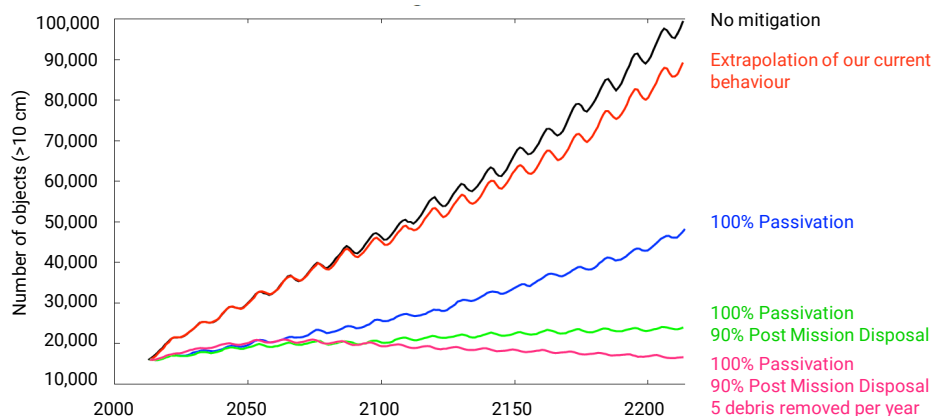


Figure 8: Evolution of space debris environment and effectiveness of mitigation measures (Source: ESA)

ADDRESSING THE CHALLENGES: THE ROLE OF DIPLOMACY

*The space ecosystem is mutating and many challenges ahead of the Europe have a strong, sometimes dominant, international dimension. Overall, it is the place of Europe **as a competitor** on commercial markets, **as a partner** in international endeavours and even **as an actor** in outer space that is at stake.*

In this challenging international context, the request of the European space sector is that European institutions implement all necessary measures to protect the industrial, commercial and strategic interests of Europe, in the same way other space powers do.

Among the policy responses to these challenges, **coherent and assertive action to promote Europe's interests and defend its positions on the international arena proves of paramount importance**. Indeed, given the impact that international trends and undertakings of other actors have on European space strategy, European efforts to cope with the identified challenges necessitate actions in the international arena. As also recognised by the EC in its Space Strategy for Europe³, Europe's efforts to meet the three goals of its space strategy will be undermined unless the continent achieves a fourth goal, that of "taking a much stronger role on the world stage".

Diplomacy, generally understood as the dialogue and conduct of negotiations between sovereign nations, is a major instrument to meet this goal. Importantly, when applied to the space context, the term can assume a variety of forms, as briefly summarised in Table below

Space for diplomacy	Diplomacy for space	Diplomacy of space
The utilisation of space cooperation to support foreign policy goals (e.g. strengthen political and economic ties with third countries)	The conduct of diplomatic initiatives to support the fulfilment of public space objectives (e.g. space industry exports, programmatic synergies, etc.)	The formulation, negotiation and implementation of initiatives to manage strategic interaction in space and ensure convergence of behaviours

The role of diplomacy to support competitiveness of Europe's space industry

European actors have already embarked on a number of activities aimed to support the competitiveness of European space industry. However, no concrete actions have been taken to address the recent growth of competition amidst market asymmetries and to restore a level-playing field on the international stage. Europe is the only major power for which a clearly stated preference on the procurement of space-based systems or services from European industry in the context of institutional programmes is still lacking. In addition, Europe has been making lesser use of economic diplomacy to promote access to foreign markets for its industry and space is not well connected to foreign policy efforts at European level.

In order to secure the long-term competitiveness of its industry, future European efforts should be first and foremost driven by the need to address the growing asymmetries in the global markets. Today, the request of the European space industry is that governments and European institutions implement all necessary measures to protect the industrial, commercial and strategic interests of Europe, in the same way other space powers do. In addition to a needed domestic action, it is clear that Europe's quest for restoring a level-playing field with other spacefaring nations also need to go through complementary diplomatic measures.

³ Available at: <https://ec.europa.eu/docsroom/documents/19442>

To role of diplomacy to support safe and secure access & use of space

Given its limited appetite for power competition, the comparably lower support towards a muscular military doctrine based on the maxims of space control, as well as the complex multi-layered governance, Europe's efforts towards ensuring and safety and security of its space infrastructure inevitably require sound actions in the international arena.

Diplomacy and tools of international cooperation indeed offer a complementary way of addressing the identified challenges and do not necessarily reflect the same rationales as the programmatic tools or the legal instruments measures put in place on the domestic front.

Equally important, because of the very nature of space as a shared resource, any negative development on safety, security and sustainability of space operations will have a widespread impact across the entire space community. Individual efforts to tackle these challenges are certainly needed, but these will not suffice alone to properly ensure continued ability to access and use space safely and securely in the future. Space safety, security and sustainability can be effectively pursued only by ensuring the adoption of internationally agreed principles, norms and rules that clarify behavioural standards and reduce the risk of mistrust, misunderstandings, and mishaps.

Diplomatic measures overview

In addressing these strategic objectives pertinent to the European space strategy, European actors have already embarked on a multifaceted set of actions in domestic front as well as on international stage. Alongside these measures – and considering the trends at play and actions pursued by other actors – ESPI identified six areas of diplomatic actions that European actors could consider to further pursue:

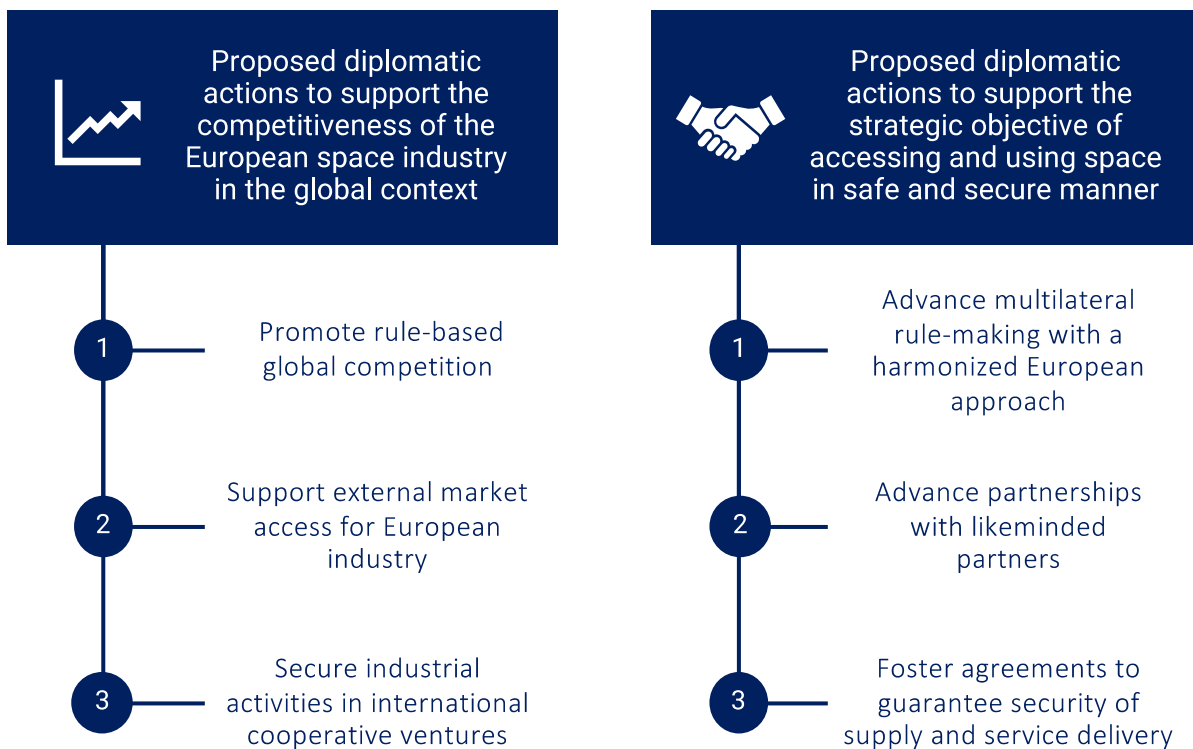


Figure 9: Diplomatic actions in line with the objectives of the European space strategy

The bottom line: Towards dedicated policies making greater use of diplomacy

As the global space sector is rapidly shifting towards a scenario characterised by the growth of strategic competition in the commercial, political and security spheres, the need for sound diplomatic action is inevitably bound to increase. **An assertive and coordinated European diplomacy on can do a lot to cope with the challenges ahead and avoid that European singularities turn into European weaknesses.**

As amply discussed by the speakers at the 13th ESPI Autumn Conference, leveraging diplomats is of paramount importance in protecting European interests and positions on the international scene, be it on commercial markets or bilateral and multilateral frameworks. It is however recommended that European actions on the international stage should be consistent with and embedded within the broader agenda and action of the EU on the international stage, which should itself become more strategic, assertive and united.



ESA Director General Jan Wörner addressing the audience of the 2019 ESPI Autumn Conference

Besides this, there is also a need to make these actions an integrant part of dedicated policies serving the interests of the European space sector, in line with a clear and shared political vision for Europe in space and space in Europe. More specifically, **any international action should be fully integrated in a European policy framework taking into account both “internal” and “external” aspects**, thus including:

- Relevant external actions to promote European positions and protect European interests,
- Appropriate mechanisms to promote a coherent diplomatic engagement by:
 - enhancing the coordination between European stakeholders
 - ensuring consistency between internal and external actions
- Mandates to ensure an appropriate representation in relevant fora

In light of the specific challenges faced by Europe, two dedicated sectorial policies would be needed, i.e.:

- Space industrial policy
- Space security policy

The need of these two policies is broadly recognised by institutional and industrial stakeholders alike. In order to ensure the successful implementation of these policy initiatives, Europe needs to remain a major player on the global scene. Towards this, there is a need for Europe to move towards:

- a **coherent – if not unified – European space diplomacy** that will be an integral part of the European space strategy and embedded in the broader international agenda
- a **top-down approach to space policy**, with key areas for common policies and diplomacy action such as space industry and commercial business as well as space security and defence
- a more **strategic, assertive and United Europe in space**, which itself would require crafting an effective one-voice system to ensure that EU will be in a position to weigh in international negotiations.

Meeting these requirements, and in particular progressing toward a more strategic, assertive and united Europe, will be an essential condition to maintain a level playing field and fair competition, to ensure a safe and sustainable access to and shared use of outer space and to preserve Europe’s place as a key actor and partner in space.

ABOUT ESPI



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ESPI is supervised by a General Assembly of member organizations and supported by an Advisory Council of independent high-level experts.

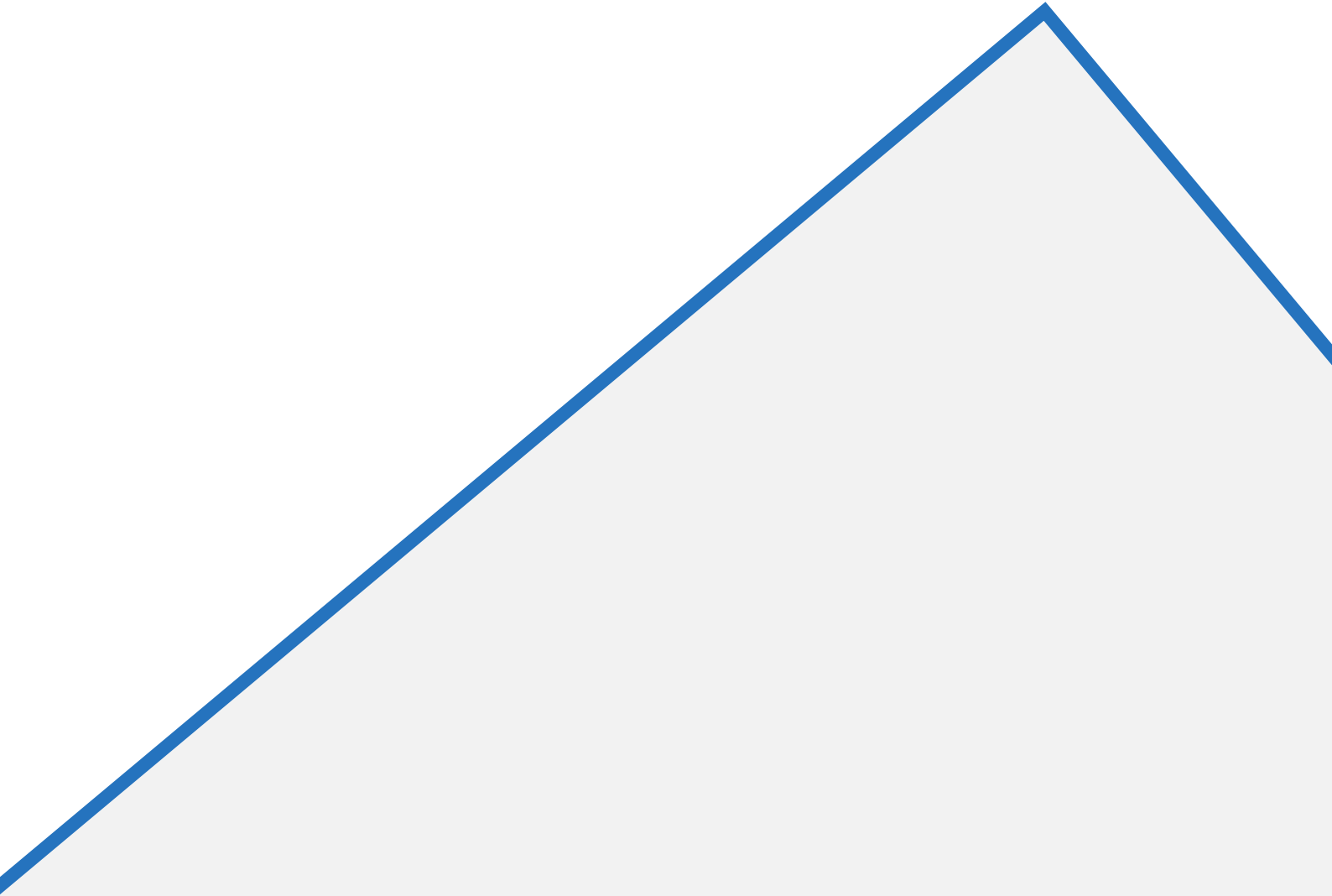
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