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PART 1/2

COMMISSION STAFF WORKING DOCUMENT

IMPACT ASSESSMENT REPORT

Accompanying the document

Proposal for a Regulation of the European Parliament and of the Council

on the safety, resilience and sustainability of space activities in the Union

{COM(2025) 335 final} - {SEC(2025) 335 final} - {SWD(2025) 336 final}

Contents

Glossary of abbreviations

3SOS	Safety, security and sustainability of outer space
B2C	Business to consumer
CER	Critical Entities Resilience (Directive)
CRA	Cyber Resilience Act
CSIRT	Computer security incident response team
ENISA	European Union Agency for Cybersecurity
ESA	European Space Agency
EU SSSD	European Union space strategy for security and defence
EU SST	EU space surveillance tracking
EUSPA	European Union Agency for the Space Programme
FTE	Full-time equivalent
GEO	Geostationary Orbit
HAO	Higher airspace operations
IADC	Inter-Agency Space Debris Coordination Committee
ISAC	Information sharing and analysis centre
LCA	Life cycle assessment
LEO	Low Earth orbit
MEO	Medium Earth Orbit
NASA	US National Astronautics and Space Administration (NASA)
OECD	Organisation for Economic Cooperation and Development
OEF	Organisational environmental footprint
OEWG	Open-ended working group
OST	Outer Space Treaty
PEF	Product environmental footprint
PEFCR	Product environmental footprint category rules
SMEs	Small and medium-sized enterprises
SPOC	Single point of contact
STM	Space traffic management
TFEU	Treaty on the Functioning of the European Union
UN	United Nations
UN COPUOS	UN Committee for the Peaceful Uses of Outer Space
VLEO	Very low Earth orbit

1. INTRODUCTION: POLITICAL AND LEGAL CONTEXT

Space systems have become essential for today's economies and society in the EU. Member States' public policies increasingly rely on space systems and related services and data, including in security and defence. Space systems also contribute to achieving the EU's political agenda, enabling the digital and green transitions, and strengthening its resilience.

These systems are vital for the EU single market in important sectors of the economy, such as banking, finance and insurance, energy, telecommunications, aviation and rail. Many critical functions of society, such as civil protection, police, coastguards and the military heavily rely on satellite systems and the data and services they provide. It is estimated that approximately 10% of the EU's GDP is dependent on satellite navigation signals[1].

Space systems facilitate a wide range of applications that are an integral part of our daily lives, e.g. satellite television, internet connectivity and navigation. They enable the operation of infrastructure, such as smart power grids and gas pipelines, and strategic sectors, such as finance (e.g. high-frequency trading). Space systems and services are also essential for security and defence operations, with defence spending on space capabilities continuing to increase at national[2] and EU level[3].

The global space economy[4]

The global space market reached a value of EUR 368 billion in 2022, an 8% increase from 2021. Satellite navigation and communications spearhead revenue generation, constituting 54% and 38% of revenue respectively, largely propelled by business-to-consumer (B2C) applications. North America, Europe and Asia dominate the market, with Europe having experienced a steady 7% growth over the past five years. Key industrial players are concentrated in these regions, especially for the upstream segment, benefiting from strong domestic demand and mature commercial markets.

The upstream market refers to all activities related to sending objects, satellites and people into space (manufacturing, launch and ground segments[5]). There are different types of clients, most of them commercial clients, and the market is particularly driven by satellite constellation projects. Civil government bodies prioritise national industries and non-profit activities, while defence bodies contribute to lower-volume, high-end systems often influenced by the US budget. The downstream segment refers to services and applications that use satellite data. In this sector, commercial activities – especially B2C applications – dominate, and the primary customers are private companies and end users.

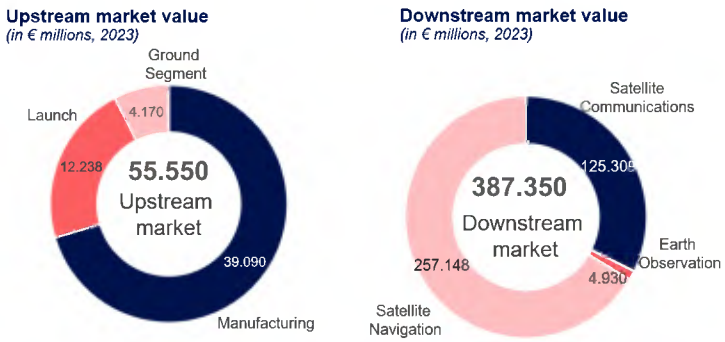
Looking ahead, the global space economy is set to continue growing and have an estimated value of EUR 700 billion by 2031. This expansion is primarily attributed to the flourishing space services sector, fuelled by new supply and demand drivers, disruptive innovation, and transformative business models. The industry is undergoing a profound transformation, witnessing the emergence of a range of new players and prompting traditional incumbents to reassess their business strategies.

[1] European Commission Galileo | Satellite Navigation - European Commission
[2] Roughly EUR 1.5 billion per year, i.e. 15% of European space budget, according to Eurospace Facts and Figures (2023).
[3] More than 10% of the European Defence Fund supports space-related projects.
[4] Source: Euroconsult, Space Economy Report 2022.
[5] Ground segments means the Earth-based infrastructure essential for space operations, including ground stations, communication equipment, control centres, and facilities for spacecraft assembly and infrastructure needed for carrying out launch activities, such as the launch pad.

Focus on Europe

The European space sector, the third largest in the world after North America and Asia, has been growing over the past decade, driven by an increasing demand for space-based data and services. Today, its valuation (public government budgets, private revenues, investments) is worth EUR 84 billion (20% of the global space economy). The EU Space Programme supports more than 250 000 jobs across all segments (e.g. satellite communication, launchers)[6]. Employment in the European space sector has been experiencing steady growth in recent years, fuelled by a rising demand for space-qualified professionals, particularly driven by the expansion of New Space start-ups and small and medium-sized enterprises (SMEs)[7]. Europe's share of the space market by segment totals about 10% (EUR 5 billion) of the global upstream market value (estimated at EUR 55 billion in 2023), behind the US and Asia, which represent 50% and 15% respectively. For the downstream market, Europe's share represents just under 25% (EUR 89 billion) of the total value, which is seven times larger than the upstream (89 billion) of the total value.

Figure 1: Upstream and downstream market value (globally) (Source: Euroconsult 2023)

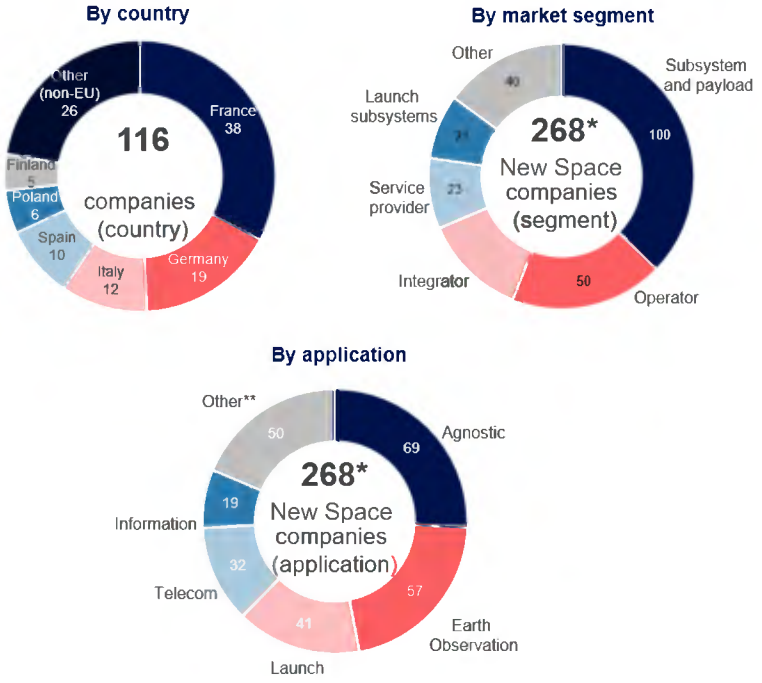


Space activities used to be concentrated in a few Member States (France, Germany and Italy) and dominated by large established industrial players. However, in the last few decades, space and the use of space applications have become more accessible, helping new companies enter the market. This has enabled the emergence of new commercial entrants (known as New Space actors) across all Member States, leading to economic growth and job opportunities.

[6] The future of European competitiveness – In-depth analysis and recommendations (Draghi Report), 2024 (p. 173). Available at: ec1409c1-d4b4-4882-8bdd-3519f86bbb92_en

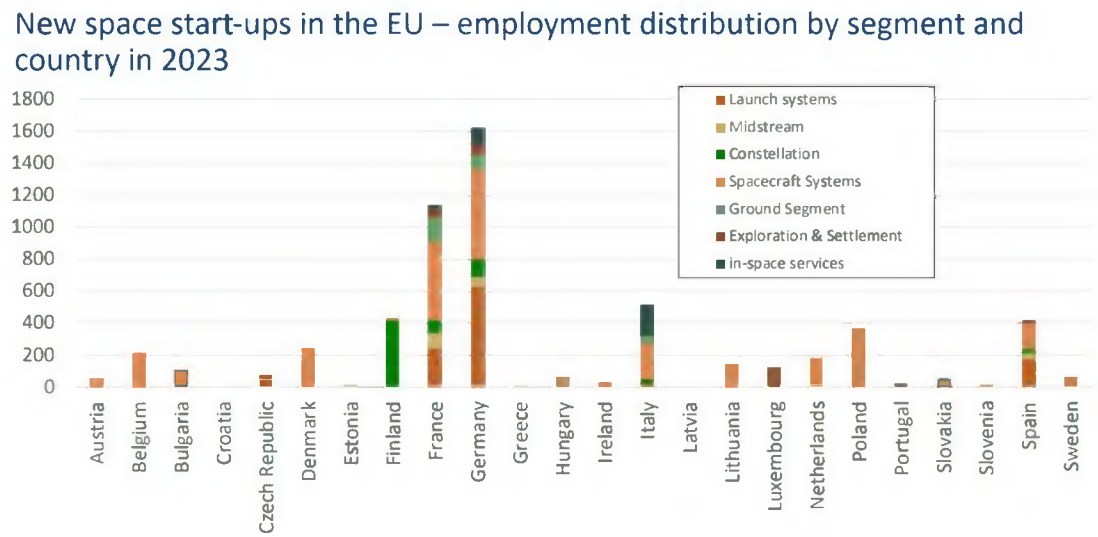
[7] Facts and Figures Report 2024, ASD Eurospace. Available at: Eurospace Facts & Figures - Eurospace

Figure 2: New Space in Europe: number of companies by country, market segment and application (Source: Euroconsult 2023)



* Can be counted twice because a company can be active in multiple applications/segments
** includes space logistics, signal intelligence, Space Situational Awareness (SSA), and human spaceflight

Figure 3: Overview of New Space employment in Europe (Source: Eurospace)



The European space sector saw significant growth in space investment in 2022. Total investments reached EUR 1 billion, up by 23% compared to 2021. Compared to the US, European companies, however, still face challenges, including smaller deal sizes and a concentration of capital in a handful of companies[8].

[8] Space Venture Europe 2022, ESPI.

As the global space economy is projected to reach a value of over EUR 700 billion in 2031, Europe stands poised to play a pivotal role in this expansion. If it maintains its current market share, the value of the European space economy will grow to EUR 378 billion by the next decade.

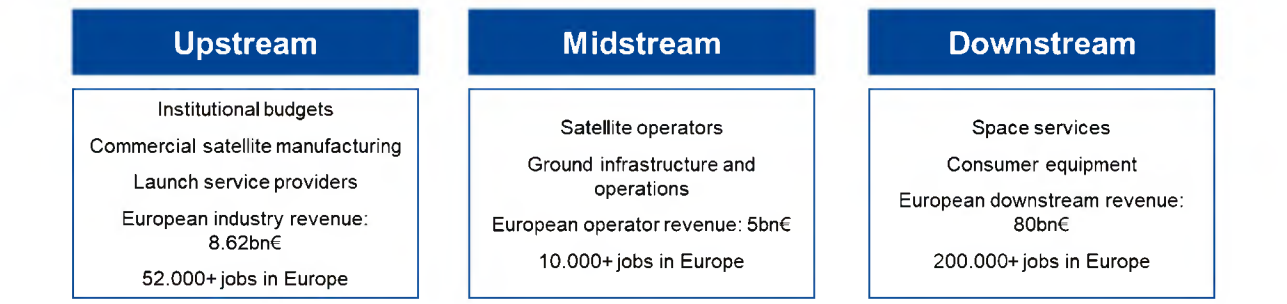
Bilateral trade in spacecraft (including satellites) and spacecraft launch vehicles

Recent data published by Eurostat[9] indicates that, between 2011 and 2021, EU exports and imports in spacecraft and spacecraft launch vehicles grew annually by an average of 23% and 12%, respectively. While most trade still took place in a few Member States dominated by large established industrial players (e.g. France, Germany, Italy, Spain and Luxembourg), many other Member States started to engage in bilateral trade. Particularly in the last few years, Belgium, the Netherlands and Sweden have seen a large increase in the value of exports and imports.

Member States have mostly been exporting to trading partners in non-EU countries (approx. 61% of total exports) and importing mostly from EU countries (approx. 55% of total imports). Nevertheless, the amount of extra-EU exports and imports has been increasing more rapidly compared to intra-EU exports and imports (respectively, a yearly average of 130% and 263% for extra-EU exports and imports, and 6% for both intra-EU exports and imports).

In the last decade, the space sector has undergone a profound transformation, driven by significant technological advancements, the reduction of costs in accessing and using space, and the expansion of private space activities, accompanied by the emergence of New Space actors. Against this background, more than 800 space companies have been created across all EU Member States, contributing to exponential economic growth and job creation. They cover all application domains: satellite communications, Earth observation and satellite navigation (see Figure 2 above). Some of these companies own and run their satellite constellations to generate data or provide services. Moreover, there are 44 companies currently developing launcher solutions in Europe (26 in the EU), which will require orbital launch sites in Europe[10].

Figure 4: Overview of the European Space economy (source: Euroconsult, Eurospace, EUSPA)



The emergence of New Space is the result of a series of technological and business model innovation trends, lower costs, shorter product development life cycles and a more balanced sharing of industrial risks between the public and private sectors. Both the EU and Member States have put in place measures to harness the potential benefits of New Space companies'

[9] https://ec.europa.eu/eurostat/web/experimental-statistics/european-space-economy-thematic-account More details can be found here: European Union/European Space Agency (2023). *Developing a space economy thematic account for Europe*. Publications Office of the European Union, Luxembourg.

[10] Euroconsult 2023.

innovation and services. The Commission has set up the CASSINI Space Entrepreneurship Initiative to facilitate access to more than EUR 1.5 billion of private financing. This has helped to ensure growth in the sector in Europe, with more than EUR 1 billion invested in 2022, most of which was through venture capital investment, in more than 100 deals. The Commission also increasingly acts as an anchor customer for EU New Space companies[11]. Additionally, Member States' governments, particularly defence ministries, are gradually procuring services from these companies[12].

The rapid expansion of space activities has created growth for the space market and underscored the **inherently cross-border nature of space activities**. Components, facilities and expertise are often sourced from different countries. Most EU Member States currently rely on other countries to launch their satellites, and there is an increasing number of countries planning to develop additional launch capabilities[13]. In addition, space launches and re-entry have a cross-border dimension in the EU, since they have an impact on the airspace of several Member States.

The growth in space activities and the rapid emergence of New Space has been accompanied by the increasing need for Member States to regulate these activities. Regulation aims to: (i) provide legal certainty for market operators and support the growth of New Space companies; (ii) mitigate the risks of the exponential growth in space activities, including of satellite safety, sustainability and resilience to physical attacks and cyberattacks; and (iii) fulfil their responsibilities stemming from relevant international treaties[14].

The United Nations (UN) Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space (OST) governs the global regulatory framework for outer space. The OST was created during an era dominated by a few space powers and focused on Cold War geopolitics. It emphasises state responsibility, requiring states to authorise, supervise and be liable for their national space activities. However, the OST lacks specific guidelines for fulfilling these obligations, leading to varied authorisation requirements. In the absence of a detailed international legal framework, Member States have pursued different regulatory approaches.

Today, 13 Member States have national space laws, and more are in the process of drafting space legislation to manage the emergence and development of new commercial entrants. The lack of coordination in the regulatory approaches adopted by Member States has led to a fragmented legal framework and created obstacles that impede the emergence of a single market for space products and services in the EU. Member States' frameworks focus on **three sectoral challenges** that may affect the development of space activities and new commercial

[11] By purchasing data or services, including launch services, from such companies as part of the Copernicus programme and IRIS^2, the EU's secure connectivity programme.
[12] See, for example, the 2019 Space Defence Strategy of France, the 2022 Defence Space Strategy of Luxembourg and the 2022 Defence Space Agenda of the Netherlands.
[13] Currently, the only EU spaceport is located in France. This is set to change, with plans to develop launch sites in Germany, Italy, Portugal, Spain and Sweden.
[14] At global level, space activities are governed by several treaties dating back to the 1960s and 1970s, notably the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (OST), further elaborated in the 1968 Rescue and Return Agreement; the 1972 Liability Convention; the 1975 Registration Convention and the 1979 Moon Agreement.

entrants if not properly regulated: (i) safety; (ii) resilience; and (iii) environmental sustainability.

Existing and planned national legislation on licencing requirements differ in scope and detail. Without coordination, the means and approaches to regulating space activities in the EU will continue to diversify. While the growing number of players in the space industry fosters cross-border activities, the increasingly diverse licencing requirements will create barriers for the space industry in the single market, with a negative impact on its competitiveness.

The EU space industry is globally competitive, on par with some of the most experienced players internationally. It is a net positive contributor to the EU's trade balance, selling complete satellite systems, launch services, and equipment and subsystems. However, the industry is facing three key challenges: (i) an exponential increase in new competitors (e.g. the United Arab Emirates, New Zealand, Australia and Singapore) due to the emergence of the privately funded space industry; (ii) limited market access – only 36% of total space activity is open to global competition, and 64% is dominated by institutional markets and is often closed to global bids[15]; (iii) the need to comply with the increasingly strict regulations in non-EU jurisdictions when using launch facilities outside the EU.

Against this background, the Commission identified the EU Space Act as a key priority in two recent joint communications: (i) an EU approach for space traffic management; and (ii) the EU space strategy for security and defence[16]. This echoes Member States' calls for laying down a coherent framework and a single market for space operations. In recent Council conclusions, Member States have recognised the need to avoid fragmentation of the single market for space services and products and to boost the global competitiveness of the EU space industry[17]. They acknowledged the relevance of EU action to ensure equal treatment and a level playing field for the EU space industry[18]. The importance of a legal framework that ensures the long-term sustainability of space has also been recognised by national parliaments[19]. The EU space industry, including small and medium-sized enterprises (SMEs), is also supportive of this approach and calls for a clear legal framework regulating space activities in the EU[20].

The Draghi report on EU competitiveness underlines, that EU action could increase legal certainty and create a level playing field[21]. The Letta report on the single market calls for greater coherence and coordination of the rules applied to the space sector[22]. EU action would help harmonise licencing requirements on safety, resilience and environmental sustainability

[15] European Space Strategy in a Global Context – European Space Policy Institute, June 2022.
[16] Joint Communication to the European Parliament and the Council 'An EU Approach for Space Traffic Management – An EU contribution addressing a global challenge' JOIN(2022)4final from 15.2.2022; and Joint Communication to the European Parliament and the Council on Space Strategy for Security and Defence JOIN(2023)9final from 10.3.2023.
[17] Council Conclusions on the 'EU Space Strategy for Security and Defence', 14512/23 adopted on 13 November 2023, https://data.consilium.europa.eu/doc/document/ST-14512-2023-INIT/en/pdf.
[18] Conclusions on 'Space Traffic Management: state of play' 15231/23 adopted on 8 December 2023, https://www.consilium.europa.eu/en/press/press-releases/2023/12/08/space-traffic-management-council-adopts-conclusions-on-the-current-state-of-play/.
[19] https://www.assemblee-nationale.fr/dyn/16/dossiers/loi_europeenne_espace.
[20] See position paper of Eurospace (an association representing the views of more than 80 space companies, including primes); SME4Space (an association defending the views of more than 800 companies, including 90 start-ups); and YEESS (an association recently created, representing the views of 13 New Space companies).
[21] Mario Draghi "The future of European competitiveness – Part B | In-depth analysis and recommendations", September 2024
[22] Enrico Letta "Much more than a single market", April 2024

across Member States and make them more consistent, and ensuring a higher level of protection. This could improve the conditions for the functioning of the single market for space-based services and data, with a considerable positive impact on the European space industry and its competitiveness. It could stimulate and accelerate industrial innovation through the development of new technologies driven by the requirements set out in the legislative initiative. Ensuring legal certainty could also encourage more investment in the sector, which is essential for the scaling up and commercial growth of New Space companies.

To prepare this impact assessment, the Commission extensively consulted all stakeholders: Member States, space infrastructure manufacturers, space operators and space service providers, along with research organisations and other stakeholders that were invited to contribute to a targeted consultation and take part in four stakeholder workshops. Their input has been integrated into the study supporting the Commission's preparatory work. The Commission also published an open public consultation and a call for evidence, to which stakeholders could submit feedback. Annex 3 contains more details on the stakeholder consultation.

2. PROBLEM DEFINITION

2.1. What are the problems?

The expansion of the space industry in the EU, driven by a rising demand for satellite services, has led to a growing network of players engaging in cross-border activities. However, in the absence of international solutions, the challenges for the future growth of the space industry have led individual Member States to develop a regulatory environment at national level, without proper coordination.

The diverse range of national approaches to regulating space activities is leading to a fragmentation of the single market and is likely to increase as more Member States have announced their intention to set up their own legal frameworks. This can: (a) impede cross-border value chains for space activities in the EU; (b) create difficulties in protecting space assets, jeopardising the long-term availability and use of space-based infrastructure for users in the EU; and (c) compromise the ability of market players in the EU to address the environmental impact of space activities.

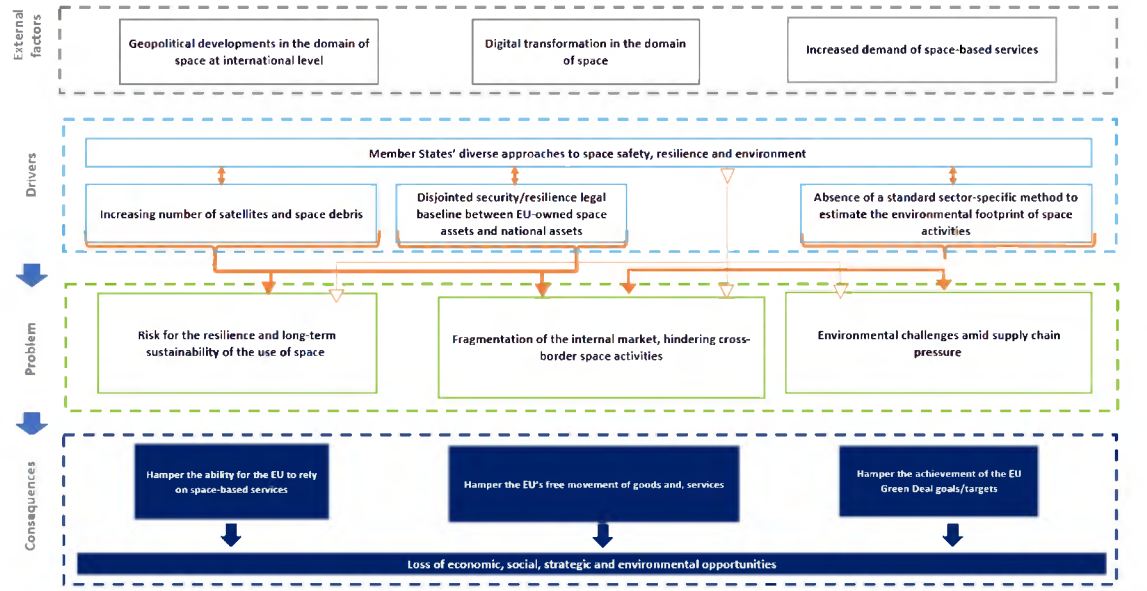
Table 1: Problems and stakeholders involved

Problem	Stakeholders involved
Fragmented single market, hindering cross-border space activities	EU space industry (space operators, launch service providers, manufacturers)
Risk for the resilience and long-term sustainability of space activities carried out by commercial and governmental bodies across the EU	EU space industry (space operators, launch service providers, manufacturers), users of space data and services (Member States, the EU public, business, governments), the aviation industry

Environmental sustainability challenges amid supply chain pressure on the EU space sector	EU space industry (space operators, launch service providers, manufacturers), Member States, space agencies, environmental organisations and the EU public

The following problem tree illustrates the general factors behind these three problems.

Figure 5: Problem tree



2.1.1. Problem 1: Fragmented single market, hindering cross-border space activities

The rapid expansion of space activities has clearly outpaced the OST[23], which has governed the domain for more than five decades. As multilateralism has deteriorated over the past decade, the need for unanimity in decision-making at the UN has led to political stalemate when it comes to advancing on further binding measures. The existing international framework is therefore riddled with gaps. This has driven Member States to tackle the serious and rapidly increasing challenges to the safety, resilience, and environmental sustainability of space activities at national level. The result is a patchwork of national regulations varying in scope and stringency.

The **lack of common and consistent minimum standards, approaches and baselines** due to the different national frameworks hinders the space industry's ability to conduct cross-border activities in the EU. This, in turn, affects the functioning of the single market of space services and data, as echoed by the EU space industry throughout the consultation process[24]. **Most stakeholders (84%) replying to the targeted consultation believe that the increase in space**

[23] Some of its provisions have been further developed in subsequent treaties: the 1968 Rescue and Return Agreement, the 1972 Liability Convention, the 1975 Registration Convention and the 1979 Moon Agreement.
[24] For example, a start-up manufacturing space equipment reported that they faced significant challenges navigating the different sources of requirements applicable to their products due to regulatory divergence across the EU, which has a negative impact on their business.

activity calls for specific requirements and guidance for safety in space. There is a need to develop new standards, particularly for the development of mega-constellations[25]. The space industry is particularly vulnerable to regulatory fragmentation due to its limited size (0.5% of EU GDP) and its inherent high-risk and high-cost endeavours.

Space activities involve a **long-term commitment** (from a commercial perspective) and a **complex and sophisticated set of operations** (from a technical perspective). The development of space infrastructure and products involves a transnational value chain where the products are designed, manufactured, assembled, tested and integrated into existing systems across a value chain involving numerous actors, who are often in different Member States. The actual requirements to be considered and applied in this process are the result of a combination **of regulatory obligations and commercially driven requirements**: national licence requirements, conditions set out in procurement and tender specifications (when satellites are commissioned by companies or governments), and sometimes industry-led commitments to follow certain best practices or guidelines. Space activities are therefore subject to a complex mix of regulatory and voluntary factors.

It is important to underline that **the regulatory entry point at national level is through the operator** who needs to get a licence as: (a) **satellite operator;** or (b) a **launch operator:**

- the satellite operator needs both a licence both to operate in space (from the 'appropriate state' who is responsible according to the OST) and to launch its satellite (from the launching country);
- the launch operator needs one licence per launch from the country where the launch takes place.

The OST is open to different interpretations about who is the 'appropriate state' to authorise and continuously supervise space activities. As result, several licences may be required for a satellite's operation, especially if the operation is outsourced to a country other than the one where the satellite operator is based, e.g. via a ground station as a service. For example, a satellite owner based in Luxembourg may need several licences: one from Luxembourg, another from Belgium if the **effective control** of the operations takes place from there (outsourced operation), and another from France if the launch takes place there. If one of these countries e.g. has stricter de-orbiting rules than the others, there is a risk that the relevant authorities could refuse granting those licences. A similar scenario could arise due to resilience or environmental obligations. Similarly, if the launch takes place in a country other than the one where the launch company is based, the launch company may require additional licences.

As a result, some companies may choose to go to less regulated jurisdictions or simply base themselves outside the EU[26]. Stakeholders interviewed for the study supporting this impact assessment confirmed that this is already happening today. Stakeholders also noted that legal uncertainty in some jurisdictions about licencing procedures and requirements and burdensome procedures in other jurisdictions negatively impacts companies based in the EU, especially

[25] More than 100 satellites.

[26] Study on improving access to test facilities for EU New Space transportation solutions, contract number L02/10 implementing framework contract 712/PP/2018/FC For instance, as not all companies can afford to test a microlauncher engine in-house, those needing to use at a test centre may face more stringent rules or longer times in some Member States (e.g. rules for handling propellants).

SMEs, and will create future obstacles for the EU space industry. This phenomenon affects the competitiveness of European companies, endangering and breaching the fundamentals of the good functioning of the single market. An uncertain regulatory environment for space products in the EU also hampers new initiatives and innovation in the space industry.

Companies interviewed for the study supporting this impact assessment, specifically smaller ones, reported not to have the resources, capabilities or legal expertise to navigate the multiple requirements and frameworks to mitigate the effects of unfair competition on the market. This makes it challenging for them to fully understand and comply with the relevant specifications.

In position papers sent to the Commission as part of the consultations, space industry associations (SME4SPACE, YEESS, Eurospace) recognise that the EU Space Act is a crucial tool to **prevent market fragmentation**, create a stable and predictable regulatory framework for the EU space industry and promote competitiveness globally.

Throughout the consultation process, some companies (especially SMEs) reported facing significant **challenges and costs** associated with navigating the different sources of requirements applicable to their products and services due to the regulatory differences across the EU.

Consequently, the set-up of national legislative initiatives and cost incentives regulating the space industry is creating unfair conditions for EU companies in the single market. This situation is undermining the fundamental freedoms of the single market and leading to an uneven playing field for the EU space industry.

2.1.2. Problem 2: Risk for the resilience and long-term sustainability of space activities

Member States and the EU are increasingly dependent on the use of space-based services and therefore on the robustness of all underlying space infrastructure. The growing number of satellites being launched into orbit not only reflects this reliance but also presents a tempting and vulnerable target for cyberattacks. Moreover, the growth of the space industry is becoming its own weak point as it has led to the accumulation of objects in Earth's orbit, which creates greater risks of collisions[27]. **The threat of physical impacts in space and the rise of cyberthreats poses a risk to the future viability of space activities**. **The fragmented approach to the regulation of space activities and the lack of common standards and rules undermines the effectiveness of Member States' efforts to tackle these challenges. This is only exacerbated by the interconnected nature of space infrastructure, where a given system is only as strong as its weakest link.**

In a 2023 UN report, the problem of **space debris was identified as one of six tipping points that can impact 'life-sustaining systems that can shake the foundations of our society'**[28]. There has been an increase in the number of collision avoidance alerts in low Earth orbit (LEO),

[27] There are around 7 000 satellites in orbit, out of which only 4 800 are active. In addition to the increasing number of active satellites in orbit, there is a growing amount of debris. See more details in Annex 10 and in the Joint Communication to the European Parliament and the Council 'An EU Approach for Space Traffic Management – An EU contribution addressing a global challenge' (JOIN(2022)4 final).
[28] 2023 Executive Summary - Interconnected Disaster Risks (interconnectedrisks.org)

which is the most densely populated orbit with satellites providing essential services to the EU. Simulations have shown that over the next 25 years, if nothing is done, 25 catastrophic collisions can be expected in LEO [29]. The risk of collision is not only a threat to the satellite infrastructure itself but can also seriously affect many users of **downstream space-based data and services across the EU**.

92% of respondents to the targeted consultation agree that the growing amount of space activities and debris increases the risk of collision in space and when re-entering the Earth's atmosphere, and 62% consider the risk of the 'Kessler effect'[30] to be 'high' or 'medium-high'.

Moreover, the problem of collision extends beyond in-orbit activities: **there is risk when space objects (launchers and spacecraft) re-enter Earth's atmosphere**. Although the re-entry of satellites at their end of life can be seen as a measure to mitigate debris (in line with international guidelines), the amount of debris that does not burn up in the atmosphere (depending on the size, materials and mass of the satellite) risks colliding with an aircraft in flight or landing in a populated area. By 2035, 28 000 hazardous fragments are expected to survive re-entry every year[31].

80% of European aviation industry stakeholders who responded to the targeted consultation consider the risk of re-entering space debris to aircraft to be medium-high and are concerned by it.

Meanwhile, satellites are becoming vulnerable to a variety of cyberattacks and electronic interference, which can disrupt signals. Like any other economic sector, space infrastructure and systems have been profoundly impacted by digitalisation in the past decade. The huge societal shift from the use of analogue technology to the use of software and digital technology has had major consequences for all space infrastructure and systems. Malicious actors may target satellite communication networks and attack ground stations and space-based infrastructure components, aiming to disrupt services, steal sensitive data, compromise satellites missions, and gain unauthorised access. Exposure to cyber risks grows as digital technologies become more sophisticated[32] and software environments become more vulnerable to cyberattacks. The risk of cyberattacks is escalating significantly due to the nature and complexity of space infrastructure with distinct operational segments (space, ground and links) and the impossibility or difficulty in updating hardware in space.

78% of respondents to the targeted consultation agree or strongly agree that there is a need to increase the overall level of cybersecurity and resilience of different space infrastructure. Industry representatives believe that the digitalisation of space systems and their rather complex architecture (space segment, ground segment, link segment, user segments) create specific challenges for ensuring the resilience and physical and digital security of

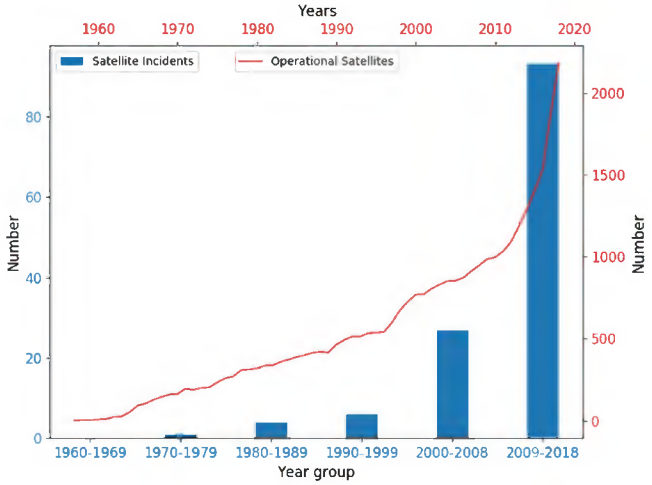
[29] AC105_C1_2025_CRP10E.pdf
[30] A situation in which the debris in LEO is so dense that collisions become a self-sustaining cycle, leading to LEO becoming unusable for future generations. It also makes activities in other orbits and space exploration impossible because of the need to cross LEO.
[31] faa.gov/sites/faa.gov/files/Report_to_Congress_Reentry_Disposal_of_Satellites.pdf
[32] Through the use of new technologies such as artificial intelligence and machine learning and the advent of the Internet of Things.

infrastructure and call for specific requirements. Most respondents see a need for harmonised cybersecurity standards for the space sector at EU level.

The space ecosystem has experienced an exponential increase in cyberattacks over the past two years. Most industry stakeholders replying to the targeted consultation ranked the likelihood of cybersecurity incidents targeting space systems in the coming years as 'high' or 'very high'[33]. According to one large industry group, 'cyber risk is one of the main threats in terms of likelihood and operational impact'.

A recent attack on Viasat/KA-SAT[34] has also shown how cyberattacks can be actively and strategically used in modern warfare. **The consequences and damage not only affected Ukraine but also thousands of internet users and internet-connected wind farms in Central Europe. Cyberattacks on space systems can therefore spill over into other countries and cause systemic disruptions, putting at risk essential public services and the population's security.**

Figure 6: Number of satellites attacks per year is plotted on the bottom and left axes, and the number of operational satellites between 1958 and 2018 is plotted on the top and right axes



In summary, **without the proper physical and cyber protection of space infrastructure, Member States, the EU population, businesses and the EU itself may lose their ability to access essential space services.**

2.1.3. Problem 3: Environmental challenges amid supply chain pressure

The expansion of space activities has triggered growing concerns about their **environmental impact, both on Earth and in space**. For example, space activities generate ozone-destroying emissions directly in the atmosphere's middle and upper layers. Propellants used in spacecraft

[33] Between 4-5 on a scale of 1 to 5, where 1 stands for 'very low' and 5 for 'very high'.

[34] Russia's cyberattack on Ukraine's KA-SAT satellite network occurred just before its invasion into Ukraine, causing widespread disruptions. Since the beginning of the war in Ukraine, a significant number of cyberattacks have been observed, mainly targeting the ground segment or the signal segment and aiming to support military operations. https://www.consilium.europa.eu/en/press/press-releases/2022/05/10/russian-cyber-operations-against-ukraine-declaration-by-the-high-representative-on-behalf-of-the-european-union.
Aerospace America, 'Why the Viasat hack still echoes', 2022, https://aerospaceamerica.aiaa.org/features/why-the-viasat-hack-still-echoes/.

are hazardous, posing a risk of explosion and generating space debris, which can lead to collisions. Finally, there are uncertainties about how rocket exhaust behaves in the atmosphere, particularly during the burning and expansion phases. This makes it challenging to accurately incorporate the effects of small-scale rocket plume into larger climate models. As part of initiatives like the European Green Deal, designed to steer the EU towards a more ecologically responsible future, the space industry needs to cautiously use resources, reduce its reliance on hazardous materials and minimise its environmental footprint.

In addition, as described below, the space sector is strongly impacted by pressure on global supply chains and raw materials.

- **Supply chain pressure**. The space sector is affected by several dependencies in the supply chain, many of them affecting semiconductors[35]. Another example spacecraft production, including satellites and suborbital and spacecraft launch vehicles, for which approximately 94% of EU foreign imports in 2018 depended on US and UK producers[36]. The impact of the disruption of global supply chains is amplified by: (i) the small size of the space industry compared to other industries (space is only a small customer in terms of volume compared to other large-scale industries); (ii) the complexity of identifying substitutes for the materials and chemicals needed to build space components; and (iii) the dual-use nature of space technologies, especially certain components for semiconductors, which are available to EU end users subject to restrictions and authorisations managed by non-EU countries[37].
- **Raw materials dependency**. The growth of the space sector has led to an increased demand for raw materials. The current geopolitical situation has significantly disrupted the space sector's global value chains. Russia's war in Ukraine has disrupted the supply of critical raw materials, including nickel, palladium, vanadium and boron. This poses a risk to the space sector, which is highly dependent on these strategic and critical raw materials[38]. Another example is China's recent export restrictions on gallium and germanium. Many space-related electronic components depend on these materials, which brings challenges and limitations to manufacturing space equipment.

The cumulative impact of recent global crises has exerted **unprecedented pressure on global supply chains and value networks,** which has impacted the space industry in the EU. These challenges have exposed the space industry's vulnerabilities and its reliance on critical materials and resources, creating the need for a critical re-evaluation of its business practices

[35] Supply chain analysis and material demand forecast in strategic technologies and sectors in the EU – A foresight study. Joint Research Centre (JRC). Available at: JRC Publications Repository - Supply chain analysis and material demand forecast in strategic technologies and sectors in the EU – A foresight study. This also was highlighted by the Observatory of Critical Technologies (OCT) established with the European Commission's Joint Research Centre (JRC).

[36] Rueda-Cantuche, JM., Pedauga, L., and Mandras, G. (2022). *The relevance of re-exports for identifying strategic dependencies*. European Commission, Science for Policy Brief. No JRC128381.

[37] Insights into supply chain dependencies and gaps in space technologies are systematically being gathered through work undertaken under the Joint Task Force (JTF) and the Observatory for Critical Technologies (OCT).

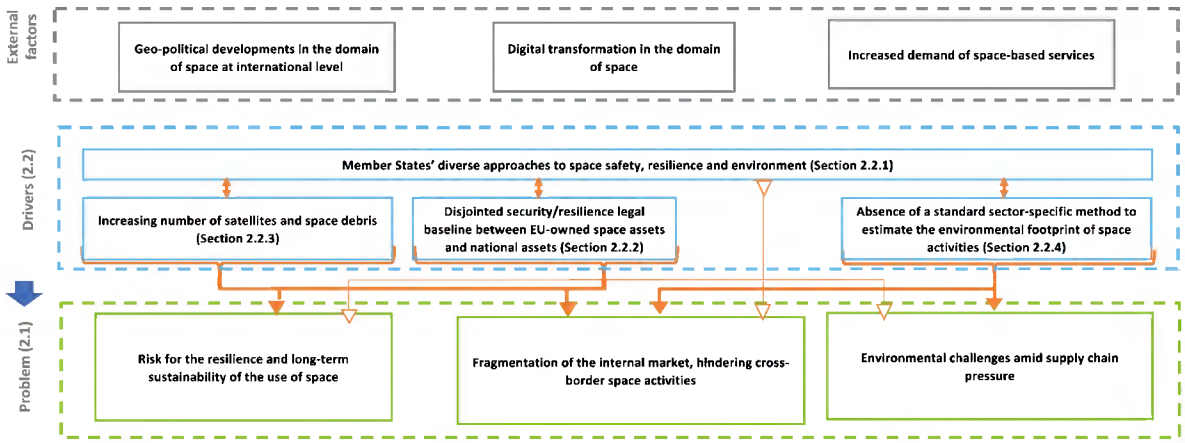
[38] Supply chain analysis and material demand forecast in strategic technologies and sectors in the EU – A foresight study. Joint Research Centre (JRC). Available at: JRC Publications Repository - Supply chain analysis and material demand forecast in strategic technologies and sectors in the EU – A foresight study

There is a strong consensus among respondents to the targeted consultation on the environmental impact of space activities. **93%** stress **concerns about the environmental footprint of space activities**, emphasising the pressing need to reduce it. Additionally, respondents point to the need for adopting an integrated approach to measuring the environmental impact of space activities that considers **supply chains, including raw material extraction, transformation and transportation.** Respondents also note the importance of improving **propellants and materials** to make space activities sustainable.

2.2. What are the problem drivers

The problems described above are fuelled by different underlying parameters.

Figure 7: Problem drivers



2.2.1. Problem driver 1: Member States' diverse approaches to space safety, resilience and environment

International space law was not designed to cope with the rapid expansion of New Space. The OST was conceived at a time when only a few powers were involved in space, primarily driven by the geopolitical dynamics of the Cold War. The OST was structured to focus on aspects revolving around a country's responsibility, entrusting that country to authorise and continuously supervise its national space activities and holding them liable for such space activities.

The table below gives an overview of Member States that: (i) have an existing space law (X); (ii) are planning to develop a space law (P); (iii) or have made official declarations committing to comply with at least some international guidelines and standards on space safety and sustainability (D).

Table 2: Overview of space laws in EU Member States

BE	BG	CZ	DK	DE	EE	IE	EL	ES	FR	HR	IT	CY	LV	LT	LU	HU	MT	NL	AT	PL	PT	RO	SI	SK	FI	SE
X		D	X	DP	P		X	DP	X		X				X			X	X	DP	X	P	X	X	X	X

Although it sets out a framework with high-level principles, the OST does not describe how those fundamental obligations should be fulfilled, leading to **significantly different requirements for the actual conditions for authorising and supervising space activities. This is particularly true where liability and responsibility are invoked, such as the safety, resilience and environmental impact of space activities**.

Safety. Table 3 below illustrates the divergent safety rules that companies face when applying for a licence in different countries (a detailed overview is provided in Annex 6)[34]. Most national space legislation stipulates – with varying degrees of detail – that licencing procedures should consider whether the operator has made **appropriate provisions for space debris mitigation,** apart from Luxembourg, the Netherlands and Sweden. The specific requirements imposed on space operators for **space debris and safety and environmental considerations differ significantly from one jurisdiction to another**. For example, the Greek, Danish and Slovenian legislation merely prescribes that operators *make appropriate provisions* for the mitigation of space debris. However, other jurisdictions (e.g. Austria, Finland France) specify that *operators must take specific measures* to avoid space debris residue being released during normal operations, to prevent on-orbit break-ups of the space object, and to remove the space object from Earth's orbit at the end of the space activity. Some national space legislation prescribes detailed safety, sustainability and space debris requirements for operators (e.g. France). Only Austria, Denmark and France set a deadline for deorbiting space objects at the end of their operating period (25 years). As explained in Section 2.1.1, **these different rules contribute to the fragmentation of the single market and challenge the long-term sustainability of space activities** (see Section 2.1.2).

Most respondents to the targeted consultation (79%) do not believe that current national space laws are fully fit to ensure the safe and long-term use of space. 83% claim that increased space activity calls for specific requirements for space safety.

Stakeholders identify several key issues with existing space regulations, including: (i) the low level of enforcement; (ii) outdated rules; (iii) the inability to keep pace with technological advancements and changes in the space sector; and (iv) regulatory differences.

Environment. Table 3 also illustrates the divergent environmental requirements in national space laws. Even when these laws mandate an environmental assessment, the extent of this assessment can differ significantly between them. For example, the scope can cover the impact on Earth and space or just on space (e.g. avoid the risk of contaminating the space environment). While some laws require general information, others require specific and detailed information (e.g. France). This disparity leads to **fragmentation** in national space licencing, **giving companies the flexibility to report and measure using different parameters**. This situation not only poses challenges for having consistent environmental rules

but also creates a potential loophole for less ambitious companies. These companies can selectively seek out the Member State with the least stringent environmental requirements, which undermines broader sustainability efforts in the EU.

While most respondents to the targeted stakeholder consultation (65%) say that their organisation implements specific measures to mitigate the environmental footprint of its space activities, only 40% of the organisations report on this.

Table 3: Overview of Member States with space laws on safety and environmental requirements[39]

	BE	DK	EL	FR	LU	NL	AT	PT	SI	SK	FI	SE
General reference to international standards / guidelines for space debris mitigation	X						X	X		X	X	
Specific reference to in-orbit collision avoidance measures				X			X	X			X	
Requests operator to make appropriate provision for space debris mitigation with few specifications		X	X				X	X	X	X	X	
Detailed measures for space debris mitigation				X								
Limit on orbital lifetime (25 years)		X		X			X					
Requires an environmental impact assessment	X	X	X	X							X	
General condition that space activities do not cause adverse changes to the environment							X		X	X		

Resilience. **Fragmentation in the single market** is caused by the current disparities in national requirements for having a risk management framework truly suited to the needs of space systems, coupled with no common approach to cybersecurity across the space value chain. If fundamental cybersecurity requirements are not agreed upon by all market players (as no legislative act prescribes them clearly) and are not included from the outset (at the initial stage of design or manufacturing), they cannot be addressed through subsequent risk management practices. This may prevent the respective products from meeting higher or stricter risk management and cybersecurity standards that may be required when applying for licences in other Member States. Similar to safety measures, the lack of a common approach to risk management **also undermines the long-term sustainability of space activities** (Section 2.1.2). This can impact downstream services, and a malicious takeover may lead to a satellite being used as a weapon against other satellites in orbit.

Although respondents to the targeted consultation acknowledge that current applicable frameworks provide some building blocks for the resilience of space activities, 57% argue

[39] The Italian space law has not yet been published at the time of this documents publication.

that the space sector needs a more complete and tailored approach. This view has also been confirmed by the industry at dedicated stakeholder workshops.

2.2.2. *Problem driver 2: Disjointed security/resilience legal baseline between EU-owned space assets and national assets*

The EU space programme operates in an increasingly interconnected architecture, including integrated national or commercial assets and (commercial) payloads. However, there is a serious imbalance between the level of cybersecurity protection afforded to EU-owned assets and that of certain national assets. Space programmes have been developed under parallel tracks at: (i) national level for national assets; and (ii) EU level, through the EU space programme flagships. At regulatory level, this parallel development has led to fragmented cybersecurity baselines and an uneven risk management approach for EU-owned[40] and national space assets.

This problem is compounded by the absence of a common cybersecurity and risk management baseline tailored to space systems in national space legislation (where such legislation exists). There is no consistency in the approaches taken at legislative level by Member States. In a few cases, Member States have recently started to draw up, through guidelines, tailored technical requirements for the security of space systems[41]. In other cases, approaches draw on general risk management frameworks or local efforts to achieve convergence[42] or take inspiration from international recommendations. However, without a normative approach (as not all Member States have put in place specific space legislation that also addresses cybersecurity for all space assets), the actual level of protection for space systems ultimately depends on how strict or lenient companies are in integrating cybersecurity into their space mission's design and operations.

The disjointed cybersecurity baseline is ultimately a threat to the EU space programme and to the delivery of space services underpinning the single market. In addition, satellite operations require an integrated approach. This approach must: (i) cover digital and physical systems and subsystems (space- and ground-based) that work together and are closely interconnected to fulfil mission requirements; (ii) addressing all possible risks (cyber risks, physical risks and jamming risks); and (iii) assess in a coherent manner the protection required for all space sector segments (ground segment infrastructure, space segments and the links between them).

66% of the respondents to the targeted stakeholder consultation reported that the current cybersecurity and resilience legislative frameworks at EU and national level are not fully fit to ensure the resilience of space assets, systems and infrastructure.

[40] For EU-owned space assets: Based on the 2021 EU Space Programme Regulation the security and cybersecurity aspects are addressed through strong and detailed security requirements for different component (in the EU space programme). They result from implementing decisions and technical specifications in the context of tendering procedures linked to the EU space programme.
[41] For instance, Germany has recently published its Technical Guideline BSI TR-03184 Information Security for Space Systems and Technical Guideline SatDSiG BSI TR-03140 (TR-SatDSiG) as well as the IT baseline protection profile for space infrastructures.
[42] In the context of the European Cooperation for Space Standardisation.

However, it is important to clarify that there have been notable developments at EU level in recent years to address these gaps. First, the revision of the Network and Information Systems (NIS) Directive led to the adoption of the NIS2 Directive[43] in 2022, the new general EU framework for cybersecurity. Second, for non-cyber resilience, a new directive has been adopted, the Critical Entities Resilience (CER) Directive[44].

The NIS2 and CER Directives will have a significant impact on strengthening the cybersecurity and physical resilience of the ground segment of space infrastructure as they apply to operators of **ground-based infrastructure** (owned, managed and operated by Member States or by private parties, that support the provision of space-based services). They do not cover the EU-owned space assets that are part of the EU space programme.

The CER Directive sets out national strategies on the resilience of critical entities as well as risk assessments carried out at national level. As explained above, the CER Directive applies in part to space, by including operators of ground-based infrastructure identified by Member States as critical entities (according to the criteria laid down in the Directive). For such identified critical entities specific obligations laid down in CER Directive include the carrying out of risk assessments and measures to boost the resilience of critical entities.

While the CER Directive does not cover the EU-owned space assets (which are part of the Union Space Programme) a cross-reference exists in the Space Regulation to the predecessor of the CER Directive. The Space Regulation requires Member States to ensure the protection of the ground infrastructure (which forms an integral part of the Union Space Programme) by taking measures that are at least equivalent to those required for the protection of European critical infrastructure under the CER Directive and the protection of their own national critical infrastructure. As the deadline for transposing the CER and NIS2 Directives into national law was October 2024 and the ground segment of the space sector is covered by these Directives, Member States' legislative frameworks on cybersecurity and resilience will be reformed in the near future, including the obligations applicable to the space sector[45].

The implementation of the NIS2 and CER Directives will lead to significant changes to Member States' laws and acts referenced in Annex 6. It may entail in many cases certain overhauls of the frameworks applicable to the critical infrastructure, the emergency and disaster management and cybersecurity rules. The Member States risk assessments carried out under the CER Directive would need to take into account other relevant risk assessments and the relevant risks arising from the extent to which the sectors set out in the Annex of the CER Directive depend on one another. In this context, cross-sector dependencies are particularly pertinent for the resilience of the space sector, an enabler of services and application for many critical sectors.

[43] Directive (EU) 2022/2555 of the European Parliament and of the Council of 14 December 2022 on measures for a high common level of cybersecurity across the Union, amending Regulation (EU) No 910/2014 and Directive (EU) 2018/1972, and repealing Directive (EU) 2016/1148 (NIS2 Directive).

[44] Directive (EU) 2022/2557 of the European Parliament and of the Council of 14 December 2022 on the resilience of critical entities and repealing Council Directive 2008/114/EC (Text with EEA relevance).

[45] However, transposition of the Directives into national law was not completed by the deadline by all Member States, with the Commission launching infringements. https://ec.europa.eu/commission/presscorner/detail/en/inf_24_5988

A legislative proposal for safe, resilient and environmentally sustainable space activities in the EU will have to duly consider these developments and address certain key risk management aspects of all relevant space segments in a coherent manner. This proposal will bring about precision and legal clarity on the exact resilience baseline expected from all space actors, including through setting out clear and uniform concepts and definitions. It will enable the national legislations adopted in the transposition of the CER and NIS2 Directives to benefit from a tailored baseline for all the components and segments of the space sector, while leaving sufficient flexibility to the transposition of the general EU resilience and cybersecurity frameworks into national law.

At the same time, to maximise efficiency and avoid regulatory overlaps, the proposal will not entail any altering of the reporting mechanisms foreseen by the CER and NIS Directives. These are well functioning mechanisms anchored in the CER and NIS ecosystem which should be fully observed and preserved.

Table 4: Policy gaps in NIS2 Directive

Category	NIS2/Cyber Resilience Act (CRA) coverage	Existing gaps to be addressed by EU Space Act (Resilience chapter)
Union-owned space assets		
Union-Owned Space Assets	n/a	Clarify how the Union-owned assets integrate into the NIS2 incident detection & response mechanism (CSIRT network and Cyclone) and ensure coordination at the EU level.
Satellite operators (other than for the Union-owned space assets)		
Medium and large companies	Cybersecurity risk management requirements - medium/large PECN/PECS[46] operators and some ground segment operators in the Union.	No coverage for **earth observation, SSA**, or ground operators outside the Union; small operators not included unless designated as critical under NIS 2.
Micro- and Small-Sized Operators	Cybersecurity risk management requirements - only PECN/PECS and entities identified as critical under NIS2 or CER.	No inclusion for the **non-critical** micro and small-sized space operators.
Education institutions	Cybersecurity risk management requirements - only entities covered/ identified by Member States.	Most such satellite outside the scope.

[46] Public electronic communications networks and services

(for assets such as CubeSats, non-commercial)		
Space segment		
Spacecraft Security	NIS2: Only PECN/PECS spacecraft with security requirements (e.g., cryptography, disaster recovery). CRA: spacecraft and components placed on the Union market.	No regulation for **non-PECN/PECS spacecraft** (e.g., earth observation, SSA); No requirements for **components launched outside the Union.**
Supply Chain	NIS2 imposes supply chain security requirements for all entities in scope. CRA product security requirements.	Scope extension - additional measures needed to secure space supply chains.
Ground segment		
Ground Segment Security	Specific requirements on infrastructure. NIS2: Covers PECN/PECS ground infrastructure and Union-based ground operators covered under NIS2 CRA: covers ground segment equipment entering EU market.	No security requirements for **non-PECN/PECS ground operators** (earth observation, SSA) / operators outside the Union / operators not considered critical under NIS2 / products not placed on the Union market.
Launchers		
Launchers & Spaceports	CRA: covers spacecraft and ground segment equipment placed on the Union market. NIS2: covers spaceports and LEOP[47] infrastructure only if bigger than small size or identified by MS or identified as critical entities under NIS2/CER.	No regulation for spacecraft not placed on the Union market. Spaceports and LEOP infrastructure established outside the Union or, where in the Union but small-sized and not considered critical under NIS2/CER.
Transversal		
Governance & Licensing	Mandatory cyber requirements for any authorisation to operate a satellite or launch a service: NIS2 supervision through relevant cybersecurity authorities. CRA: system of notified bodies and conformity assessment in line with NLF model[48].	Adequate linking and tailoring of cyber resilience requirements with **space authorisation / governance frameworks**.

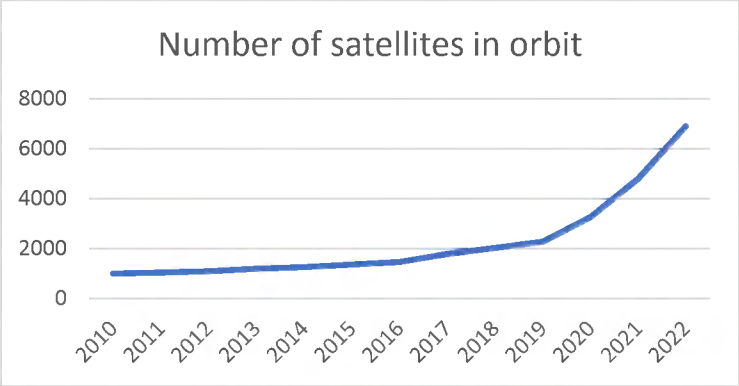
[47] Launch and Early Orbit Phase
[48] New Legislative Framework. New legislative framework - European Commission

Incident Reporting	NIS2: Covers significant incidents for entities in scope. CRA: covers incidents affecting products' security of and actively exploited vulnerabilities.	No reporting obligations for **non-NIS2 entities or space products not in CRA scope.**

2.2.3. Problem driver 3: Increasing amount of satellites and space debris

There has been an exponential **increase in the number of satellites launched into orbit**. According to Euroconsult, an average of 1 700 satellites will be launched globally every year until 2030, with five broadband mega-constellations accounting for more than half (58%) of them[49].

Figure 8: Cumulative number of satellites in orbit (Source: UNOOSA)



In addition to the increasing number of active satellites in orbit, a **growing amount of space debris** (see Table 5) is contributing to congestion in space.

Table 5: Number of space debris objects currently in orbit and their related risks

Size	Number of objects	Potential risk to satellites
> 10 cm	34 000	Complete destruction
1-10 cm	900 000	Complete to partial destruction
1 mm - 1 cm	128 million[50]	Degradation, loss of certain sensors or subsystems

Depending on a satellite's altitude, a substantial portion of the debris created by satellite collisions can remain in orbit for several decades. Larger pieces with a greater mass, such as

[49] Space Economy Report 2022, Euroconsult.
[50] Objects of this size cannot be tracked and catalogued, so the estimation is based on statistical models (MASTER-8), and these figures could be even bigger. These limitations in tracking debris makes it difficult to mitigate the risks they pose.

undisposed satellites, tend to stay in orbit longer than smaller and lighter fragments. Approximately 25% of large debris is estimated to remain in orbit for longer than 30 years[51]. As space operations increase, a **potential doubling of space debris may occur within 25 years**[52]. In the longer term, it is expected that there will be 10 times the amount of space debris due to the increasing rate of catastrophic collisions[53].

A study looked at trends in satellites and debris and the cumulative collision scenarios in LEO (at 600 km). It found that if there are 40 000 active satellites at 600 km in orbit, the accumulation of debris will accelerate so much that 'after 50 years satellites are destroyed faster than they are launched'[54].

Even mitigating measures will not eliminate the problem posed by existing and future space debris: they can only curb the rapid growth in space debris in the future. Based on research by the UN and NASA, the accumulation of space debris will continue to grow, even if no more satellites are launched[55]. Since there is currently no effective operational method to remove large amounts of debris from orbit, debris will continue to accumulate, increasing the risk of collisions with satellites. These circumstances have amplified the long-term risks to the sustainable use of space.

The public consultation shows that space debris is a concern for EU citizens: 75% of respondents consider the risk of a major accidental collision in space and a potential chain reaction of collisions to be 'medium-high' to 'high'.

2.2.4. Problem driver 4: Absence of a standard sector-specific method to estimate the environmental footprint of space activities

Implementing a robust **life cycle assessment (LCA) framework** is crucial for comprehensively evaluating the environmental, social and economic impact of space missions, spacecraft and space infrastructure[56]. However, the **lack of space industry specific methodologies for assessing and quantifying the environmental impact of space activities** hampers the effective measurement and monitoring of this footprint in the EU. There is no consistent LCA method adapted to the specific characteristics of the space industry and used as a reference point by the space industry, either at EU level or at the European Space Agency (ESA).

(1) The EU sustainability legislation and environmental, social and governance framework do not reflect the unique environmental impact of space activities, such as burning

[51] Wright. D, *Colliding Satellites: Consequences and Implications*, in Union of Concerned Scientists, 2009. Available at: https://www.ucsusa.org/sites/default/files/2019-10/SatelliteCollision-2-12-09.pdf.
[52] IADC, Report on the Status of the Space Debris Environment, 2023.
[53] IADC, Report on the Status of the Space Debris Environment, 2023.
[54] https://nsf.gov/news/special_reports/jasonreportconstellations/JSR202H_The_Impacts_of_Large_Constellations_of_Satellites_508.
[55] 'The future debris environment will be dominated by fragments resulting from random collisions between objects in orbit, and that environment will continue to increase, even if we do not launch any new objects into orbit.' - NASA researcher Donald Kessler, from the Impact Assessment accompanying the Commission Proposal for a space surveillance and tracking support programme, https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX%3A52013SC0055
[56] Maury et al., *Application of environmental life cycle assessment (LCA) within the space sector: A state of the art*, 2020 https://www.sciencedirect.com/science/article/pii/S0094576520300552.

propellant, disposing of space objects, decommissioning spacecraft, and generating space debris[57].

(2) LCA-related activities initiated by the ESA face significant shortcomings, in particular: (i) data accessibility (most data is for internal use by the ESA, and there are restrictions in giving access to the industry); and (ii) data quality (data not reviewed by independent experts and not aligned with existing standards). Stakeholders acknowledge those shortcomings and support the development of a space-specific LCA method at EU level[58].

Consequently, the **space industry grapples with adequately meeting its environmental responsibilities and aligning with broader EU sustainability objectives.** The absence of a standardised sector-specific method to estimate the environmental footprint of space activities, especially amidst mounting environmental challenges and supply chain pressures, presents a significant barrier to achieving sustainability and ecological responsibility in the space sector.

Most stakeholders who responded to the targeted stakeholder consultation (82%) either agree or strongly agree that there is a need for a common method to measure the space sector's environmental footprint on Earth and in space.

2.3. How likely is the problem to persist?

The cost of access to space is likely to decrease further in the coming years, prompted by increasing global competition and the development of very heavy launchers. The lower costs of launch services combined with the lower costs of satellite development are conducive to the further growth of the space industry in the EU, including New Space actors. This proliferation has democratised access to space, but it also creates a patchwork of regulatory approaches, with a risk of a 'race to the bottom'.

The EU space industry will continue to become even more cross-border: as more Member States develop launch capabilities, there will be a greater choice of jurisdictions for operators when applying for launch licences. In the same vein, the evolving market trends, marked by the emergence of new types of players and advancements in technology, are fuelling a greater demand for outsourcing satellite operations, a shift which is reflected in the growing industry of **ground-segment-as-a-service**. Outsourcing can mean that the operational control of a space mission is carried out from and located in a different country than the one where the company that owns the satellite is based. Since most Member States' national space laws link licencing requirements with the conduct of operations (and effective control), this practice will continue to generate complex licencing requirements across multiple jurisdictions. This will hamper cross-border business and the creation of a single market for space-based services and data.

Member States will be driven to find ways to protect space assets from potential liability related to safety, resilience and environmental aspects due to the following factors:

[57] Analysis of the consequences of the EU's environmental framework for space activities and options for promoting greener space activities in Europe.
[58] Supporting the Green Deal ambitions applied to EU space activities – PEFCR feasibility study.

- space activities will continue to grow: 1 000 satellites are expected to be launched in the next 10 years by EU companies[59];
- the increased dependence of many critical sectors on space infrastructure makes it a vulnerable cyber target (including in future warfare);
- the growing overall recognition of the environmental risks associated with space activities[60].

The updated EU legal frameworks for resilience and cybersecurity mentioned earlier (with the NIS2 and CER Directives having entered into application on17 October 2024) need to be taken into account when ensuring the physical security and cybersecurity of bodies managing ground-based infrastructure in the space sector.

The obligations and related changes at national level under the NIS2 and CER Directives were considered in the future legislative initiative (the EU Space Act), which would bring together tailor-made rules for the space sector, building on the resilience and cybersecurity baselines of the frameworks mentioned above.

Acting **without coordination and common approaches will lead to deeper or more fundamental disparities between national solutions**, which will increase the fragmentation of the single market.

3. WHY SHOULD THE EU ACT?

3.1. Legal basis

This initiative is based on Article 114 of the Treaty on the Functioning of the European Union (TFEU). This article enables the EU to adopt 'measures for the approximation of the provisions laid down by law, regulation or administrative action in Member States which have as their object the establishment and functioning of the single market.'

As explained in Section 2 on the problem definition, Member States are regulating space activities at national level. In doing so, they have introduced national measures that apply to space infrastructure operations, particularly authorisation requirements (involving the various steps to develop and operate space products and services).

Disparate rules across Member States result in uneven levels of protection in relation to: (a) safety; (b) resilience; and (c) environmental sustainability. The patchwork of national rules leads to a fragmentation of the single market, which is likely to grow as more Member States intend to update or develop national space legislation. At the same time, the level of safety, resilience and environmental sustainability has a particularly **strong cross-border dimension**. This is because space infrastructure manufactured in one Member State, needed to provide space data and services, is very often used by companies across the EU, and space operators often need to acquire several licences in several Member States. Moreover, the rules that exist today in the EU do not address or do not fully address these matters (e.g. disparate rules on

[59] Source: Euroconsult.
[60] OECD, The Space Economy in Figures – Responding to Global Challenges, 2023, https://www.oecd-ilibrary.org/docserver/fa5494aa-en.pdf.

safety for space operations; on the resilience of the space segment and only minimal non-sector-specific rules on the ground segment; on measuring the environment footprint of space activities).

Therefore, the EU proposal for a legislative act for safe, resilient and environmentally sustainable space activities should **provide the cross-cutting regulatory action that would bring targeted harmonisation to several key aspects of national licencing requirements**. The legislation should ensure, as a main objective, the creation and functioning of a single market satellite-based services and data. The initiative would create greater legal certainty for companies and users across the EU by: (i) ensuring a uniform and high level of protection of space services and data (including space infrastructure); and (ii) facilitating the free movement of space-based services and data in the single market and the capacity of companies to work across multiple jurisdictions without hindrances.

Although the Treaty also provides a legal basis related to space policy (Article 189 TFEU), that legal basis cannot be used for this initiative. While Article 189 TFEU is suited as a legal basis for different types of measures that promote joint initiatives, support research and technological development or coordinate efforts for the exploration and exploitation of space, it explicitly excludes any harmonisation of national laws and regulations. As a result, Article 189 TFEU – enshrining a parallel competence of the EU to develop its own space policy – cannot be used to regulate aspects such as requirements for the safe, resilient and sustainable use of satellites that are not in the EU space programme's scope. According to case law[61], Article 114 TFEU can be used to regulate aspects related to the functioning of the single market of space sector goods and services. See Annex 7 for a more detailed analysis.

3.2. Subsidiarity: need for EU action

EU action would strengthen the competitiveness of EU companies in the global space economy. Having one set of requirements instead of (+) 13 creates simplification for the EU industry, reducing administrative burden on companies – and public authorities- and increase their ability to innovate and compete globally. Safety, resilience and environmental sustainability requirements would create business opportunities for the industry, and the development of innovative new markets. Finally, it will enable measuring the environmental footprint of space activities.

EU measures would also increase space activities' overall level of safety, resilience and environmental sustainability. This brings clear added value compared to individual Member State action by: (1) creating a level playing field across the EU by harmonising licencing conditions related to safety, resilience and environmental sustainability; (2) aligning the scope of national space legislation to avoid overlaps, duplication and conflicts, contributing to the functioning of the single market; (3) facilitating the transfer or recognition of licences to provide EU-wide services and goods; (4) improving and harmonising protection for space infrastructure in the EU, thus strengthening the capacity of these systems to deliver data and services that support the single market; and (5) ensuring consistency when evaluating the environmental impact of space activities in the EU.

[61] Case C-376/98, *Germany* v *Parliament and Council*, 2000 E.C. R. 1-8419.

Regarding point 4, it is worth recalling that the cross-border nature of cybersecurity means that an attack on space infrastructure in one Member State will create spill-over effects in another. Due to this interconnectedness, protection cannot be effectively addressed by individual and uncoordinated actions. Similarly, as regards safety, any unsafe satellite can create risks for other Member States' satellites in orbit. Furthermore, as described in Section 2, divergent national approaches risk hampering an open and competitive single market.

3.3. Subsidiarity: Added value of EU action

A common approach for safe, resilient and sustainable space activities at EU level could bring multiple benefits to the EU space sector. Space activities are transnational by nature, and the EU should ensure a consistent and predictable framework for its space industry. The transnational nature of the space market and the global competition in this sector make it difficult and therefore inefficient for Member States to individually address the various challenges in protecting space infrastructure. The space sector is only as **safe and resilient as its weakest link**, as demonstrated by the amount of debris generated by only a few incidents[62]. The more satellites comply with safety and resilience measures, the less they are likely to collide with other satellites or explode. Similarly, cyberattacks on a satellite in one orbit could have an impact on other satellites in the same orbit (regardless of the country or operator managing it). Finally, EU action that helps the space industry reduce its environmental footprint would drive more innovation in sustainable space technologies, facilitate access to sustainable finance and ultimately increase competitiveness and build market confidence.

Common minimum requirements for the safety, resilience and environmental aspects of space activities for all EU satellite operators and non-EU operators providing a service in the EU would create a critical mass, enabling the EU to influence and further strengthen global standards in these areas. A common approach at EU level could position the **EU as a global leader in setting standards in a field that is urgently calling for solutions**[63]. The EU space industry would contribute to shaping regulations and creating EU norms, which would lead to mutual recognition agreements between the EU and non-EU countries. In turn, this would increase market access.

As regards the **proportionality** of the action, it would not go beyond what is needed to achieve the objectives of this initiative and would not impose disproportionate costs that could harm the competitiveness of the EU space industry. The EU action would:

a. create a common baseline for safety, resilience and environmental sustainability for all space infrastructure in the EU;
b. be proportionate to the specific risks of different orbits and altitudes and the specific characteristics of non-critical missions (as described in Section 6);
c. remain technology neutral;
d. respect Member States prerogatives on national security.

[62] The majority of space debris comes from Chinese weapons testing and the Iridium-Kosmos collision.
[63] United Nations, Our Common Agenda Policy Brief 7, For All Humanity – the Future of Outer Space Governance, 2023 https://www.unoosa.org/oosa/en/documents/doc/policy-brief.html.

The positions of Member States expressed during bilateral exchanges broadly support the development of a common legal framework for safe, resilient and sustainable space activities. Member States all underscore the paramount importance of prioritising competitiveness in the proposed framework and favour embedding proportionality in the proposed rules as a strategic measure to safeguard and boost the competitiveness of the EU space industry. Additionally, Member States emphasise the need for the proposed initiative to fully respect their national security powers and complement existing national space laws.

4. OBJECTIVES: WHAT IS TO BE ACHIEVED?

Considering the problems outlined in the previous sections, the general objective of this initiative is to **support the development and functioning of an EU single market for the space sector.** This will: (i) provide legal certainty to space market operators and foster competitiveness in the industry; and (ii) mitigate the risks of the exponential growth in space activities and ensure the long-term use of space.
Specifically, the initiative aims to:

(1) lay down an EU framework guiding the conduct of European space operators in a way that provides a stable, predictable and competitive business environment that fosters innovation;
(2) ensure space objects can be tracked and reduce the amount of space debris generated by EU space operators and space operators providing their services in the EU;
(3) create a risk assessment framework that is tailored to the cybersecurity needs for space infrastructure in the EU and Member States;
(4) create a common method to assess and measure the environmental impact of space activities in the EU.

In addition, by achieving the above objectives, the initiative will be aligned with the following priorities.

- **Space strategy for Europe**[64]. The strategy underlines the need for a competitive and innovative European space sector and enabling measures and capacity building at Member State and EU level 'to create the right ecosystem with a favourable regulatory and business environment that incentivises the private sector to be more risk-prone and encourages businesses to develop innovative products and services'.
- **Strategic autonomy** for the EU in space. This can be achieved through:
    - global leadership in space governance: the EU can harness a common approach to safety, resilience and environmental sustainability and build on more global approaches to common global problems (in line with the EU space traffic management joint communication);
    - technological innovation and research: encouraging innovation in the EU space sector, the initiative aligns with the broader objectives of technological leadership;

[64] Space strategy for Europe, COM(2016) 705 final.

- strengthened resilience, protecting the upstream space sector to ensure operations continue and the downstream space sector for the reliable provision of services in line with **EU space strategy for security and defence.**

- The development of a common LCA method is in line with the **EU Green Deal** ambition for a sustainable future, particularly with the Commission Recommendation[65] for the use of product environmental footprint (PEF) and organisational environmental footprint (OEF) methods. Reducing space debris and identifying areas to reduce the environmental effects demonstrates the EU's commitment to protecting the Earth's orbit and shared natural resources.

5. WHAT ARE THE AVAILABLE POLICY OPTIONS?

5.1. What is the baseline from which options are assessed?

The baseline is understood as the situation that is applicable today, with different developments meant to address the safety, resilience and environmental sustainability of space activities at Member State, EU and international levels.

In the absence of a common EU regulatory framework that is tailored to space activities, Member States continue to tackle aspects related to safety, resilience and sustainability in different ways which, as described in Section 2.1.1, leads to a fragmentation of the single market. More Member States will inevitably regulate space activities, including by providing a regulatory framework for the New Space industry emerging in their jurisdiction. Space operators therefore continue to be faced with different rules and standards in the EU, in addition to those in non-EU countries. This patchwork of rules hampers their competitiveness and potential for innovation. Private investors do not have the legal certainty that is required to continue investing in New Space companies in the EU. This may lead to large industry groups opening subsidiaries abroad to develop and carry out their businesses, and some start-ups and SMEs moving to larger markets (like the US).

On space safety, EU and non-EU space operators can make use of free collision avoidance and re-entry prediction services, such as those provided by the **EU SST Partnership**[66]. However, the use of these services is not mandatory. At EU level, reflections on the aerospace sector are ongoing[67], assessing the need for a potential regulation of higher airspace operations (HAO) – this concerns safely operating vehicles in the higher airspace (which may lie in the 'grey zone' between aircraft and spacecraft). However, such an initiative would not address space activities.

On **resilience and risk management/cybersecurity,** as explained in Section **2.2.1,** two recent directives aim to further strengthen the physical resilience of critical entities (CER Directive) and the cybersecurity of essential and important entities (NIS2 Directive). However, while the space sector is partly in the scope of both directives, not all space operators are subject to their

[65] https://environment.ec.europa.eu/system/files/2021-12/Commission%20Recommendation%20on%20the%20use%20of%20the%20Environmental%20Footprint%20methods_0.pdf.
[66] A partnership composed of 15 EU Member States, which created a network of ground-based and space-based sensors aiming at surveying and tracking space objects to provide data, information and services on space objects orbiting the Earth. See: https://www.eusst.eu/.
[67] https://www.easa.europa.eu/en/newsroom-and-events/news/roadmap-higher-airspace-operations-hao-proposed-easa.

rules. Entities operating the ground-based infrastructure are in the scope of both directives, so they will be subject to the risk assessments and Member States strategies in the CER Directive. The CER Directive follows a risk-based approach that includes identifying the critical entities that will be subject to obligations to carry out risk assessments and implement measures to boost their resilience. Therefore, not all space operators will be subject to specific obligations.

Finally, space operators continue to face difficulties in demonstrating their commitment to sustainability and environmental responsibility as there is no universally accepted method to quantify these aspects. While many environmental requirements apply to space activities, space operators continue to face uncertainties and complexities when seeking to obtain licences and ensure regulatory compliance. This leads to delays, uncertainties and potentially more stringent licencing and regulatory requirements as national authorities grapple with the lack of standardised environmental metrics for space operations.

Therefore, in the baseline scenario, the situation described above will continue to apply: no additional action at EU level is planned in the fields of space safety, resilience and environmental sustainability. EU-owned assets and national assets will continue to follow different tracks and requirements, while being in practice increasingly interconnected, especially as regards the requirements for shared payloads and commercial payloads hosted on EU-owned satellites.

5.2. Description of the policy options[68]

The starting point for assessing the options are specific technical and operational safety, resilience and sustainable environmental measures. As previously explained, these core technical requirements are different and will remain different as Member States advance due to the related risks (problem drivers 2, 3 and 4) to enact requirements in these areas. All options therefore address all three fields. Each option proposes a different way (for instance, different degrees of regulatory involvement and industrial autonomy) to tackle the objectives of the initiative, which in turn affect the stringency of the requirements (for instance, the technical thresholds set out in the measures). Furthermore, certain options have been ruled out due to their political unfeasibility (see Section 5.3).

Table 6: Overview of measures

Risk to be addressed	Measures
Safety: risk related to collision can be mitigated through collision avoidance[69]	• Subscription to a collision avoidance service (launch, in-orbit, end-of-life) • Improvements to trackability • Mandatory notification of changes in operation
Safety: risk related to collision can be mitigated by limiting the amount of debris produced[70]	• Design to minimise release of debris or protect space objects against impact • Satellite and launcher passivation (removing any energy at the end of its mission or life) • Launcher neutralisation[71]
Safety: risk related to collision can be mitigated through post-mission disposal[72]	• Reliable and safe means to dispose of objects (re-entry, graveyard orbit) • Determining in advance the probability of the post-mission disposal plan's success • Limit on orbital lifetime
Resilience: risk related to increased threat level can be mitigated by laying down certain tailored risk management rules	• Identification and inventory of assets on all segments • Risk assessment per segment • Detection of incidents • For cyber and physical risks: prevention measures and protection measures (see next point) • Business continuity and recovery measures • Supply chain risk management (strategy, rules, possible future certification scheme)
Resilience: risk related to increased threat level targeting space assets can be mitigated by laying down information security requirements tailored to the space sector	• Protection measures, such as encryption

[68] Please see Annex 8 for a more detailed description of the policy options.
[69] In line with the UN Long-Term Sustainability Guidelines B.1-B.5, Inter-Agency Space Debris Coordination Committee (IADC) Guideline 5.4, UN Space Debris Mitigation Guideline 3.
[70] In line with IADC Guideline 5.2, UN Space Debris Mitigation Guideline 2 and 5.
[71] The process of disabling or rendering a missile or rocket launcher inoperative to prevent its use.
[72] In line with the UN Long-Term Sustainability Guidelines B.9, IADC Guideline 5.3, UN Space Debris Mitigation Guideline 6-7.

Resilience: risk related to increased threat level can be mitigated by promoting an information-sharing scheme on cyber risks	• Via a space information-sharing and analysis centre
Environmental sustainability: lack of a reliable method to assess and compare the space sector's environmental performance	• Development of a life cycle assessment for space activities based on the PEF method (PEFCR)[73] • Communicate on the environmental footprint

5.2.1. Policy option 1: Co-regulation

Option 1 aims to set out certain voluntary measures on safety, resilience and sustainability through a co-regulation approach[74]. The Commission, building upon its experience with the EU space programme (Galileo, Copernicus, SST and IRIS² [75]), would draw up specific requirements to be met in the field of safety, resilience and sustainability through a legislative act[76]. The Commission would mandate space industry bodies (such as trade associations, standardisation bodies) to develop the technical application of these requirements and steer the process. The bodies would develop and adopt a series of non-binding measures (e.g. in best practices, guidelines and charters).

To ensure that these voluntary measures are effective, the Commission would set **specific minimum targets in the legislative act launching the initiative**. If these targets are not met, the Commission would be able to end the process. When developing the voluntary measures, the industry would draw on existing international non-binding texts (see example of measures in Table 6: Overview of measures) and therefore anticipate potential future needs.

This approach would require a broad participation of stakeholders to ensure widespread compliance with the non-binding measures produced. At the end of the process, the Commission would analyse the **results achieved by the space sector. If they are in line with the objectives and targets set out in the legislative act, they would be incorporated into an implementing act.**

The implementing act would be non-binding. It would be up to those in the industry and government to comply with them on a voluntary basis. However, the following steps could help increase compliance.

1. **Setting up a forum**

- In proposing a specific **forum for exchanges with Member States on the legislative act,** the Commission would help share best practices and the best approaches to **incorporate the non-binding measures at national level** in their licencing systems. It could be inspired by the current practices of Member States when referring to non-binding international texts in

[73] Building on Commission Recommendation C(2021) 9332, 16/12/2021.
[74] Co-regulation would combine legislative and regulatory measures with actions taken by those most concerned, drawing on their practical expertise. Co-regulation is defined as 'the mechanism whereby a community legislative act entrusts the attainment of the objectives defined by the legislative authority to parties which are recognised in the field (such as economic operators, the social partners, non-governmental organisations, or associations). This mechanism may be used on the basis of criteria defined in the legislative act so as to enable the legislation to be adapted to the problems and sectors concerned, to reduce the legislative burden by concentrating on essential aspects and to draw on the experience of the parties concerned', https://www.eesc.europa.eu/sites/default/files/resources/docs/auto_coregulation_en--2.pdf.
[75] Article 3(2)(i) of Regulation (EU) 2023/588 of the European Parliament and of the Council of 15 March 2023 establishing the Union Secure Connectivity Programme for the period 2023-2027 (OJ L 79, 17.3.2023, p. 1).
[76] Communication from the Commission of 25 July 2001 'European governance - A white paper', COM(2001) 428 final.

national licencing requirements. Considering the non-binding nature of such acts, Member States would still have the freedom to refer to them or not.

2. **Development labels**

- The legislative act would support the industry in developing a mechanism to **recognise satellite operators that effectively implement the non-binding measures through the creation of 'space safety/resilience/sustainability labels'**[77]. Today, many space companies make an effort to sign pledges to improve space safety, security and sustainability. The labelling mechanism would create a government-approved tool that verifies, validates and certifies those companies that meet the applicable standards. Such transparency would reduce 'greenwashing' and help to incentivise behavioural change. In addition, companies may be more willing to choose a partner carrying a space label that attests that their product is safer or more secure, thereby limiting the risk of future damage.
- The legislative act would outline cross-cutting rules for all the labels, covering governance aspects (e.g. setting up stakeholder groups, setting out the roles and responsibilities of the EU Agency for the Space Programme) and procedures for developing the specific labelling schemes (e.g. space safety, environmental sustainability, resilience). This would include guidance on how to obtain the label and how to use it (including the procedures for monitoring and addressing its potential misuse).
- The different labels would share the same underlying approach. However, as the scope of the topics differs, they would be governed by different steering committees (key stakeholders, including industry and Member States) that would support the Commission in drawing up the requirements.
- The bodies would agree on the most efficient and transparent way to manage the labels' proper use.

Table 7: Overview of policy option 1

Nature of act	The EU adopts a legislative act asking for the development of non-binding measures (e.g. best practices, guidelines, charters) by key stakeholders in the sector. An EU act will promote voluntary labelling schemes in the industry, whose measures will become binding once companies sign up to the label.
Scope	EU satellite operators (public and private), EU operators providing launch services, space infrastructure manufacturers. Only those bodies deciding to participate in the labelling scheme.
Content	Measures listed above (Table 6: Overview of measures). Co-regulation would enable industry ownership and innovation but would result in less stringent regulations due to the emphasis on voluntary adherence and industry-driven priorities.
Obligations	No obligations (unless implemented in national space laws).
***Ex ante* check**	Checks of the non-binding instruments produced by the industry in order to verify if they address the requirements and the targets set in the legislation.
Enforcement	Checks done by the industry (only relevant for the labels).
Governance	Governance to draw up the non-binding rules.
Timeline	Two years to develop the co-regulation; Two and half years to develop the PEFCR.

[77] Similar to ecolabels and cybersecurity labels under ENISA.

5.2.2. Policy option 2: A binding framework at EU level

The binding framework envisaged under this policy option would entail the adoption of a legislative proposal harmonising certain national licencing conditions that cover safety, resilience and the environmental sustainability of space activities[78].

These requirements on safety, resilience and environmental sustainability would therefore be integrated into the national licencing systems, whether they already exist or need to be developed[79]. Table 6 provides an overview of the proposed measures on safety, resilience and sustainability.

The licencing decisions by the relevant national authorities would assess the EU conditions for safety, resilience and environmental sustainability, and the assessment of any other potential applicable national requirements (e.g. aspects related to insurance) would be done in line with national law.

For **EU-owned assets**, the European Union Space Programme Agency (EUSPA) would receive reports on major incidents from operators of space infrastructure, which would align the rules covering the EU-owned assets with the NIS2 and CER approach to incident reporting.

The legislative proposal would apply to satellites and launchers launched after the date of entry into force of this initiative.

Table 8: Option 2 – Scope of applications

EU (public and private) actors	EU satellite operators[80]: they will have to comply with certain measures related to safety, resilience and sustainability[81].
	EU operators providing launch services: they will have to comply with certain measures related to safety, resilience and environmental sustainability[82].
	EU-based providers of different types of space-based services: they will provide and use only data/services derived from the use of satellites that are compliant with EU measures[83]. This rule would apply to all types of space-based services and should affect all providers of such data[84]: - satellites producing space-based data, such as for Earth observation, e.g. Copernicus; - companies using space-based data for providing different services (e.g. gathering space data in hubs, space applications).

[78] It would not address other aspects of the licence, such as what kind of vehicle the Member State chooses to define as a spacecraft. This is at the discretion of the Member State but could be further regulated in a future HAO regulation.
[79] See Annex 6.
[80] Not covering satellites used only for military purposes.
[81] Ultimately this means that only operators having implemented these measures (and consequently only satellites for which the operators show evidence of observing such rules) can obtain a national licence.
[82] Ultimately this means that only those launchers for which operators show evidence of observing the rules can be used by EU satellite operators for the launch activity/service.
[83] Ultimately this means that only data/services derived from the use of satellites that are compliant with the EU Space Act can circulate in the single market.
[84] While certain exceptions could be envisaged.

	Space infrastructure manufacturers: they would be subject to certain risk management rules to ensure that their processes (manufacture, installation, repair) are resilient.
Non-EU actors	Providers of launch services based in a non-EU country – where the EU satellite operator chooses to launch its satellite in a non-EU country and the satellite-based services are intended to be provided in the EU.
	Providers of space-based services will be covered if they intend to provide their services in the EU[85].

This scope would ensure no conflicting requirements for bodies in the space sector that will fall under the NIS2 and CER Directives. Furthermore, it will avoid operators based outside the EU distorting competition because they may otherwise benefit from less stringent standards in their jurisdictions. It will also prevent potential loopholes in the regulatory system that might lead to circumvention of the obligations imposed under this option.

Member States would have to designate 'notified bodies'. The EU legislative proposal would set the requirements for entities to become notified bodies[86] who would help Member States with their conformity assessment of the EU requirements.

Table 9: Overview of policy option 2

Nature of act	EU legislative act (adopted under the ordinary legislative procedure).
Scope	EU actors: public and private satellite operators and operators providing launch services; providers of space-based services; space infrastructure manufacturers. Non-EU actors: providers of launch services based in a non-EU country; non-EU-based providers of space-based services.
Content	Measures in Table 6. Requirements to be laid down for the three areas covered (safety, resilience, environmental sustainability) in the main articles and annexes (high-level requirements that are technologically neutral). Certain technical elements (building on international standards and best practices when they already exist) would be developed through implementing acts. Guidelines to be developed to further clarify and explain the content of the implementing acts.
Obligations	Binding requirements for satellite operators, manufacturers and Member State authorities.
***Ex ante* enforcement**	Relevant national authorities in charge of granting satellite operation licences, supported by certifying/notified bodies.
Post enforcement	Relevant national authorities.
Governance	At national level and at EUSPA level (for reporting significant incidents involving EU-owned assets).

[85] Ultimately, this means that non-EU satellite operators/providers of services will not be able to sell data or provide services in the EU until a check has been carried out (by EUSPA or national bodies notified by Member States as responsible for analysing requirements) and confirms these operators comply with the EU requirements on safety, resilience and sustainability (and consequently the satellites for which they are granted a licence to operate).

[86] Inspired by the new legislative framework https://single-market-economy.ec.europa.eu/single-market/goods/new-legislative-framework_en

Timeline	Entry into force expected in 2027.

5.2.3. Policy option 2+: A binding framework at EU level, combined with non-binding measures

This option would build on option 2 and include certain additional non-binding measures.

Award of labels

Through this measure, a mechanism would be developed to better recognise companies implementing non-binding instruments. The '**space safety/resilience/ sustainabiity labels**' would be granted to companies that correctly implement the instruments on which the labels are based. The same process as in option 1 would be followed.

The voluntary measures laid down under the label aim to encourage the industry to exceed basic compliance and demonstrate a commitment to higher standards and best practices. Such measures would: (i) contribute to further improving the protection of space systems; (ii) signal exemplary behaviour by the industry; (iii) enable regulators at national and EU levels to observe the readiness and ability of the space industry to change and innovate in specific market sectors. The voluntary measures would be particularly relevant in areas where there is a lack of consensus on common solutions, for example, the development of innovative solutions to reduce light pollution.

The exact content of the measures is to be determined (with the help of stakeholder consultations) but what is essential is the intention to go further and meet higher targets.

Table 10: Overview of policy option 2+

Nature of act	An EU legislative act combining binding and non-binding measures.
Scope	EU actors: public and private satellite operators and operators providing launch services; providers of space-based services; space infrastructure manufacturers. Non-EU actors: providers of launch services based in a non-EU country; non-EU-based providers of space-based services.
Content	Policy option 2 and non-binding measures (Table 6) – information-sharing platform and voluntary label mechanism.
Obligations	Binding requirements for satellite operators, launch operators, space infrastructure manufacturers and relevant national authorities.
***Ex ante* enforcement**	Policy option 2 (binding rules) and label managed by EUSPA and ENISA.
Post enforcement	Policy option 2 (binding rules) and label managed by EUSPA and ENISA.
Governance	Policy option 2 (binding rules) and label managed by EUSPA and ENISA.
Timeline	Entry into force expected in 2027.

5.2.4. Policy option 2++: Bilateral agreements

If options 2 or 2+ are applied, a further step forward could be coming up with a viable solution for the EU to act on the international stage. This policy option would build on the content of options 2 or 2+ in a phased approach.

(1) Adoption of an EU legislative initiative on the safety, resilience and sustainability of space activities, which would create a single market for space products and services with a minimum amount of harmonisation (step 1).

(2) Conclusion of a series of bilateral agreements (step 2). Considering the global nature, scale and impact of space activities, the EU would work to achieve better regulatory convergence at international level by building partnerships with like-minded international partners, especially those with whom the EU already works with as part of Space Dialogues[87] and the EU-led 'Space safety, security and sustainability of outer space' (3SOS) public diplomacy initiative.

The focus of these bilateral instruments would be measures that have an impact on the safety, resilience and sustainability of space activities. In addition, the international agreements would provide the legal means to deepen discussions on essential aspects, such as satellite licencing requirements, or possibly trigger the development of mission profiles and, most importantly, shape a common understanding of different concepts and approaches.

Concluding such agreements would inevitably take a long time. However, the outcome, once the agreements are in place, would be reflected in the creation of a body of law of the respective parties[88], enriching the normative development of the global space sector.

Under option 2++, the Commission would propose a common set of negotiation directives for approval by the Council. The bilateral agreements would aim to have a similar effect as NASA's Artemis Accords[89], which have been endorsed by 32 countries, each entering into a separate bilateral agreement with the US. In a similar way, this option would see the EU enter into separate bilateral negotiations with different non-EU countries with the goal of concluding agreements with the same vision and content. The negotiation mandate would stipulate rules that build on the EU's core measures (set out in option 2 or 2+). The process for concluding bilateral agreements would follow Article 218 TFEU[90].

Table 11: Overview of policy option 2++

Nature of act	Policy option 2 (PO2) and a set of EU binding bilateral agreements with non-EU countries.
Scope	EU actors: (public and private) satellite operators and operators providing launch services; providers of space-based services; space infrastructure manufacturers.

[87] With countries like the US, Japan, Canada, Australia and others.
[88] Agreements concluded by the EU are binding on the EU institutions and Member States.
[89] NASA Artemis Accords, or Principles for Cooperation in the Civil Exploration and Use of the Moon, Mars, comets and asteroids for peaceful purposes. Text of 13 October 2020 available at https://www.nasa.gov/specials/artemis-accords/img/Artemis-Accords-signed-13Oct2020.pdf.
[90] Under Article 218(2), the Council must authorise the opening of negotiations, adopt negotiating directives, authorise the signing of agreements and conclude them.

	Non-EU actors: providers of launch services based in a non-EU country; non-EU-based providers of space-based services.
Content	PO2 and measures to be included in the bilateral agreements.
Obligations	PO2 and the respective non-EU country.
***Ex ante* enforcement**	Bilateral oversight body/board responsible for the effective functioning of the bilateral agreement.
Post enforcement	The relevant national authorities.
Governance	The bilateral oversight body/board could be composed of: (i) the non-EU country's relevant authority; and (ii) the European Commission, assisted by EUSPA and relevant national authorities in the space domain.
Timeline	Longer timelines for negotiating the different international agreements. Potentially around 2035.

5.3. Options discarded at an early stage

5.3.1. Full harmonisation of national regulations with the creation of a European licencing scheme

The option of creating a European licencing scheme, which would take over the authorisation of satellite launches and operations from Member States, was explored but quickly discarded because the EU is not a party to the OST in line with international law. It therefore cannot take over Member States' responsibility for authorisation and continuous supervision. A Member State would be liable either as the launch country or as the place where the satellite operator is based but would not be responsible for the authorisation procedure. This option was therefore assessed as legally and politically unfeasible.

5.3.2. International agreements at UN level in the area of space security

The option of negotiating an international agreement on space security at UN level was discarded because: (i) the work of the Open-Ended Working Group (OEWG) on Reducing Space Threats Through Norms, Rules and Principles of Responsible Behaviours in the UN framework has been blocked; and (ii) national powers in the area of security do not make this a politically feasible and realistic option.

5.3.3. Amending existing UN space treaties and setting up a global space governance within the UN framework

The option of strengthening the UN multilateral framework on space by amending existing UN space treaties[91] was also considered but quickly dismissed. The EU itself is not party to the UN space treaties and therefore does not have the right to amend these treaties. In addition,

[91] Such amendments would aim to, among other things, clarify and strengthen the obligation to consult in cases of harmful interference in the Outer Space Treaty (OST), insert enforceable information-sharing, transparency and confidence-building measures in the OST, and further strengthen the registration obligation in the Convention on the Registration of Objects Launched into Outer Space (REG), by, for example, including recommendations set out in UNGA Resolution 62/101.

with only observer status at the UN Committee for the Peaceful Uses of Outer Space (UN COPUOS), the EU can only present proposals and amendments orally. As a result, the EU would need to rely on its Member States to have formal proposals for amendments introduced in COPUOS. These difficulties are compounded by the current geopolitical environment and the historically difficult and lengthy process for adopting New Space treaties, which make action under this option unfeasible. Moreover, any proposal for amending the UN space treaties, particularly the OST, carries the risk of upsetting the balance in these treaties, which are widely considered as being a critical, albeit incomplete, foundation for safe, sustainable and secure spacefaring. Similarly, changing the global space governance within the UN framework was considered politically unfeasible.

6. WHAT ARE THE IMPACTS OF THE POLICY OPTIONS?

The analysis in Section 2 has shown key problems and drivers leading to severe consequences for the long-term safety, resilience and sustainability of the space sector. Inaction will inevitably lead to large investments and market adaptations being needed for companies to address all regulatory disparities and the legal-based constraints in a fragmented EU space sector. All policy options should ensure that the EU space industry remains future-proof, by fostering early compliance and risk-mitigation to address the challenges to space safety, resilience, and environmental sustainability

To accurately capture the magnitude and extent of the impact of each policy option, this report takes the following assumptions.

- **Policy option 1:** Under this option, the Commission facilitates the codification of non-binding measures between industry and Member States. In addition, it encourages industry to develop labels. The analysis assumes that 60% of the European satellite industry and 80% of the European launcher industry[92] would comply with the non-binding measures either through the codified codes of conduct or the labels.
- **Policy option 2:** This option involves adopting an EU binding framework. The legally binding nature of the measures implies a high compliance rate of the European space industry and of non-EU space operators providing services in the EU to the measures put in place by option 2.
- **Policy option 2+:** This option envisages the adoption of an EU binding framework referred to in option 2, paired with non-binding and support measures. It is assumed that this will lead to a high compliance rate among those in the European space industry with the binding components of this policy option and a 20% take-up rate of the voluntary measures that builds upon measures that are binding.
- **Policy option 2++:** Based upon the implementation of options 2 and 2+, this option would involve international bilateral agreements in order to foster a global approach to space safety, resilience and the sustainability impact of space activities. Building on the same compliance rate as under option 2, this option would also reach foreign operators that do

[92] Source: ESA; Space environment report, 2023. Existing international industry initiatives are already drawing a lot of support, i.e. the Declaration | Net Zero Space initiative that has 62 different companies supporting it, or the Space Safety Coalition that has 60 endorsees for their first version of their best practices for sustainability of space operations.

not provide services in the EU and are located in a country subject to the bilateral agreement. It could be reasonably assumed that there are certain efficiency losses, coordination costs and dilution of legal content associated with the international scale of the action.

Based on the above-mentioned assumptions, the following section lists the expected impacts[93] stemming from the policy options and identifies how they affect the baseline scenario (Section 5.1).

The table below provides an overview of the economic, social and environmental impacts and a high-level estimation – for each policy option – of the magnitude of the impact compared with the baseline scenario. A Likert scale from 0 to 3 visualises an estimation of whether there is an impact, either positive or negative, 'to a limited extent', 'to a certain extent' or 'to a large extent'. The caption to interpret results is presented below:

0	**No impact** in comparison to the baseline
1	**Impact to a limited extent** in comparison to the baseline
2	**Impact to a certain extent** in comparison to the baseline
3	**Impact to a large extent** in comparison to the baseline

Regarding the effectiveness, efficiency and coherence analysis of the selected policy options, the various policy options were assessed with a score from 1 to 3 depending on their suitability to target the general and specific objectives.

6.1 Economic impacts

6.1.1. Baseline

A fragmented single market would create economic challenges for the industry due to several factors.

A. Without legal **certainty and clarity** investors may be deterred from investing. A lack of available funding would more significantly impact emerging New Space companies who would face difficulties in scaling up and as a result may even choose to leave the EU. On the other hand, established industrial players would see no or little incentive to invest in innovation and become more competitive.

B. The baseline is not conducive to improving the **position of small players** in the space sector. SMEs would need to navigate through several different and complex national requirements (to achieve regulatory compliance under each applicable regime). Small players may not necessarily find in each national regime a tailored baseline for their

[93] A number of annexes are restricted in light of certain features: the sensitivity of the information on the impacts of cyberattacks upon space assets; the level of maturity of the space sector (the market entry of certain players such as New Space is recent).

specific needs or the proportionality they seek so their needs may be understood and reflected upon differently in each national regime.

104 SMEs replied to the targeted consultation. According to 87% of them, the current national space laws are not fit to ensure the safe and long-term use of space. 85% of SMEs claimed that the increased space activity calls for specific requirements for the safety of space activities, and 69% claimed that the risk to space infrastructure also calls for specific requirements. 90% of SMEs agree or strongly agree that with increased space activity there is a need for a common method across the space sector to measure its environmental impact on Earth and on space.

C. The most important impacts are those related to actual costs. The baseline prompts a clear risk of leaving space infrastructures **unprotected from safety and cyber risks**.

Costs due to safety risks

As shown in Section 2, the risk of collision would continue to grow. The Organisation for Economic Cooperation and Development (OECD) has estimated the **risk of collision to be costly**, averaging 5-10% of the mission cost which often reaches to hundreds of millions of euro[94]. Industry would also face costs for carrying out satellite manoeuvres due to service interruption. Without improved compliance with safety measures, the European Space Agency (ESA) has projected that by 2040, the number of close collisions at 500 km altitude will increase nearly sixfold[95]. The risk to the orbits is at a tipping point, where mitigating space debris is imperative to ensure the future usability of space. Once the Kessler effect is triggered, the space industry will lose access to space, and users lose access to important space-based services.

Costs due to cyber risks

Without proper cyber protection in place, the space industry is vulnerable to attack (see Section 2). The costs of **cyberattacks on space assets** – as explained in the estimations carried out through several use cases[96] – lead to: i) serious financial impacts (direct operational loss of the service, equipment destruction) depending on the magnitude of the cyberattack and the level of vulnerability; ii) a loss of market potential in front of competitors; iii) lengthy periods of time needed to resume activities; iv) potentially significant reputational damage; v) loss of market confidence (investors withdrawing); and, in some (limited) cases; vi) bankruptcy (overdue payments and incurring fines).This is compounded by the lack of legal certainty in the space sector, which exacerbates the financial and operational risks associated with cyber threats.

The gaps identified in the NIS2 framework, create regulatory uncertainty and ambiguity, making it difficult for businesses to assess their exact obligations, ensure compliance and secure investments. To date, **most Member States have not yet fully transposed the NIS**

[94] OECD, 'The economics of space sustainability'.2022. URL: Earth's Orbits at Risk: The Economics of Space Sustainability | en | OECD.
[95] ESA annual space environment report 2024, https://www.sdo.esoc.esa.int/environment_report/Space_Environment_Report_latest.pdf
[96] Cyberinflight support study in the Annex (Public report).

2 directive[97], thus leading to a transitional period of regulatory uncertainty. Uncertainty discourages private sector engagement, slows innovation and limits funding opportunities, as investors perceive heightened risks. Lack of clarity on the applicable rules to space entails uncertainty as regards the level of legal protection which can lead to fragmented cybersecurity approaches of space operators increasing the overall vulnerability of space infrastructure. Without a comprehensive regulatory approach and without explicit rules on how cybersecurity baseline applies to the space sector, market instability may rise, hindering long-term growth in the space industry.

In the three cases considered in this analysis, the costs of cyberattacks were estimated at EUR 10 million, EUR 290 million and EUR 525 million, respectively. On average, in a realistic scenario, the average cost of a cyberattack could be estimated at around EUR 26 million, therefore making the total systemic cost of all cyberattacks per year (taken for 2023) around EUR 1.17 billion. This estimation would suggest space cyberattacks could cost the space industry approximately at least **EUR 900 million per year**. In a pessimistic scenario, the annual cost would increase almost threefold by 2032[98].

The cost of the baseline or status quo would have severe repercussions on the safe, resilient and sustainable use of space, and the EU space industry.

D. **Lack or loss of competitiveness**:

Globally: the fragmentation stemming from differing national licencing conditions, leading to barriers emerging in the single market is likely to adversely impact the EU space industry' capacity – including that of the New Space industry – to grow and reach the level of maturity needed to compete and innovate on a global scale.

Locally: while the planned new spaceports in Europe are expected to create economic opportunities (new possibility to launch satellites), the complexities and disparities of differing safety, resilience and sustainability licencing requirements would hinder business opportunities across EU borders, as these would have to be implemented at design phase.

E. The quantification of the **missed opportunity** (net present value[99]) from the **global** satellite industry in 2040 – i.e. the cost of inaction – varies from around EUR 270 billion if optimal management begins in 2025 to around EUR 630 billion if optimal management begins in 2035[100]. This represents almost the entire value of the global space sector. It is also estimated that the loss of access to space could represent a global loss of 2.56% of the global GDP.

[97] https://ec.europa.eu/commission/presscorner/detail/en/inf_24_5988
[98] Ibid.
[99] The industry value is measured as net present value (NPV) – the long-run value of the entire fleet of satellites in orbit, accounting for both the financial costs of replacing satellites due to natural retirement and collisions as well as the opportunity cost of investing funds in satellites rather than capital markets.
[100] Akhil Rao, Matthew G. Burgess, Daniel Kaffine, Orbital-use fees could more than quadruple the value of the space industry, PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES, 2020.

6.1.2. Policy option 1

The development of the non-binding option (co-regulation and voluntary labels for safety, sustainability and resilience) for the EU space industry - as envisaged by option 1 - would be an industry-driven initiative, intending to increase compliance with the most relevant existing standards, best practices, and guidelines to proactively develop at EU level.

Main impacts:

The partial reach of this option would yield only a limited impact on the competitiveness of the EU space industry, and no impact on the development of the single market, as Member States would retain own requirements for safety, resilience and sustainability.

It can be assumed that a co-regulation approach, which is industry-led and industry-oriented, may lead to a certain degree of compliance. Therefore, in terms of protecting space assets, it can be assumed that, for most EU satellites, space operators may comply with certain protective measures (such as space debris mitigation, satellite tracking and certain good practices of encryption of critical parts of the satellite). Moreover, some operators may be incentivised to comply with the extra non-binding measures, leading to the award of the label to gain a competitive advantage (increased investment; government use of the label in procurements).

However, the **level of protection** achieved through this option **would not be all-encompassing**. Considering the extent of the interconnectedness of all space systems, only one part in the overall satellite population complying with protective measures may imply that this option would still leave space infrastructure vulnerable to collisions. In addition, the level of ambition sought may be also influenced by unpredictable factors such as: i) the bargaining power of large space operators compared with the position of small players; ii) the inability of small players to comply with certain non-binding standards due to lower budgets; and iii) inevitable diverging economic self-interests.

The co-regulation is not expected to feed into a lot of **research and innovation activities.** Due to the industry-driven approach, it can be assumed that the results will be largely based on existing industry practices. However, some limited business and research opportunities may be created.

In the targeted consultation, 54% of SMEs agree that non-binding measures provide flexibility for the industry to develop new technological solutions, but 67% agree that they provide less legal clarity. 56% agree that safety and resilience measures can limit revenue-producing activities and that non-binding measures are therefore not sufficient.

6.1.3. Policy options 2 and 2+

A regulatory option through targeted harmonisation would generate several benefits.
In the short term, this option would contribute to a **well-functioning single market** in a straightforward, rapid manner, by removing and avoiding barriers and hindrances in EU cross-border trade. It would boost the **competitiveness** of the space industry, (including for start-ups and SMEs) by reducing the level of administrative burden and costs for companies that would:

(i) no longer have to comply with multiple uncoordinated requirements[101]; (ii) place the same product in all EU-27 Member States; and (iii) have faster time to market (shorter time to prepare licencing file, including for constellations).

In the mid-term, this option would increase the **lifetime of satellites** due to energy savings on board satellites (induced by the decrease of manoeuvres) and therefore enable companies to extend their mission and generate **more revenue** (for example: a one-year extension of a LEO satellite that has a 5-year lifetime would enable companies to generate 20% more revenue without additional expenditures). These options would help to further grow the EU space industry through: (i) consumer-confidence: the level of protection for space infrastructure would increase the use of more space-based services that would be more reliable; (ii) access to private funding: a stable and predictable regulatory environment would attract further private investment, which is key for New Space actors to scale up and grow (based on the commercial growth of current start-ups, the total investment need for the next seven years is estimated at EUR 10 billion), especially those in need of larger fundraising[102].

This option would also enable **new commercial markets** to be developed (e.g. in-space operations and services), accelerate **innovation** (e.g. innovation related to reducing the environmental footprint) and enable new space-based services (e.g. satellite tracking services).

The options 2 and 2+ would lead to the following **estimated benefits.**

- Regulatory simplification induced by streamlined licencing process for constellation (for satellite operators): EUR 68 million over the next 10 years;
- Savings related to the reduction of the number of manoeuvres by two (for satellite operators): EUR 674 million on average per year;
- Savings induced by a higher level of protection against cyber incidents (for manufacturers): EUR 320 million on average per year.

In the long-term, this option would help preserve the **space-related business** by reducing the risk of collision (with debris and active satellites, saturation and cyberattacks). Considering that the global space economy is estimated to reach EUR 700 billion by 2031 and that the EU-27 currently represents 20% of it, this option helps secure business activity worth EUR 140 billion for the EU space industry in the long term.

On the other hand, the binding nature of the measures envisaged would create additional obligations and therefore lead to additional costs for the space industry. Although the level of compliance costs would depend on the extent of measures currently implemented by companies along the value chain, options 2 and 2+ would lead to a generalised increase in costs for companies on the market compared to the baseline[103].

Additionally, the space industry is now operating within an evolving EU legislative framework on resilience and cybersecurity, with the **CER** and **NIS2 Directives** entering into application,

[101] 68% of SMEs believe option 2(+) would decrease the risk of operators 'cherry picking' Member States with the least safety, resilience or sustainability requirements. 73% agree it could create an equal level playing field for all European companies.

[102] 71% of SMEs agree that option 2 could provide a common, stable and predictable framework to boost the long-term sustainability of activities of new commercial space actors and attract private investment.

[103] The assessment of impacts in relation to resilience aspects (detailed cost estimation for resilience/cybersecurity measures, as well as detailed costs estimation for costs of cyberattacks are part of a restricted annex not subject to publication).

both of which are still being fully transposed by Member States. This ongoing process can generate legal uncertainty and **cost duplication** for space actors, as they may have to comply with resilience and incident-reporting obligations under different frameworks. At the same time, **important synergies** could arise by leveraging common governance mechanisms already envisaged for CER and NIS2. For instance, the same notified bodies or national authorities responsible for reporting under CER or NIS2 could also verify compliance for space-specific requirements, thereby preventing multiple, overlapping audits and certifications. Similar benefits may emerge on the physical and operational resilience side—by aligning with CER's processes, space operators can avoid duplicating impact assessments or reporting lines. This could streamline compliance across the different legal acts and **avoid unnecessary administrative overhead**, while at the same time ensuring coherence among the different frameworks.

According to the industry, the impact of the requirements from option 2 and 2+ would lead to a **cost increase** for the EU space industry of:

- between 3 and 10% of the total manufacturing costs, representing an average annual cost of EUR 180 million over the next 10 years;
- approximatively EUR 28 million per year on average for launchers;
- approximatively 1% of the manufacturer's turnover for the resilience-related measures, representing an annual average of EUR 80 million.

However, the costs associated with this policy option would be far less substantial than the costs of the baseline. Indeed, the **cost of a cyberattack is estimated to be approximately five times higher than the estimated cost of cybersecurity measures** needed to prevent or withstand the attack. Therefore, a strong regulatory framework could not only reduce the number of successful cyberattacks in the future but also reduce the average cost associated with each cyberattack. Similarly, without reducing the collision risk to satellites, operators will lose satellite lifetime and service revenue from having to carry out manoeuvres, and in the worst-case scenario lose the satellite altogether in a collision.

The absence of a common LCA methodology for companies can result in environmental degradation, regulatory non-compliance, reputational damage and missed business opportunities, including **no access to sustainable finance**.

The regulatory framework would be key to ensuring long-term sustainability of space infrastructure, and therefore the ability for the EU space industry to continue its activities. In addition, the costs would be partially offset by (i) proportionality and (ii) support measures. The level of sophistication of the measures implemented by the space industry would vary depending on certain criteria, such as the level of criticality of space missions (see in Section 3.3).

Proportionality

The proposed EU initiative could acknowledge the possibility of applying a light regime in the licencing process, while Member States could remain in charge of assessing and deciding, on a case-by-case basis, whether to approve such a light regime or not, in light of certain criteria set out in the EU initiative (e.g. i) taking into account the objectives and low technical complexity of the mission; ii) lack of strategic importance of the respective space programme;

and iii) track record and severity of security incidents incurred by the actors). To avoid different approaches being used to approve such light regimes across the Member States, coordination mechanisms could be put in place along with a notification to the Commission. Additionally, to ensure consistency in national approaches and prevent regulatory arbitrage, EUSPA could regularly monitor the application of such regimes across Member States and submit appropriate recommendations to facilitate supervisory convergence.

Table 12: Overview of light regime

Category	Application	Rationale	Consequences
Safety	Light regime to be applied to satellites in Very low Earth orbit (VLEO)	(i) VLEO is not crowded and is below the ISS, reducing the need for manoeuvrability; (ii) Satellites in VLEO burn quickly in the atmosphere, ensuring natural compliance with disposal rules.	(i) No need for a propulsion system; (ii) No need for redundancy/passivation (energy depletion requirement); (iii) Natural compliance with disposal rules.
Resilience	Light regime to be applied to SMEs and universities	Key criteria: (i) Size of the space operators (ii) Main risks (iii) Criticality of assets and functions Comparatively minor risk to the overall space ecosystem.	(i) Less stringent risk management requirements.
Environmental Sustainability	Light regime to be applied to micro enterprises and universities	Reduce administrative burden allow resource allocation to research and innovation.	(i) Voluntary measures

Support measures

To offset part of the costs induced by complying with the binding requirements outlined in option 2, especially the costs for SMEs for which some of the measures may be more burdensome than for large players[104], the following (non-exhaustive) list of **support measures** could be envisaged.

- **Capacity building**: to support companies (satellite operators, launch service providers, manufacturers), the Commission would propose to produce additional documents (guidelines and templates) on how to best comply with the rules and use the space labels in national procurement procedures. The Commission would also develop supplementary

[104] 36% of SMEs agree that the cost would be burdensome for operators, and 64% stated that binding requirements needs to include supportive measures for industry.

guidance documents related to the binding rules that would apply to novel areas, such as in-space operations and servicesor orbital traffic rules. This support measure would also benefit Member States (relevant national authorities and notified bodies).

- **Technical assistance**: to offset the number of full-time equivalents (FTEs) required by SMEs to prepare licencing files, the Commission would create a pool of independent experts that would assist the SMEs with this task free of charge.
- **Mentoring and coaching**: To offset part of the costs related to cyber resilience for those manufacturers moving from the light to the normal regime, and for SMEs implementing LCA practices based on PEFCR, the Commission would develop a mentoring and coaching programme, under which vouchers would be provided.
- **Access to testing**: to offset part of the costs related to the testing (including threat-led penetration test) of the platforms, a mandatory requirement, the Commission would (i) map existing testing facilities and services in the EU, and (ii) develop a framework contract that would ensure fast and affordable access for companies (in particular SMEs) to threat-led penetration testing
- **Development of new technological solutions**: to offset part of the costs related to innovating and developing new technological solutions that would enable the industry to comply with the mandatory requirements (for example, developing new encryption technologies and on-board safety systems), the Commission could co-fund joint research and development projects as part of the Horizon Europe Programme.
- **Exchange of best practices**: to enable the sharing of best practices and lessons learned as regards cybersecurity, the Commission would promote and facilitate collaboration and knowledge sharing among stakeholders, through the information-sharing hubs/platforms. The legislative initiative would acknowledge that all such sharing of information would take place in compliance with EU rules on competition and data protection. The Commission would promote the use of the EU Space Information Sharing Analysis Centre (EU Space ISAC).
- **Standardisation**: to offset part of the manufacturing costs, the Commission would fund the development of standards that would streamline the production processes and components involved in the manufacturing process. The development of standards would closely involve EU industry, including SMEs. Such standardisation activities would also reduce supply chain risks and encourage innovation. For example, launcher neutralisers (safety components to reduce space debris) are currently bought off the shelf from abroad. The development of European standards would stimulate the development of neutralisers in line with the mandatory requirements.
- **One-stop-shop approach**: to further increase the benefits of administrative simplification and streamline compliance procedures, particularly for SMEs, the Commission would propose a one-stop-shop approach. To enable this, the following steps would need to be carried out: (i) the Commission would propose that each Member State sets up a helpdesk for any questions related to the licencing system; (ii) at EU level, the Commission, with the support of EUSPA, would set up a helpdesk to answer SMEs' questions, for example, if they have difficulty identifying the Member States in charge of the licence (such as an SME based in Spain launching from Portugal and having German shareholders); (iii) the

Commission would create an online regulatory portal/self-assessment tool to help companies navigate and identify applicable legal requirements; and (iv) the Commission would provide clear compliance checklists to enable companies to comply with relevant requirements.

6.1.4. Policy option 2++

The impact of option 2++ could result in a complex landscape. As the content of these agreements cannot be fully envisaged due to the intricacies of diplomatic discussions, a conservative estimation of the potential impact is imperative.

Option 2++ would have approximately the same economic impacts as option 2 but at a greater scale compared to the baseline, as it would also ultimately affect both EU and non-EU space operators, as well as service providers not providing services in the EU. However, for non-EU space operators who do not provide services in the EU, the requirements are likely to be less strict than those under the binding EU act (option 2). The option 2++ would also have delayed benefits due to the time needed for negotiating the various bilateral agreements, therefore delaying the reduction of space debris in orbit.

Most SMEs consider that additional action by a larger number of international players would strengthen the overall protection of the environment in orbit and on Earth (59%), but 57% agree that the multiplication of bilateral agreements would create legal uncertainties for operators. 57% believe that an international approach could lead to more high-level requirements as a compromise.

Summary of the cost-benefit analysis

The main assumption taken to carry the cost-benefit analysis was that the legislative act would reduce the amount of space debris by 50% by 2034 due to increased sustainability of space activities. This reduction of space debris will be enabled by an overall increase of protection for space assets due to higher standards for satellite shielding and requirements for satellite passivation and end-of-life de-orbitation. Registering EU and non-EU satellites with EU-SST would also allow for better prediction on when in-space close encounters could occur. This would lead to better coordination between satellite operators, therefore reducing the need to do on-orbit manoeuvres and limiting the risk of collision with space debris. In addition, regarding the space sector's resilience, the main assumption is a reduction in cyberattacks on space infrastructure operators leading to a reduced disruption of space-based services.

The data used for the analysis comes from the ESA, national space agencies, the targeted and public consultations supporting this report (collecting 333 and 44 replies, respectively) and the dedicated industry workshops (which gathered over 170 participants).

Table 13: Summary of expected costs

	Costs
Compliance	EUR 136 million annually (1% of annual turnover of the upstream and midstream)

Manufacturing costs	EUR 180 million annually
Private overhead	EUR 2.4 million annually
Administrative overhead	EUR 4.4 million annually
Total costs	**EUR 322.8 million annually**

The overall safety, sustainability and resilience requirements would create an increase in costs for satellite operators of EUR 322.8 million. However, this increase in cost could be partially negated depending on the specific practices of satellite operators.

Table 14: Summary of expected benefits

	Benefits
Operational benefits	EUR 674 million annually
Resilience benefits	EUR 320 million annually
Regulatory simplification benefits	EUR 6.3 million annually
Total benefits	**EUR 1 000.8 million annually**
Total benefits minus costs	**EUR 677.5 million annually**

Assuming that a legislative act for safe, resilient and environmentally sustainable space activities would allow for a 50% reduction of space debris over the next 10 years, the initiative would benefit satellite operators, enabling an annual benefit of EUR 677.5 million, completely offsetting the costs driven by the higher requirements stemming from the law. Those benefits do not take into account the market opportunities that will be created thanks to new markets emerging, such as in-orbit servicing, as they are not mature enough to be objectively quantified at this stage.

A detailed cost-benefit analysis is provided in the following sections.

6.1.5. Focus on the costs for the public and private sectors

From the public sector perspective, the costs of implementing the various options would depend on the maturity of the space sector in each Member State. The public costs in Member States that have an extensive space economy and a space law in place would be lower (1-2 FTEs) compared to other Member States that do not have an existing regulatory framework (4 FTEs). Some Member States would require between 1 and 4 FTEs to handle the regulatory needs of the licencing requirements and may decide to entrust certain tasks to the EUSPA, which would need up to 15 FTEs. **In total, options 2 and 2+ would require 59 FTEs, while option 2++ would require 62 FTEs.**

From the private sector perspective, the costs for options 2, 2+ and 2++ would be similar. From an administrative burden point of view, those options will reduce the administrative burden by creating **a common set of rules instead of 27 different rules** that the operators must comply with if they want to provide satellite based services across the EU. For option 1, the cost of the licencing requirements is not considered. However, the satellite operators would still need to receive a licence from the launching state and from the authorities from their place of operation.

Not taking action would entail significant costs. European stakeholders operate several hundreds of satellites, contributing to a market valued at over EUR 80 billion per year. Moreover, the EU and its Member States increasingly rely on space-based services. Losing access to space due to uncontrolled proliferation of space debris and increased risk of cyberattacks would have far-reaching negative consequences for the space industry itself and for all economic and societal activities that depend on space services.

In addition, the cost of **a cyberattack is estimated to be approximately five times higher than the estimated cost of the cybersecurity measures needed to prevent or withstand an attack**. A strong regulatory framework could therefore not only reduce the number of successful cyberattacks in the future but also reduce the average cost associated with each cyberattack.

Table 15: Public and private costs

		Option 1	Option 2	Option 2+	Option 2++
Public costs	Administrative overhead	**2 FTEs** for label management for EUSPA (label management – safety and sustainability) **1 FTE** for ENISA for certification schemes tailored for space (for ICT products, services, processes)	**1-4 FTEs** per Member State[1] **Up to 15 FTEs** for notifying body + **2 FTEs** for label management for EUSPA **1 FTE** for ENISA for certifications schemes tailored for space (for ICT products, services, processes)	**1-4 FTEs** per Member State **Up to 15 FTEs** for notifying body + **2 FTEs** for label management for EUSPA **1 FTE** for ENISA for certifications schemes tailored for space (for ICT products, services, processes)	**1-4 FTEs** per Member State **Up to 15 FTEs** for notifying body + **2 FTEs** for EUSPA (label management - safety and sustainability) + **1 FTE** for ENISA for certifications schemes tailored for space (for ICT products, services, processes) **3 FTEs** for the European Commission for bilateral agreements
	Label	**EUR 3 m** for developing and implementing the label (EUSPA)	n/a	**EUR 3 m** for developing and implementing the label (EUSPA)	**EUR 3 m** for developing and implementing the label (EUSPA)

	Standards	**EUR 10 m/15 m** (EUR 1 m per standard)	**EUR 10 m/15 m** (EUR 1 m per standard)	**EUR 10 m/15 m** (EUR 1 m per standard)	**EUR 10 m/15 m** (EUR 1 m per standard)
	Enforcement	n/a	**EUR 2 m-3 m** per year	**EUR 2 m-3 m** per year	**EUR 2 m-3 m** per year
Private costs	Overhead	**1.5 FTEs** per company	**1.5 FTEs** per company	**1.5 FTE** per company	**1.5 FTEs** per company
	Compliance costs	Annual fee of EUR 200 to EUR 2 000 for the label	**EUR 100 000+** for the licencing requirements **EUR 4 000-8 000** for carrying out PEFCR (as part of the licencing request) **Up to EUR 240 000** for risk management (initial expenditure), then 1% of the turnover of the operators and manufacturers	**EUR 100 000+** for the licencing requirements **EUR 4 000-8 000** for carrying out PEFCR (as part of the licencing request) **Up to EUR 240 000** for risk management (initial expenditure) then 1% of the turnover of the operators and manufacturers **EUR 200 to EUR 2 000 annual fee** for the label (as part of the licencing request)	**EUR 100 000+** for the licencing requirements **EUR 4 000-8 000** for carrying out PEFCR (as part of the licencing request) **Up to EUR 240 000** for risk management (initial expenditure) then 1% of the turnover of the operators and manufacturers **EUR 200 to EUR 2 000 annual fee** for the label
	Satellite manufacturing costs	**3-10%** increase for satellite platform[105]	**3-10%** increase for satellite platform	**3-10%** increase for satellite platform	**3-10%** increase for satellite platform
	Launcher manufacturing costs	**EUR 200 000 to EUR 1.5 m** for safety and neutralisation systems depending on the capability of the launcher and specific requirements related to the launch base	**EUR 200 000 to EUR 1.5 m** for safety and neutralisation systems depending on the capability of the launcher and specific requirements related to the launch base	**EUR 200 000 to EUR 1.5 m** for safety and neutralisation systems depending on the capability of the launcher and specific requirements related to the launch base	**EUR 200 000 to EUR 1.5 m** for safety and neutralisation systems depending on the capability of the launcher and specific requirements related to the launch base

[105] Based on data provided by the ESA and consultation with stakeholders (bilateral meetings, replies to targeted stakeholder consultation).

The aggregated costs from this increase in satellite manufacturing costs over the next decade are presented in the table below[106]:

Table 16: Aggregated costs of satellite manufacturing cost increase in the EU (Source: Roland Berger)[107]

Type of satellite	*Orbit*	*Mission*	*Sat. planned for the next 10 years [#, 2023–2033]*	*Sat. planned to be operational in 2033 [#]*	*Average cost of the satellite [EUR m]*	*Average cost of the platform [EUR m]*	*MIN Increase of the cost of compliance [%]*	*MAX Increase of the cost of compliance [%]*	*MIN Annual cost [EUR m]*	*MAX Annual cost [EUR m]*	*MIN Cumulated costs [EUR m]*	*MAX Cumulated costs [EUR m]*	*MIN Share of compliance cost for satellite manufacturing [%]*	*MAX Share of compliance cost for satellite manufacturing [%]*	*Average annual cost [EUR m]*	*Average cumulated cost [EUR m, 2023–2033]*
Constellation	LEO	Satcom	650	600	20	10	3%	10%	18.0	60.0	180.0	600.0	1.5%	5.0%	39.0	390.0
Constellation	MEO	Satcom, GNSS	50	50	36	24	3%	10%	3.6	12.0	36.0	120.0	2.0%	6.7%	7.8	78.0
Individual	GEO	Satcom	95	100	350	150	3%	10%	45.0	150.0	450.0	1 500.0	1.3%	4.3%	97.5	975.0
Individual	LEO	EO	26	50	150	75	3%	10%	11.3	37.5	112.5	375.0	1.5%	5.0%	24.4	243.8
Individual	LEO	Satcom, Techno	67	100	20	10	3%	10%	3.0	10.0	30.0	100.0	1.5%	5.0%	6.5	65.0
Individual	LEO	Science	34	40	50	20	3%	10%	2.4	8.0	24.0	80.0	1.2%	4.0%	5.2	52.0
Total			**922**	**940**					**83.3**	**277.5**	**832.5**	**2 775.0**	**1.5%**	**5.0%**	**180.4**	**1 803.8**

The total average cumulated costs increase over 10 years will imply an average increase of the costs of a European satellite of EUR 2 million, to be compared to an average cost of a satellite of EUR 93 million.

[106] Average cost of satellites based on EU space programme, ESA missions and commercial prices. The space segment costs cover the costs of the platform and the payload. The platform consists of the satellite bus, the propulsion, solar panels, on-board energy storage and on-board electronics. Regarding the manufacturing costs, it is assumed that the costs of the platform consist of 50% of the cost of an entire satellite.

[107] Based on data provided by the ESA, CNES, DLR and consultation with stakeholders (bilateral meetings, replies to targeted stakeholder consultation).

Table 16 presents the aggregated costs from this increase in manufacturing costs for launcher manufacturing over the next decade[108]:

Table 17: Aggregated costs of launcher manufacturing cost increase in the EU (Source: Roland Berger)[110]

Type of launchers 109	*Projected launches for the next 10 years [#, 2023–2033]*	*Average cost of the launcher [EUR k]*	*MIN cost of the safety requirements [EUR k]*	*MAX cost of the safety requirements [EUR k]*	*MIN annual cost [EUR k]*	*MAX annual cost [EUR k]*	*MIN cumulated costs [EUR k]*	*MAX cumulated costs [EUR k]*	*MIN share of safety requirement cost for launcher manufacturing [%]*	*MAX share of safety requirement cost for launcher manufacturing [%]*	*Average annual cost [EUR k]*	*Average cumulated cost [EUR m, 2023–2033]*
Heavy	116	120 000	1 000	1 500	11 600	17 400	116 000	174 000	0.8%	1.3%	14 500	145 000
Medium	102	95 000	700	1 000	7 140	10 200	71 400	102 000	0.7%	1.1%	8 670	86 700
Light	62	35 000	500	700	3 100	4 340	31 000	43 400	1.4%	2.0%	3 720	37 200
Micro	54	15 000	200	500	1 080	2 700	10 800	27 000	1.3%	3.3%	1 890	18 900
Total	**334**						**229 200**	**346 400**	**0.7%**	**1.3%**	**28 780**	**287 800**

The total average cumulated costs increase over 10 years will imply an average increase of the cost of European launchers of EUR 800 000 representing an average increase of 1% of the launcher costs.

[108] Average cost of European launchers based on commercial data.
[109] Using as reference European launcher classes (Heavy: Ariane 64, Medium: Ariane 62, Light: Vega-C, Micro: Upcoming small launchers developed by European start-ups.
[110] Based on data provided by the ESA, CNES, DLR and consultation with stakeholders (bilateral meetings, replies to targeted stakeholder consultation).

6.1.6. Focus on the quantification of the operational benefits

From an operational perspective, as collision risks for potentially trackable or untrackable debris are difficult to predict, satellite operators tend to carry out avoidance manoeuvres based on alerts of close approaches of space debris. Modelling work at global level has suggested that close approaches will rise from 20 000 in 2019 to more than 50 000 by 2059. This means that satellite operators will have to carry out up to three times as many avoidance manoeuvres in 2059 than in 2019.

Combined data from CNES, DLR and ESA suggest 1.5 collision avoidance manoeuvres per satellite per year in LEO. Considering that European operators operate 779 satellites in LEO in 2023, this would imply around **1 000 collision avoidance manoeuvres per year** in LEO carried out by European satellite operators or EU Member States space agencies.

Collision risk avoidance manoeuvres are also a problem in the GEO region, not necessarily related to the need to avoid collision with debris, but due to the number of satellites in this very confined area of outer space. Stakeholder interviews reveal that an average GEO satellite operator with a fleet of 20 satellites carries out up to 50 collision avoidance manoeuvres per year.

Collision avoidance manoeuvres come at a price. They take significant time to plan, and in particular, they require fuel, which ultimately shortens the lifetime of the mission. Furthermore, due to the inaccuracy of data related to the position of the objects in question, it may not be essential to carry out lots of manoeuvres, but they have to be carried out as a precaution, which generates extra costs. Furthermore, each collision avoidance manoeuvre causes satellite services to be interrupted briefly.

The table below shows the estimated annualised costs of collision avoidance manoeuvres resulting in the shortening of satellites' lifetime. The table also indicates the costs linked to the interruption in collecting and distributing Earth observation data resulting from collision avoidance manoeuvres of Earth observation satellites in LEO[111].

Table 18: Estimated yearly costs of collision avoidance manoeuvres (Source: Roland Berger)[112]

Europe	Collision avoidance manoeuvre (yearly)	Impact over time (10 years)	Indicative economic effect in EUR m (10 years)	Annualised economic effect in EUR m
779 satellites in LEO	1 031	Lifetime shortening in years 604	13 747	1 324.3
26 EO satellites in LEO	37	Days of EO loss of data 366	6.50	0.65
145 satellites in GEO and MEO	30[113]	Lifetime shortening in years 16	241.7	24.65
Total	1 098		EUR 1 361.2 million	EUR 1 349.5 million

[111] In general, there is no interruption of services during avoidance manoeuvres for satellites in GEO.

[112] Based on data provided by the ESA, CNES, DLR and consultation with stakeholders (bilateral meetings, replies to targeted stakeholder consultation).

[113] Only 10% of the avoidance manoeuvres in GEO lead to a significant consumption of propellant (e.g. only in cases of large fly-bys).

Policy options 2, 2+ and 2++ will have a significant impact on the reduction of space debris and therefore on the number of collision avoidance manoeuvres. Assuming collision avoidance manoeuvres are reduced by 50%, the following benefits to the European operators can be expected:

Table 19: Benefits for European operators thanks to the reduced number of collision avoidance manoeuvres (Source: Roland Berger)

Europe	Collision avoidance manoeuvre reduction (yearly)	Impact over time (10 years)	Indicative economic effect in EUR m (10 years)	Annualised economic effect in EUR m
779 satellites in LEO	516	Lifetime extending in years 302	6 874	662.15
26 EO satellites in LEO	18	Days of EO data gain 183	3	0.325
145 satellites in GEO and MEO	15	Lifetime extending in years 11	121	12.325
Total	**549**		**EUR 6 998 million**	**EUR 675 million**

As described in Table 19 above, the annual operational benefit for space operators thanks to the reduced number of collision avoidance manoeuvres can be estimated at EUR 675 million. Comparing this benefit with the increase in manufacturing costs for satellite operators described in Table 16 (EUR 180 million) leads to a **net operational benefit for the European operators of EUR 495 million annually.**

The benefits of cyber protection that would be required under policy options 2, 2+ and 2++ would also add to the overall benefits. It is considered that the cost of cyberattacks amounts to five times the costs of cyber protection, which results in an **annual benefit of EUR 320 million**[114] for manufacturers.

Furthermore, the policy options 2, 2+ and 2++ would enable **regulatory simplification** in proposing one single licence per satellite constellation rather than one licence per satellite, which today does not exist in Europe. Assuming that up to 20 constellations representing approximatively 700 satellites over the next decade, this would represent a benefit of EUR 68 million.

[114] The cost of cybersecurity is estimated to be 1% of the annual turnover of the upstream space industry (EUR 8 billion).

6.1.7. Focus on international competitiveness

Europe is a worldwide leader in the space sector with an estimated 20% share of the total global space economy, worth EUR 84 billion out of a total of EUR 420 billion globally. Projections indicate that by 2035, the space economy could reach EUR1.7 trillion, driven by advancements in communications, positioning, navigation, timing, and Earth observation services.

While the EU has historically held a significant share of its value, the **competitive position of EU space industry in the global market is being challenged**. With only 5% growth over the past five years, Europe is losing ground to more dynamic global players.[115] The competitive landscape is evolving rapidly, with established space powers such as the United States, China, and India intensifying pressure on the European space sector. Additionally, the rise of emerging space-faring nations and increased global private investment in space technologies signal a shift in market dynamics that could challenge Europe's market position.

Structural challenges facing the EU space sector

In the **upstream market** segment[116], **both commercial and export markets have seen a decline**. According to industry estimates, the number of customers has fallen by 30% both among European private sector customers and public institution customers in the rest of the world.[117] Satellite application systems and launchers have been particularly affected. The European space industry, once thriving in the geostationary segment, has struggled to adapt to market evolution (e.g. the rise of Low Earth Orbit constellations) and keep up with international competitors[118]. European companies have visibly fallen behind the US and China in developing reusable launchers, and EU projects have been marred by delays and cost overruns. Meanwhile, highly innovative new launcher start-ups and SMEs are emerging across Europe, but they often struggle to find the capital they need to finance their development in the EU and seek financing opportunities in third countries, especially for commercialisation and industrialisation, resulting in Europe not being able to fully leverage this innovation potential.

The European space sector differs from space sectors elsewhere on several aspects such as: (i) a smaller institutional budget; (ii) a strong reliance on commercial and export sales, making it more exposed to market fluctuations; (iii) limited military expenses in the sector; (iv) relatively less developed synergies between the civil and defence sectors; (v) limited access to finance and lower R&D funding compared to other established space nations; (vi) a lack of standardisation; and (vii) a fragmented regulatory framework across EU Member States.

[115] Euroconsult, *Space Economy Report*, 2024.

[116] The "upstream" space sector refers to the segment of the space industry that involves the design, development, and manufacturing of space technologies and infrastructure. This includes activities such as satellite and spacecraft manufacturing, launch services, ground support and infrastructure.

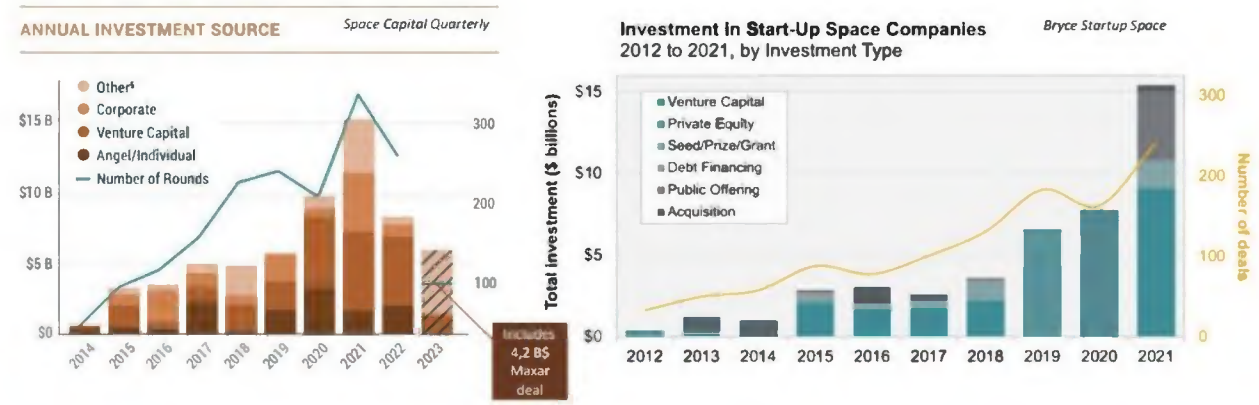
[117] Eurospace, Facts & Figures Report – 28th edition, July 2024.

[118] The European space industry was late in embracing the transformation towards LEO satellite constellations and reusable rocket technology for several reasons, e.g. governance and regulatory hurdles, public and private funding and investment gaps, established business models, conservative and risk-averse approach to innovation.

The fragmentation of national space laws across EU Member States, together with the lack of common standards in upstream and downstream segments, creates barriers for cross-border space activities, leading to inefficiencies and uneven business conditions[119]. This regulatory divergence hampers the EU space industry's global competitiveness. The lack of regulatory certainty discourages private investment, essential for scaling up New Space companies and developing emerging markets. Moreover, the fragmented space data market in Europe, partly caused by divergent regulatory landscape, also affects the capacity of space companies to scale up and expand across the Europe.

While investment in space start-ups (upstream and midstream) saw a big increase in value until 2021, reaching more than EUR 14 billion globally, this spike in investment has been diminishing. Since 2021, the current market cap of New Space companies accounts for EUR 4 billion, showing the nature of New Space activities reflects that of a deep tech sector[120]. This reduction in the market cap of New Space companies is also explained by the lack of standardisation in the sector, as well as the lack of regulatory stability.

Figure 9: Private investment in New Space companies globally (Source: Eurospace)



Although Europe remains the second region attracting the most investment into New Space ventures, the US is leading by far with significant growth over the past three years.

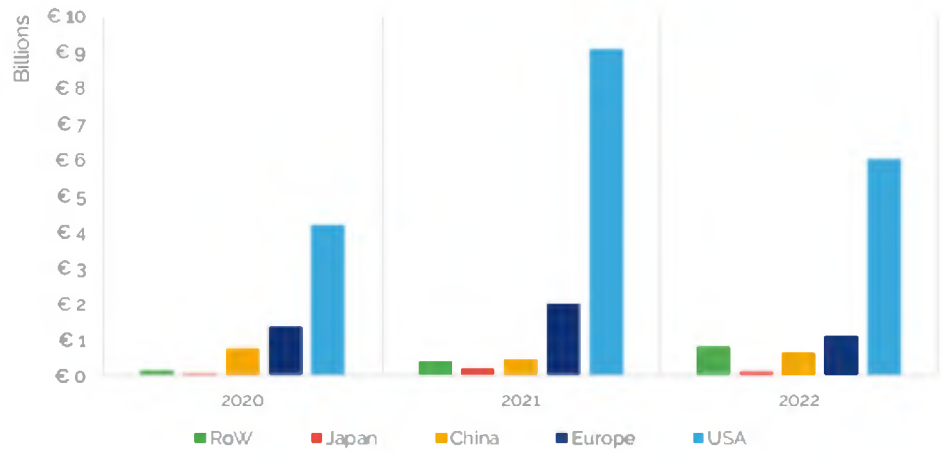
Additionally, EU space companies face an increasingly limited access to international markets. Globally, 64% of space activities are captive to domestic actors, primarily due to domestic-preference policies, export control requirements[121], insufficient cooperation with third countries and lack of reciprocity in global public procurements.

[119] Throughout the consultation process conducted in the preparation of the proposal for an EU Space Law, many companies (especially SMEs) reported facing significant challenges and costs associated with navigating the different sources of requirements applicable to their products and services, due to the regulatory divergences across the EU. This was also highlighted by industry associations such as SME4SPACE, YEESS and Eurospace in their position papers.

[120] Source: CNBC https://www.cnbc.com/2023/10/12/investing-in-space-a-reality-check-on-spac-frenzy-revenue-projections.html.

[121] For example, ITAR (International Traffic in Arms Regulations). ITAR are a set of US government regulations that control the export and import of defence-related articles and services, including in the space sector. Compliance with ITAR regulations involves complex documentation, licensing, and approval processes.

Figure 10: Investment volume per region (Source: ESPI)



EU Competitiveness in Emerging Space Markets

New Space represents a growing sector characterized by private investment, commercialization, and innovation in space activities. Despite Europe being the second-largest region attracting investment into New Space ventures, the US continues to lead with significant expansion over the past three years. Without a harmonised and stable regulatory framework at the EU level, European start-ups and SMEs struggle to secure funding, scale operations, and maintain a competitive edge. The lack of legal clarity also impedes market development in emerging segments such as in-space operations and services, an industry projected to grow from EUR 2 billion in 2023 to EUR 4.5 billion by 2030.

While it is important to lay down standardised rules at EU level, it is crucial to avoid a situation where the adoption of more stringent requirements, compared to those of non-EU countries, would hinder the competitiveness of the EU industry. Imposing overly strict rules may discourage space companies from choosing the EU for their operations.

The introduction of voluntary labels and non-binding guidelines by the EU space industry, as envisaged by policy options 1 and 2+, represents a market-driven approach. This aims to encourage companies to comply with the **most relevant existing standards, best practices and guidelines, proactively developing non-binding instruments at EU level**. Past initiatives from the industry in other sectors have demonstrated that voluntary measures, such as labelling, can be powerful tools. When used effectively and responsibly, they create a pro-competitive market environment for the industry.

Implementing binding measures outlined in policy options 2, 2+ and 2++ would incur some additional costs for manufacturers, estimated to range from 3% to 10%, according to industry representatives and ESA. However, these increased costs would be offset by higher revenues resulting from better reliability and durability of space assets. This improvement stems from increased safety and resilience measures. Policy options 2, 2+, and 2++ could potentially boost the competitiveness of the EU space industry at international level for both established and New Space players. Compliance with higher standards could help EU companies compete in a global market with increasing demand for safe, secure and sustainable standards. At the same time, EU requirements would be based on state-of-the-art measures, building on existing standards. The improved

reputation of the EU industry and its leadership in sustainable space practices globally would benefit the entire industry, including SMEs and start-ups. The fact that those measures would also apply for non-European companies that want to address the single market will also level the playing field between European and non-European companies.

International competitiveness and market position

The US space sector operates under stringent licensing requirements enforced by the Federal Communications Commission (FCC) and the Federal Aviation Administration (FAA). These requirements, which often exceed those currently implemented by EU Member States, establish a high benchmark for international market access. As a result, EU companies seeking entry into the US market currently face additional regulatory barriers. By aligning with international best practices, policy options 2, 2+, and 2++ would provide European companies with a competitive advantage by facilitating mutual recognition between the EU and the US requirements. This alignment would enhance Europe's ability to compete in the global marketplace.

As shown above, the proposed legislative initiative will not put the European industry at a disadvantage compared to its main competitors in the US, especially as space is a relatively closed market outside of Europe and the US, with the other major space competitors (Russia, China) being closed to western companies.

Table 20: Comparisons of safety and sustainability requirements in selected EU Member States and the US

	BE	DK	FI	FR	EL	NL	AT	SI	EUSL	USA (FCC)	USA (FAA)
Cybersecurity requirements									Yes	Yes	
In-orbit collision avoidance measures	Yes		Yes	Yes			Yes		Yes	Yes	Yes
Make appropriate provision for the mitigation of space debris		Yes			Yes			Yes	Yes	Yes	Yes
Operators must take specific measures to mitigate space debris			Yes	Yes			Yes		Yes	Yes	Yes
Limit on orbital lifetime		Yes		Yes			Yes		Yes	Yes (5 years)	Yes (< 5 years)
Requires environmental impact assessment	Yes	Yes	Yes	Yes	Yes				Yes		Yes
General condition that space activities do not cause adverse changes to the environment						Yes		Yes	Yes		Yes

Furthermore, since non-EU competitors would be subject to equivalent requirements when providing services within the EU, the impact on EU manufacturers' relative prices and market shares is expected to be limited. This will create a **level playing field for space companies and would benefit SMEs and start-ups, since increased EU-wide market access and easier cross-border trade would boost their market share.**

Reducing market entry barriers and boosting innovation

A major competitive advantage of the proposed regulatory framework lies in its ability to reduce administrative burdens and market entry barriers. Increased trade opportunities and regulatory stability will further incentivize investment, boost innovation, and secure Europe's standing as a leading player in the global space economy. New markets such as in-space operations and services and satellite tracking will open.

6.1.8. Focus on the impact on SMEs

As described in the previous sections, the impact of options 2, 2+ and 2++ would be twofold. On one hand, they would boost the competitiveness of SMEs by reducing the level of administrative burden for companies, who would no longer have to comply with fragmented and uncoordinated requirements across the EU. On the other, these options would also further expand space activities due to their higher level of reliability through increased resilience and safety, creating a more predictable environment that would attract more private investment and allow SMEs to scale up.

Because SMEs often lack the financial and human resources to easily adapt to new operational and technical requirements, introducing new requirements are likely to increase costs for all industry, including SMEs, potentially resulting in an increase in manufacturing costs ranging from 3% to 10%. For smaller actors it would be proportionally more expensive to comply with such measures.

This cost impact could be **mitigated by: (i) support measures;** and **(ii) proportionality** embedded in the rules, which would consider different criteria, such as the size of the companies, the criticality of the space missions or the orbits used, as described below in Table 21. A detailed description of the envisaged support measures and the proportionality regime can be found in Section 6.1.3.

Despite initial cost impacts, the initiative aims to instigate positive outcomes for SMEs. The measures included in policy option 2+ would provide a common, stable and predictable framework for conducting space activities in the EU, attracting private investment and fostering the growth of space start-ups and SMEs. This option will also ensure fairness in the market by ensuring equal treatment for both EU and non-EU space operators providing services within the EU. The redistribution of compliance costs across the market is expected to encourage equitable competition. Furthermore, the initiative seeks to strengthen the coherence of the single market. By facilitating the creation of new markets, such as in-space operations and services, the initiative will also foster business growth and employment creation. Furthermore, there is the prospect of increased business opportunities, particularly in services utilising space data.

The impact of the initiative would differ depending on the type of activity carried out by relevant SMEs.

- **For launch service providers**, compliance with new safety, resilience, and sustainability requirements may lead to higher costs for manufacturing, testing, and infrastructure upgrades. However, the harmonisation of technical requirements across the EU would reduce administrative complexity and market fragmentation,

ultimately lowering barriers to entry and fostering competitiveness. It would also help to attract investment, which is particularly relevant considering the capital intensive needs of this segment. Additionally, the growing demand for reliable and sustainable launch services could open new market opportunities.

- **For satellite operators,** the impact largely stems from enhanced cybersecurity, sustainability, and space traffic management requirements, which may increase operational costs and obligations for deorbiting or collision avoidance measures. However, greater regulatory certainty and market stability would encourage long-term investments and support business scalability, particularly for small and medium-sized satellite operators. Furthermore, extending satellite lifespans and improving orbital sustainability could enhance revenue generation over time.

The majority of SMEs consulted throughout the consultation process agree with this assessment, and have stated that policy option 2+ could: a) provide a common, stable and predictable framework to foster the long-term sustainability of the activities of new commercial space actors, and attract private investment; b) create a level playing field for all European companies; and c) decrease the risk of 'cherry picking' between Member States with the lowest level of safety, resilience or sustainability requirements.

Table 21: Impact on SMEs

Costs	Benefits	Proportionality	Offsetting (support measures)
Satellite operator: Manufacturing costs – up to 10% **Launch service provider**: EUR 200 000 All: risk management costs: 10% of **a** company's IT budget EUR 100 000 for licencing requirements EUR 4 000-8 000 for implementing the PEFCR	**Regulatory simplification:** greater market access (1 product, 27 Member States), faster time to market. **More revenues** due to life extension of satellite (from 5 to 6 years in LEO). **Greater access to funding**: attractiveness of the EU single market for bigger funding, able to meet the EUR 10billion equity demand in the next 7 years. **Global competitive advantage**: first mover and high level of protection means that companies boost their competitive advantage over non-EU competitors. **In the long term: preservation of the EU space business**, 20% of EUR 700 billion in 2031 **Development of new business segments** (such as:	**Light regime for**: - safety measures for satellites in VLEO (less than 400 km); - derogations from some resilience measures for non-critical missions and satellites not using propulsion. - potential exemptions on sustainability requirements for microenterprises and universities	Capacity-building technical assistance: €50K-€100K Mentoring and coaching: €15K-€30K reduction per SME annually Access to testing facilities: €350K-€1.4M Exchange of best practices Standardisation activities (closely involving SMEs) One-stop-shop approach: cuts administrative burden by 30%-50% (€15K-€75K saved per SME annually)

	active debris removal, OSAM and encryption).		

6.1.9. Summary of economic impacts

Table 22: Overview of main economic impacts

	Protection of space assets	Competitiveness	Positions of SMEs	Functioning of the single market	Employment	Public and private costs	Average
	=	=	=	=	=	=	=
Baseline	Cost of loss of satellite due to collision Cost of cyberattack	Intra-EU barriers prevents the EU space industry from growing and reaching the level of maturity needed to compete on a global scale. The lack of clarity on legal requirements disincentivises investment.	Costs for SMEs to navigate and comply with the different national requirements. SMEs needs are met at different levels in the Member States licence conditions. Majority of SMEs do not deem the current national laws fit to ensure the long-term sustainability of space.	Fragmentation of the national licencing conditions leading to emerging barriers in the single market	Risk that orbits become unusable or that companies want to move outside the EU due to the fragmented regulatory approach could lead to the number of jobs declining.	Risk posed to public authorities' access to satellite applications Adjustment cost for the industry to each different national requirement Industry cost of satellite manoeuvres due to service interruption	

	Protection of space assets	Competitiveness	Positions of SMEs	Functioning of the single market	Employment	Public and private costs	Average
	1	2	0	0	1	1	0.8
Option 1	Majority of EU satellites would follow protective measures (such as mitigating space debris, satellite tracking and certain good practices of encrypting critical parts of the satellite). However, the interconnectedness of all space systems, would leave them vulnerable to collisions.	Industry-oriented solutions ensured by industry being the driving force behind the selection of non-binding measures. Satellites following non-binding measures through a label could receive a competitive advantage (through increased investment attracting or government use of the label).	SMEs may have a more difficult time following non-binding standards compared to established operators because of lower budgets and may therefore not get the benefits of a label. SMEs voice needs to be properly reflected in industry discussions. Majority of SMEs agree that safety and resilience measures can limit revenue-producing activities and that non-binding measures are therefore not sufficient.	While there is an economic self-interest for companies to meet safety, resilience and sustainability requirements, adequate protection may not always be achieved (divergence on some essential aspects). In addition, while it is difficult to predict how many (if any) Member States would integrate the co-regulation into their national framework, fragments hindering the functioning of the single market are still expected.	Industry involvement and collaboration may lead to new industry solutions creating job opportunities. However, as it is expected that it will be roughly the same companies that already follow general guidelines that will follow the non-binding measures, the additional number of jobs is not expected to be high.	Depending on the ambition level, there would be costs related to compliance. Industry-driven requirements would ensure cost awareness. Administrative overhead for enforcing the label. Development of standards Industry cost of satellite manoeuvres due to service interruption	

	Protection of space assets	Competitiveness	Positions of SMEs	Functioning of the single market	Employment	Public and private costs	Average
	3	2	1	3	3	2	2.3
Option 2/2+	EU and non-EU space operators providing services in the EU would be required to implement key safety and resilience measures, ensuring a broad protection (power in numbers). However, non-EU space operators that do not provide services in the EU may still pose a threat.	Level playing field on the market, and equal treatment for EU and non-EU space operators that provide a service in the EU Redistribution of additional compliance costs across the market Increased administrative burden and costs for industry Increase in manufacturing costs (3-10%)	For SMEs binding measures are needed but can be burdensome and very costly to achieve – in particular, the smaller the operator, the more expensive (proportionality required). According to the targeted consultation, the majority of SMEs believes that option 2: • could provide a common, stable and predictable framework to foster the long-term sustainability of activities of new commercial space actors, and attract private investment; • could create a level playing field for all European companies; • binding requirements need to include supportive measures for industry; • would decrease the risk of operators cherry picking Member States with the least safety, resilience or sustainability requirements.	Increase cohesion in the functioning of the single market	Create conditions for the space industry in the EU to grow: • create jobs across the industry thanks to the increase of business opportunities (both upstream and downstream); • predictable regulatory framework can lead to more investments in start-ups and SMEs, thereby creating jobs. The supportive measures under option 2+ will create new business opportunities (i.e. OSAM), which will create more jobs. .	Costs of compliance (technical and operational). • This cost is already covered by the big satellite companies. • Cost also pending as regards which rules the companies already have to comply with (i.e. France has strict space debris-mitigation rules). Administrative overhead for enforcement and compliance checks Development of standards Industry cost of satellite manoeuvres due to service interruption	

	Protection of space assets	Competitiveness	Positions of SMEs	Functioning of the single market	Employment	Public and private costs	Average
	3	2	1	3	3	2	2.3
Option 2++	Same as option 2/2+. However, increased coverage as non-EU operators that do not provide services in the EU that are based in the bilateral state would be covered (for certain high-level requirements).	Level playing field on the global stage on the market with redistribution of additional compliance costs across the market.	While the majority of SMEs consider that additional action by a larger number of international actors would strengthen the overall protection of the environment in orbit and on Earth, they also agree that multiple bilateral agreements would create legal uncertainties for operators. The majority believe that an international approach risk leading to more high-level requirements would be a compromise.	Same as option 2/2+	Same as option 2/2+, with the potential of additional jobs created in the bilateral countries in the long term.	Same as option 2/2+	

6.2. Social impacts[122]

6.2.1. Baseline

Under the baseline, the continued fragmentation of the single market would negatively affect the industry and its ability to easily navigate through the various technical requirements from the Member States. Failure to adequately address common threats could have wide-ranging social consequences, potentially leading to a **loss of access to critical space-based services on Earth** that support essential sectors such as transport, logistics, cross-border trade, financial transactions, and aviation. Satellite navigation is essential to the operations of critical networked infrastructures in the transport, telecommunications, energy and finance sectors. Earth Observation technology can forecast severe weather events, such as drought, storms or hurricanes, making its uninterrupted operation critical for protecting potential victims. s. If the Kessler effect were to occur, access to all downstream services would be disrupted. In the meantime, access may be intermediately affected by cyberattacks and the increasing need to respond to a growing number of collision avoidance alerts[123]. Furthermore, disrupted access to satellite communication would exacerbate the digital divide problem.

An increased number of satellites without any protective measures can also cause light and radio pollution. This could affect indigenous communities' ability to use the dark skies for their traditions, and astronomers' access to dark skies to conduct research.

6.2.2. Policy option 1

Option 1 would entail developing an **industry-driven forum** to discuss the non-binding measures and the relevant appropriate instruments (for instance, best practices, guidelines, charters), but would not entail enforcement of such measures.

Compared to the baseline, option 1 would have higher social impact in terms of inclusiveness (small operators, sector associations, etc.) as it would ensure a high level of representativeness for the industry in the forum. On the other hand, the option would only partially better protect the availability and integrity of space-based services.

Certain measures may help protect the dark and quiet skies, which has an impact on especially indigenous population.

For resilience aspects, the voluntary measures are likely to increase awareness over cyber threats posed to space infrastructure, therefore increasing to a certain extent the robustness of the industry's capabilities, taking into account the various mitigation and protection measures voluntarily complied with. This would have a certain impact on the space sector's overall resilience as vulnerabilities along the value chain would be reduced and the environmental resilience improved.

[122] To avoid repetition, some of the socio-economic impacts already presented in the section above will not be addressed below.
[123] For example, it took a total of 22 processing days, including two weeks during which the satellite had to be taken out of service, for one of the Galileo satellites to perform a collision avoidance in 2021. T. Cozzens, "Galileo satellite performs collision avoidance maneuver", 2021.

6.2.3. Policy options 2, 2+ and 2++

Compared to the baseline, options 2 and 2+ would have social impacts that would be more significantly positive as they would include the possibility for space-based services to provide additional benefits for EU citisens. These options would also increase public trust in and reliance on space systems and services. Options 2 and 2+ would also have a significantly positive impact on the governance of the space sector on the public side by means of harmonising certain licencing conditions implemented in Europe. Furthermore, they would create a transparent and predictable framework. Option 2+ would have an even greater impact than option 2 by means of creating a forum for the private sector, thereby fostering ownership.

Adopting options 2, 2+ and 2 ++ could help stimulate innovation and R&D. They would also protect the ability of astronomers and indigenous communities to observe the dark and quiet skies. By driving R&D efforts, encouraging resource-efficient practices, and encouraging collaboration between academia and industry, both options can help introduce and share new production methods, new technologies and products, therefore ultimately contributing to the growth and competitiveness of the space sector.

Option 2++ would further protect space infrastructure, by having an additional number of satellites complying with safety, resilience and sustainability measures. However, according to stakeholders, this may a create some legal uncertainties for space operators due to the multiplication of bilateral agreements and variances involved (as a possible outcome of the international agreements).

Table 23: Overview of main social impacts

	Downstream services for the EU citizens	Digitalisation	Governance, participation, and good administration	Research and innovation	Resilience	Average
Baseline	=	=	=	=	=	=
	• Risk to the functioning of all space-based services on Earth (transport logistics, cross-border trade, financial transactions, air travel, etc.) that rely on satellite services. • Protection of health: emergency services rely on satellite navigation services.	• Risks to the access satellite communication. • Risks to space data corruption, thereby reducing/disrupting downstream service quality and integrity.	• Governance at national level, leading to unequal treatment of operators across the EU. • Lack of good administration to address global risks. • No protection of dark and quiet skies, which impacts indigenous traditions.	• Reduced research and innovation possibilities (for scientific purposes) due to threats to space assets and due to light and radio pollution interfering with the ability to make astronomical observations (reduction of 20-40% of observation time). • Most respondents (78%) agree that the increased number of satellites in orbit negatively impact astronomical research.	• Increased number of threats to space assets due to growing space debris and cyberattacks. • Light pollution interferes with the ability to detect hazardous asteroids.	
Option 1	**1**	**1**	**1**	**1**	**1**	**1**
	Some protection of the access to downstream essential services.	• Some risks to satellite communication. • Some risks to the data/ service quality.	• Creation of a forum for industry discussion – this creates ownership. • However, national licence conditions on safety, resilience and sustainability aspects may continue to differ leading to an unequal treatment of operators across the EU.	• Increased opportunities for innovation to comply with the voluntary measures. • Some interference with astronomy.	Development of best practices to achieve some convergence on risk assessment.	

	Downstream services for the EU citizens	Digitalisation	Governance, participation, and good administration	Research and innovation	Resilience	Average
			• The EU's involvement in the process creates more transparency. However, the majority of respondents in the targeted stakeholders consultation (60%) agree or strongly agree that non-binding rules provide less legal clarity.			
Option 2/2+	**3**	**3**	**3**	**3**	**3**	**3**
	• A high level of protection of access to essential downstream services.	• Further promote the generation of space data, fuelling the larger data economy. • A high level of cyber protection ensures data/ service quality, availability as well as data integrity. • Continuous use of satellite connectivity enabling seamless space-based global connectivity, protecting the digital divide.	• 65% of the respondents in the targeted consultation agree that a binding option would create a transparent and predictable framework: streamlined governance for safety, resilience and sustainability licencing conditions. • Protection of indigenous people's access to the dark and quiet skies.	• New business opportunities to create solutions to meet the requirements. Protect research opportunities for astronomy. • Create environmental studies. • Proportionality is needed for university space operations conducted at low altitude, to protect R&D being carried out in such orbits.	• Reduction of vulnerabilities along the value chain. • Improved environmental resilience.	

	Downstream services for the EU citizens	Digitalisation	Governance, participation, and good administration	Research and innovation	Resilience	Average
	3	**3**	**3**	**3**	**3**	
Option 2++:	Same as option 2/2+	Same as option 2/2+	• Same as option 2/2+. • 52% of respondents agree or strongly agree that a multiplication of bilateral agreements would create legal uncertainties for operators (targeted consultation). • The value added is the EU fostering shared values across legal orders by using international law instruments that can both embed substantive rules and devise any needed mechanisms to facilitate coherence and dialogue across the relevant jurisdictions.	Same as option 2/2+	Same as option 2/2+	**3**

6.3. Environmental impacts

This section anticipates different kinds of **environmental impacts** that take into account the different policy options.

However, there are certain commonalities;

i. all policy options envisage assessing (to ultimately minimise) the environmental impacts of the space industry;
ii. in all options it is assumed that there is the intention to apply circular economy principles to space activities, via the use of a life cycle assessment (LCA) method that is specific to the space sector.
iii. the specific LCA method for evaluating the environmental impacts of space activities throughout their entire life cycle (from raw material extraction to manufacturing, use and disposal of satellites) would consider a range of impact categories (e.g. environmental aspects such as greenhouse gas emissions, energy consumption, air and water pollution, and resource depletion).

These impact categories would help quantify and assess the various environmental effects of a given system, allowing for a comprehensive understanding of its sustainability and guiding decisions towards more environmentally responsible practices and products. Although the level of impact varies across policy options, the impact categories identified are applicable throughout the different actions.

Most respondents in the targeted consultation (83%) agree that: i) a common methodology is needed to measure the space sector's environmental footprint on Earth and in space, and ii) a common measure is the first step towards mitigation and setting reduction targets.

6.3.1. Baseline

Under the baseline, the absence of an LCA framework tailored to the specific characteristics of the space sector would lead to misleading conclusions. This would make it difficult for industry, Member States and the EU to assess the environmental impact of the space activities and ensure accountability for such actions. It would also hinder the development of targeted strategies for mitigating pollution, resource depletion, and other adverse effects on ecosystems. Furthermore, without detailed environmental assessments, there would be a risk of **overlooking critical aspects of space activities that exacerbate biodiversity loss, habitat degradation, and other environmental degradation**. The absence of a tailored LCA framework would also complicate efforts to align industry practices with EU environmental goals, hindering progress towards achieving sustainability and biodiversity conservation targets.

Ultimately, the environmental consequences extend beyond regulatory compliance issues to encompass **broader ecological impacts, limiting the industry's ability to proactively address and mitigate its environmental footprint**. The legislative initiative aims to lay down a foundational framework for quantifying the environmental impacts of space activities on Earth. Developing a methodology for impact measurement is crucial to align space industry practices with the EU Climate Law objectives, enabling evidence-based thresholds for the sector.

6.3.2. Policy option 1

Compared to the baseline, with the creation of PEFCR for space, the sector would have access to the methodology needed to conduct an LCA of space activities. However, due to its voluntary nature, the impact of option 1 is highly dependent on the industry adopting voluntary measures and on the exact metrics it chooses. Based on the assumption that voluntary measures will be adopted by 60% of the satellite industry and 80% of the launcher industry in Europe (in line with the base assumption in Section 7), option 1 would have somewhat of a positive impact on the EU's ability to meet its targets on reducing greenhouse gas emissions, the efficient use of resources and on efforts to lower waste production.

6.3.3. Policy options 2 and 2+

Options 2 and 2+ would have an increased impact on the climate due to the mandatory requirements covering e.g. deorbiting satellites and LCAs. Based on PEFCR, the licencing requirement would provide an overview of the different environmental impact categories, including greater standards for energy efficiency and reduce the need for critical material as well as increase the lifespan of space and ground assets. Options 2 and 2+ would also enable the EU space industry to access sustainable finance.

6.3.4. Policy option 2++

Option 2++ would have the same impacts as options 2 and 2+ but would increase the impact on a global scale, as more data would be available but with a delayed action.

Table 24: Overview of main environmental impacts

	Climate	Efficient use of resources	Waste production and recycling	Average
Baseline	=	=	=	=
	• No common methodology to assess the environmental impact	• Increased use of critical materials	• Increased waste production and very limited recycling	
Option 1	**1**	**1**	**1**	**1**
	• Limited impact due to the voluntary nature • Sharing of best practices and guidelines	• Limited impact due to the voluntary nature • Sharing of best practices and standards	• Limited impact due to the voluntary nature • Sharing of best practices and standards	
Option 2/2+/2++	**2**	**2**	**2**	**2**
	• Improved impacts on climate with mandatory requirements • Sharing of best practices and standards	• Reduced use of critical materials • Improved energy efficiency in the sector and decreased consumption	• Increased lifespan of space and ground assets • Improved recycling and reduction of waste • Sharing of best practices and standards	

7. HOW DO THE OPTIONS COMPARE?

7.1. Analysis

7.1.1. Policy option 1

While industry-driven, option 1 has lower overall economic, social and environmental impacts than options 2, 2+ and 2++. It also has a limited positive impact on the identified problems and on achieving the policy objectives as described in the Section 7.3. Those limited impacts are mostly caused by the lower reach of option 1 compared to options 2, 2+ and 2++. The voluntary nature of option 1 also means than it would not impact the entirety of the space industry and would not lower the administrative burden implied by the fragmented regulatory framework in Europe.

In terms of political feasibility, the policy proposals that have been included in option 1 are not substantial. Therefore, this option is likely to be met with resistance by stakeholders because of its limited scope and impact on the problems and would be considered as not ambitious enough.

46% of the respondents agree or strongly agree that safety, resilience/security, and sustainability measures can limit revenue-producing activities, and therefore, non-binding measures would not be sufficient.

7.1.2. Policy options 2 and 2+

Regarding the four specific objectives, measures under options 2 and 2+ are considerably more far-reaching and ambitious than those under option 1. They would lead to a decrease in regulatory disparities in Europe by laying down a transparent and predictable EU regulatory framework. This framework can be expected to have much greater impact when it comes to addressing the identified problems and achieving the policy objectives.

Options 2 and 2+ would overall have a substantial and positive impact in terms of tackling the identified problems and achieving the policy objectives as described in Section 7.3.

7.1.3. Policy option 2++

Regarding the four specific objectives, measures under option 2++ have the greatest impact in terms of tackling the identified problems and achieving the objectives. They build on most of the measures from Options 2 and 2+, but are more far-reaching, with a greater potential to expand their global footprint through bilateral agreements with other space powers.

Therefore, they would have a substantial and positive impact in terms of security and resilience of space assets as well on the functioning of the single market. Moreover, it would maximise the consistency and coherence of the global regulatory framework for space activities.

However, some of the measures included under this option either have high political costs or are likely to encounter strong opposition from non-EU countries.

7.2. Effectiveness

Table 25: Overview of effectiveness

	Policy option 1	Policy option 2	Policy option 2+	Policy option 2++
Specific objective I				
Framing the conduct/behaviour of European space operators in a way that provides a stable, predictable and competitive business environment	**(1)** • Option 1 only provides for voluntary and non-binding alignment between frameworks and does not anticipate any binding legislative action to reduce the gaps between regulative frameworks across the EU. • **The majority of the respondents (60%) agree or strongly agree that non-binding rules provide less legal clarity.** • **36% of the respondents agree or strongly agree that a label would reduce greenwashing and could incentivise behavioural change (targeted consultation).**	**(3)** • The binding nature of the proposed framework is expected to bridge effectively the existing legal gaps stemming from the fragmented nature of space regulations across the EU. • The action would provide the set of rules needed to create convergence for the space market. It would complement effectively the national approaches (where they exist) to ensure the fundamental principles of single market and of fair competition are observed. • A binding framework would provide transparency and stability and attract private investment according to 65% of the respondents (targeted consultation). • 64% of respondents agree or strongly agree that this option would create a level playing field (targeted consultation).	**(3)** • Because option 2+ is based on option 2, it would have the same benefits that would result from the development of a single market for space. • For the label, see option 1. • Platform for sharing best practices can provide support for capacity building.	**(2)** • Building on option 2, this option would have the same benefits. However, option 2++ focuses on creating fewer disparities between EU space operators and non-EU space operators. • 52% of the respondents to the targeted stakeholder consultation agree or strongly agree that a multiplication of bilateral agreements would create legal uncertainties for operators (targeted consultation) because the outcome of international agreements may also result in some variations.
Specific objective II				
Ensure space objects can be tracked and reduce generation of space debris	**(1)** • The option provides for voluntary space situational awareness and debris-mitigation measures to reduce debris proliferation and its consequences, plus a label to demonstrate that the space industry is complying with these non-binding measures. • The non-binding and voluntary dimensions of these measures means that the objective would only be partially met.	**(2)** • Due to the scope of operators and the binding nature of the proposed measures, policy option 2 would increase the overall compliance with safety measures. • Through a mandatory subscription to satellite tracking services, and adherence to space debris and post-mission mitigation plans, policy option 2 is likely to be effective in meeting specific objective 2.	**(3)** • The complementary measures aiming to create a platform of safety and sustainability best practices, and to build expert capabilities in the EU, would help increase the effectiveness of the policy options in achieving specific objectives 2.	**(3)** • Policy option 2++ would possibly lead to a multiplier effect at the international level but with a significant delay. • **69% of the respondents agree or strongly agree that additional action by many international operators would strengthen the overall protection of the environment in orbit and on Earth, considering in particular the globally interconnected space ecosystem (targeted consultation).**

	Policy option 1	Policy option 2	Policy option 2+	Policy option 2++
Specific objective III				
Create a risk assessment framework that is tailored to the needs of cybersecurity for space infrastructure	**(1)** • This option would enable the space industry to discuss and agree upon certain main/basic elements in the risk framework that can be applied to the space sector. However, there are limits in: i) the consensus that can be reached, ii) the level of ambition and protection achieved, iii) the balance to be struck between generally applicable rules and tailored ones, which may require specific analysis and a bespoke approach, and iv) the divergent approaches between small and large established players. It is therefore not clear how far this option would differ in the end from some of the existing risk management models on the market. • The option also provides the basis for creating a platform for collaboration and information sharing to achieve specific objective 3. The degree to which this specific objective could be achieved would be driven by the amount of information shared among the relevant stakeholders.	**(2)** • Through a binding framework, option 2 provides the foundation for risk management that is tailored for space infrastructure across the lifecycle of space systems and the missions of all relevant operators in the space sector. • The baseline achieved in this option would help raise the collective level of resilience for all space infrastructure. In addition, it would help achieve the objective through two voluntary channels (knowledge sharing and capacity building).	**(3)** • The complementary measures aiming to create a platform for sharing best practices, and build expert capabilities in the EU, would make the policy options more effective in helping achieve specific objective 3. • These measures would increase collective awareness and provide updated information on state-of-the-art channels to reduce risk of collisions and improve the collective level of resilience of space infrastructure in the EU.	**(3)** • Option 2++ would possibly lead to a multiplier effect at international level but with a significant delay. • 69% of the respondents to the targeted stakeholder consultation agree or strongly agree that additional action by many international operators would strengthen the overall protection of the environment in orbit and on Earth, in particular taking into account the globally interconnected space ecosystem.
Specific objective IV				
Develop a common method to measure the environmental impacts of space activities	**(3)** • This option develops a common method (PEFCR) for voluntary use.	**(3)** • This option develops a common method (PEFCR) that is mandatory for use and serves as the reference for space activities.	**(3)** • This option develops a common method (PEFCR) that is mandatory for use and serves as the reference for space activities.	**(3)** • This option develops a common method (PEFCR) that is mandatory for use and serves as the reference for space activities.
Effectiveness points				
Average for the objectives (out of 3)	**1.5**	**2.5**	**3**	**2.7**

7.3. Efficiency[124]

Table 26: Overview of efficiency

	Policy option 1	Policy option 2	Policy option 2+	Policy option 2++
Costs				
Costs related to the safety measures	(1) • Recurrent participation in the structured meetings that aimed to discuss, agree upon and set up the non-binding instruments: 1 FTE for six months for each area to be covered (safety, resilience and sustainability aspects) for both industry and the Commission. • Discussion needed with national authorities to promote the use of non-binding instruments in their licencing systems: 1 FTE for 6 months, for each area covered (safety, resilience and sustainability aspects) for both national authorities and the EU Commission. • **Cost of applying and using the label**: For the EU ECO label[125] the following applies: Micro-enterprises pay between EUR 200 and 350; SMEs pay between EUR 200 and 600; all other companies pay between EUR 200 and 2000[126], plus an annual fee for using the Ecolabel. The maximum annual fee is capped at EUR 18 750 for micro-enterprises and SMEs, and EUR 25 000 for all other companies. • **Cost of setting up, maintaining and promoting the label**: In total, this amounts to EUR 3.28 m annually for the governance costs[127].	(2) • It is assumed that a space debris-mitigation plan and a post-mission disposal plan require 1 FTE for a month. • Recurrent ROM cost estimate, can be reduced through technology developments: o small, medium to large satellites: ~2% platform cost; o Cubesat/ nanosat: < EUR 300 000. • Cost for launch operators [TBC]. • Cost to handle collision avoidance alerts (1 FTE three days/year). • Setting up notified bodies to check conformity with the various requirements in the three areas.	(2) • Similar costs to options 1 and 2. • Companies could receive a competitive advantage from using the label (incentives).	(2) • Similar costs to options 2 and 2+ • The involvement of companies from non-EU countries would greatly depend on the bilateral agreements and the extent to which non-EU countries would be interested in participating in this measure.

[124] This assessed the extent to which each option would achieve the general and specific objectives of this future public action. In this section, the **efficiency** of each policy option is assessed in terms of their costs versus the extent to which they would achieve their objectives. The main goal is to have an overview of the policy option(s) which are **most cost-effective.** When analysing extra costs stemming from the various options, it is necessary to keep in mind that many companies in the sector have already put in place practices and processes ensuring resilience or safety and even practices related to preventing environmental damage. However, the practices differ to a large extent and do not create collective effects that could bring them to a certain level of efficiency.

[125] Proposal for a Directive on substantiation and communication of explicit environmental claims (Green Claims Directive). Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52023PC0166.

Costs related to the resilience measures	**(1)** • Option 1 provides for the development of best practices and techniques to be shared among space operators. This leads to very limited costs. • Option 1 also provides for the development of practical handbooks, which would be a recurring task/cost for ENISA. • Cost of risk assessment represents a recurring cost for companies. Based on a proxy, the average cost of a risk assessment ranges from EUR 10 000 to 30 000 depending on the size of the company. • Cost of label (same as safety).	**(2)** • Cost of risk management: e.g. the management of space assets. As a proxy, building an inventory management system varies between EUR 80 000 to EUR 225 000 for a solution of average complexity; and between EUR 225 000 to more than EUR 360 000 for a large-scale system integrated with hardware and which provides inventory analytics. Assuming this cost depends greatly on the size of the space assets and overall inventory, it would vary. Also, while not possible to determine to what extent, this is probably a cost that is already incurred by most of the companies, at least the biggest ones, which tend to have a bigger inventory. The costs related to the resilience measures are estimated at 1% of the turnover of the operators and manufacturers. • Setting up the notified bodies to check conformity with the various requirements in the three areas.	**(2)** • While the costs vary according to the company size, the actual level of (cyber)security measures in place and the investments needed to implement the measures provided for under option 2, generally the costs of options 2, 2+ and 2++ are likely to be the same for this cost category. • Option 2+ might bring additional costs, which are likely to be negligible, as companies can participate in the sharing of information. The benefit of sharing information is bigger than the actual cost because companies can learn and improve their performance based on new knowledge and better practices.	**(2)** • Similar cost as option 2. • The involvement of companies from non-EU countries would greatly depend on the bilateral agreements and the extent to which non-EU countries would be interested in participating in this measure.
Costs related to the environmental measures	**(1)** • To calculate the cost of developing the PEFCR specific to the space sector to be allocated to the EU, we used a proxy based on the Commission's development of a PEFCR for tourism. The cost is estimated at EUR 2 450 million. • Cost of implementing a PEFCR for the space activities. To calculate the cost of applying the PEF method, we used a proxy based on the proposal for a directive on substantiation and communication of explicit environmental claims[128]. This proposal mentions that the cost to conduct a study would be around EUR 8 000, and EUR 4 000 if the PEFCR exists. • Cost of label (same as safety).	**(2)** • Similar costs to those in option 1. • Economic benefits to be achieved through more international players adhering to the method (incentivising cost reduction in the long term).	**(2)** • Similar costs to those in option 2. • Economic benefits to be achieved through more international players following the method (incentivising cost reduction in the long term).	**(2)** • Similar costs to those in options 1 and 2.
Benefits (as described in section 6)				
Economic impacts	**0.8**	**2.3**	**2.3**	**2.3**
Efficiency score – costs benefits (benefits minus costs)				
	-0.2	**0.3**	**0.3**	**0.3**

[128] Proposal for a Directive on substantiation and communication of explicit environmental claims (Green Claims Directive). Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52023PC0166.

7.4. Coherence

Table 27: Overview of coherence

	Policy option 1	Policy option 2	Policy option 2+	Policy option 2++
Internal coherence of different element	**(1)** • Option 1 involves setting up voluntary mechanisms to increase compliance with relevant standards, best practices and guidelines. • Potential inconsistencies between the different mechanisms in national legislation. • The non-binding character of the policy option might limit its impact in terms of coherence.	**(2)** • It involves adopting a coherent, binding framework setting out key rules related to the safety and sustainability, resilience/security, and earth environment aspects of space activities.	**(2)** • The additional non-binding measures would build on certain binding elements, therefore not disrupting overall coherence.	**(2)** • The content of the bilateral rules should build on the content from option 2, therefore not disrupting overall coherence .
EU space policy	**(2)** • In developing certain non-binding instruments there is strong coherence with respect to existing EU space standards, and some coherence with the EU Space Regulation (EU 2021/696).	**(3)** • The binding rules would increase the level of coherence. • The policy option would help achieve several objectives of the EU Space Regulation, such as boosting the safety, security and environmental sustainability of all outer space activities concerning space objects and space debris proliferation, along with the space environment. This would support an autonomous, secure and cost-efficient capability to access space and strengthen the resilience and protection of space systems and services in the EU.	**(3)** Similar **to option 2.**	**(3)** • The bilateral agreements are in line with the EU Space Regulation's objectives of promoting the EU's role in the global space sector, encouraging international cooperation, strengthening EU space diplomacy and strengthening the EU's role in tackling global challenges.
Other relevant EU policies	**(1)** • The non-binding character limits its impact in terms of coherence. • The future-proofness of policy option 1 and its coherence with the European Climate Law would especially depend on the extent to which the option also includes measures on environmental	**(2)** • Necessary to ensure full integration with the NIS 2 ecosystem and to keep the reporting obligations under NIS 2 in place. • Ensuring alignment with the Proposed Regulation[129] on a cyber resilience act (CRA), as these rules also apply to products with digital elements used in space infrastructure. Furthermore, synergies with the governance laid down in the CRA would be created.	**(2)** Similar to option 2.	**(2)** • Similar to option 2.

[129] Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on horizontal cybersecurity requirements for products with digital elements and amending Regulation (EU) 2019/1020.

	Policy option 1	Policy option 2	Policy option 2+	Policy option 2++
	sustainability, which could help achieve the climate-neutrality objective. • Importance to recognise and deal with inconsistencies between standards, best practices, guidelines but also legislation in different domains (e.g. space versus cybersecurity; space versus environmental sustainability), which would require very specific expertise on these particular topics. • In the composition and functioning of the special group of key stakeholders this should be taken into consideration.	• The EU Space Regulation (Article 35) already provides for the Member States' obligation to take measures which are at least equivalent to those set out in EU Directive 2022/2557on the resilience of critical entities. • The Commission proposal for a regulation laying down measures for a high common level of cybersecurity at the EU institutions, bodies, offices and agencies is relevant to EUSPA, which would benefit from the improved cybersecurity and cyber risk management rules. This is an essential factor for EUSPA's readiness and capacity to assume a new task that involves receiving reports of incidents in relation to EU-owned assets (as per the present envisaged initiative). • Coordination with the relevant Air Traffic Management functions, such as outlined in Regulation (EU) 677/2011 on Air Traffic Management Network Functions and the use of airspace. • Occurrences related to the interface between aviation and space operations will be reported through the mandatory EU reporting scheme provided for under Regulation (EU) 376/2014 on improving aviation safety. • Future HAO rules could address the definition of launch vehicles (not a topic under this option). • The EU Corporate Sustainability Reporting Directive (CSRD) requires all large companies and all listed companies (except listed micro-enterprises) to disclose information on what they see as the risks and opportunities arising from social and environmental issues, and on the impact of their activities on people and the environment. • The Commission proposal for a regulation on ecodesign for sustainable products lays down a framework to set ecodesign requirements for specific product groups to significantly improve their circularity, energy performance and other environmental sustainability aspects. It will enable the setting of performance and information requirements for almost all categories of physical goods placed on the EU market. • The Commission proposal for a regulation on establishing a framework of measures for strengthening Europe's net-zero technology products manufacturing ecosystem (Net Zero Industry Act). • The Commission proposal for a green claims directive on substantiation and communication of explicit environmental claims by complying with numerous requirements regarding their assessment (e.g. taking a life cycle perspective). • The EUs obligation under international trade law would need to be ensured when applying the scope to non-EU operators providing services in the EU. **[More details in Annexes 11 and 12]**		

8. COMPARISON SUMMARY

	Baseline	Option 1	Option 2	Option 2+	Option 2++
Effectiveness	(=)	1.5	2.5	3	2.7
Efficiency / economic	(=)	-0.2	0.3	0.3	0.3
Social	(=)	1	3	3	3
Environmental	(=)	1	2	2	2
Coherence	(=)	1.3	2.3	2.3	2.3
Total	**(=)**	**4.6**	**10.1**	**10.6**	**10.3**

9. PREFERRED OPTION

Based on the results of the comparison of the options above, **policy option 2+ 'Adopt a binding framework at EU level, paired with non-binding measures'**, achieved the highest score and is therefore ranked as the preferred option. This result is also in line with the preferred option selected by stakeholders (including SMEs) in the targeted consultation.

This option targets the **problems** identified in Section 3 through binding measures complemented by a non-binding framework. This option entails:

Binding measures:

- **Satellite tracking services:** To limit the risk of collisions and anticipate potential risks from trajectory deviations, subscription to a collision-avoidance service provider and regular updates on potential changes to a satellite trajectory would be mandatory. In addition, as the number of collision-avoidance alerts will continue to grow, means to improve trackability are needed to make the alerts more precise. The use of collision avoidance at launch would also be required to help determine the launch window and trajectory planning.
- **Space debris mitigation:** Satellite and launcher manufacturers and operators will be required to submit space debris mitigation plans as well as post-mission disposal plans. By making it mandatory to factor in the risks posed by debris in the context of the mission, this policy option aims to reduce the risk of congestion and collision in space.
- **Risk management framework: risk assessment, protection, detection, business continuity, recovery, risk management of the supply chain for all assets, and reporting rules for EU-owned assets:** the policy option sets out a proper risk management cycle that is tailored for all space infrastructure and assets, with cybersecurity by design along the systems and space-mission lifecycle complementing as applicable the existing risk assessment and risk management obligations in the space sector. An important part would be risk-specific assessments by segment and system. The policy option also envisages requirements to provide EUSPA with reports on EU-owned space assets. For the supply chain management: the policy option sets out checks along the supply chain, checks on ICT systems connected for maintenance, as well as review requirements in contracts with suppliers.
- **Environmental impact assessment and development of PEFCR:** the policy option involves the development of an LCA methodology based on the PEF method for the space sector (a space PEFCR). It also anticipates formalised PEFCR-based communication reporting on the data-driven environmental performance of companies in the space sector.

Non-binding measures

- **Safety/ resilience/sustainability space labels:** the labels building upon mechanisms set out in policy option 1 and criteria detailed in policy option 2 provides benchmarks to 'going the extra mile' in terms of safety, resilience, and environmental sustainability. It also lists additional criteria based on non-binding standards or best practices beyond the scope of what policy option 2 sets out. Companies would receive the label based on a rating mechanism reflecting the number of criteria met and how ambitious they are as

compared to the threshold determined by the binding rules laid down in the policy option.

- **Information-sharing platform:** the policy option includes developing information-sharing platforms and hubs to centralise, exchange and disseminate best practices on safety, resilience and environmental sustainability related to space activities, to improve capacity building.
- **Reduction of environmental impact for space activities:** the policy option envisages voluntary environmental footprint reduction plans being developed and implemented within the industry. The policy option also envisages preventive action related to claims.

Therefore, policy option 2+ 'Adopt a binding framework at EU level, paired with non-binding measures' is selected as the preferred option for this action.

Nonetheless, the option comes with some disadvantages and points that should be considered if and when implementing it.

- **Efficiency:** The binding nature of the policy option, along with its granularity are likely to create additional costs for companies. Similarly, certain recurrent costs may affect the overall response from the industry in implementing the measures leading to potential negative impacts on competition in the market.
- **Coherence:** The possible discrepancies between the binding and non-binding framework may lead to inconsistencies, impacting the overall internal coherence of the measure.
- **Equal treatment:** it is essential that the option is applied to all EU and non-EU actors selling services and data in the EU market, as potential loopholes might lead to the obligation being circumvented.

Compliance

Equal treatment between EU and non-EU actors
To ensure compliance with regulatory requirements, all companies selling their space data and services in the EU single market should abide by the safety, resilience and environmental sustainability requirements set out in the initiative.

The principle of equal treatment should ensure for a process whereby **non-EU satellite operators and EU satellite operators will be subject to the same requirements.**

Enforcement of compliance for EU actors

The enforcement of compliance with the binding requirements outlined in option 2+ will be ensured through a combination of mechanisms at EU and national level.

- At the **national** level, each Member State will appoint a National Competent Authority (NCA) responsible for issuing and withdrawing authorisations to carry out space activities, as well as supervising and enforcing compliance with EU requirements. The NCA will be supported by a technical body, which in general can be established in the Member State itself or outsourced to EUSPA. The technical body will conduct technical assessments of authorisation requests, ensuring that space operators meet relevant requirements related to safety, resilience, and environmental sustainability.

- At **European** level, to ensure consistency and clarity, a Compliance Board will be established within EUSPA, composed of Member State representatives. The Compliance Board will be responsible for authorisation and supervision of EU-owned assets, and national assets if selected by the relevant Member State. The Compliance Board will draw upon a pool of experts from Member States, enabling EUSPA to build upon existing expertise and ensure effective decision-making.

All authorised missions will be inserted into the Union Register of Space Objects (URSO) and receive a certificate of traceability.

Enforcement of compliance for non-EU actors

For third-country entities providing space-based services in the EU, compliance will be enforced through a authorisation at EUSPA. The Compliance Board at EUSPA will conduct compliance checks and ongoing monitoring to ensure that third-country entities meet the binding requirements. If the assessment is positive, satellites will be included in URSO and provided a certificate of traceability, enabling them to freely provide space-based services across the EU. If the assessment is negative, non-EU satellite operators will not be entitled to sell services or data within the EU. In exceptional cases, the Commission may grant waivers to third-country entities. Thanks to this mechanism, the EU Space Act would ensure equal and uniform treatment for EU actors and non-EU actors.

As a result, this assessment recommends the choice of **policy option 2+** to address the problems identified and reach the objectives outlined.

10. REGULATORY BURDEN AND SIMPLIFICATION

In terms of the overall regulatory burden, the financial costs and benefits of the overall package would depend on current space regulations in the Member States. Due to their international obligations under the UN treaties, most Member States with a space programme host satellite operators or act as a launching state, and assess sustainability, resilience, safety and environment requirements to some extent. **For those Member States that host most of the European space sector, the preferred option would only adapt those requirements to better fit the sector's challenges. Therefore, for those Member States, the administrative burden for the operators would be very limited**. Most of the time, Member States without existing legislation host nascent space activities. Therefore, there would be very limited adjustment costs related to the new requirements. In those cases, the administrative burden costs were assessed at 0.5 FTEs per area (safety, resilience and sustainability) per company.

The binding measures included in the preferred option would have a financial impact on the space industry (between 5 and 10% increase in manufacturing costs). Overall, these higher costs for businesses as a result of applying the requirements are largely offset by: i) the space environment being preserved, which would allow the space industry to continue building, launching and operating space assets; and ii) all the benefits for people in Europe thanks to space-based downstream services. In addition, supportive measures will support especially SMEs and start-ups with the costs.

11. ADMINISTRATIVE COSTS FOR BUSINESSES AND INDIVIDUALS WOULD BE CONSIDERED AS PART OF THE COMMISSION'S 'ONE IN, ONE OUT' PROGRAMME, ALONG WITH THE POSSIBILITY OF OFFSETTING THEM. CONSIDERATION WOULD ALSO BE GIVEN TO

REDUCING ADMINISTRATIVE COSTS WHEN ONE EU RULE REPLACES DIVERGING RULES ACROSS THE 27 MEMBER STATES, WHICH CAN LEAD TO NET BENEFITS AS THE SINGLE MARKET IS STRENGTHENED. HOW WILL ACTUAL IMPACTS BE MONITORED AND EVALUATED?

The specific objectives would be monitored on an annual basis, as described below in Table 28. The initiative would be evaluated five years after it has entered into force to assess the impact on, and reaction of the market, in particular the impact on SMEs.

Table 28: Impact monitoring and evaluation

Specific Objectives	Indicator	Method	Baseline	Target[130]	Annual Progress Estimate	Review Frequency
Support the development and functioning of a single market for the space sector	Space activities within the single market that comply with the proposed legislation	Member States reporting	0	100%	100% after entry into force of the Act	Annual
Ensure trackability of space objects and reduce generation of space debris	Number of high-interest events	Through EU SSST Partnership	622 (LEO) 33 (MEO) 101 (GEO)	10% reduction	~5% reduction per year	Annual
Ensure trackability of space objects and reduce generation of space debris	Number of successful disposals at end of life	Through EU SSST Partnership	GEO: 60% LEO: 65%	90% for all orbits	~3% increase per year	Annual
Create a risk assessment framework tailored to cybersecurity for space infrastructure	Number of reported significant cyber incidents mitigated	EUSPA through the reporting mechanism (for EU-owned assets) Computer security incident response teams (CSIRTs) /single points of contact	Not provided	50% reduction	50% after entry into force of the Act	Annual

[130] Target values are estimated for a 10 year period after entry into force of the Act, taking into account the average lifespan of commercial satellites across all orbits.

		(SPOC) (as per NIS) and the national space monitoring centres for the other assets				
Create a common method to measure the environmental impacts of space activities	% EU market share representation in PEFCR development	Member States' reporting	0%	≥51%	≥51%	Annual
Create a common method to measure the environmental impacts of space activities	Environmental footprint of space activities (e.g., CO□ emissions)	Member States' reporting	n/a (lack of common method for measurement)	To be monitored	After establishment of PEFCR framework, then annual reduction targets	Annual after framework development

12. OUTCOMES OF A SUCCESSFUL IMPLEMENTATION OF THE INITIATIVE

The successful achievement of the outlined objectives within the proposed legislative act would result in a transformative landscape for the EU's space sector. Firstly, the creation of a single market for space in the EU would mean increased integration among Member States, creating the conditions for **increased market access, driving innovation across the industry, attracting more private investment, and boosting the competitiveness of EU space companies overall**. It would encompass the creation of new innovative solutions to meet the requirements and develop new services such as ISOS.

Putting in place measures to ensure the trackability of space objects and reducing the amount of space debris would contribute to a safer and more sustainable space environment. Success in this regard would mean a significant decrease in the risk of collisions and the generation of space debris, safeguarding both operational satellites and long-term orbital sustainability. This achievement would position the EU as a responsible and forward-thinking actor in space activities, earning international recognition for its commitment to mitigating the problem of space debris and promoting orbital sustainability. The need to find solutions for space safety and resilience is recognised internationally, and by developing European practices, the **EU will be able to have a more impactful voice in future global solutions, adapted to European needs.**

The implementation of risk assessment frameworks tailored to the cybersecurity needs of the space sector would bolster the resilience of EU space activities against cyber threats. Success here would be translated into a secure space infrastructure, protecting critical space assets from

unauthorised access, data breaches, espionage, interferences or other forms of cyberattack. This strengthened cybersecurity posture would build confidence in stakeholders, including private businesses and governmental agencies. This would further drive the uptake of space services, attract investments and foster the growth of a robust and secure space industry in the EU.

Lastly, the development of a common method to measure the impact of space activities in the EU would provide a comprehensive understanding of their environmental impact of Earth. Success in this area would mean informed decision-making based on standardised metrics, allowing companies to invest in greener technologies and policymakers to balance the benefits and risks of space activities. This achievement would enable the EU to implement targeted policies, address emerging challenges, and optimise the positive impact of space activities on both regional and global scales.

In summary, the successful implementation of the legislative act would position the EU as a **leader in space governance, with a thriving single market, stronger safety and sustainability measures, and a strategic approach to addressing the complex challenges of the evolving space domain**. This success would not only benefit the EU Member States but also contribute to the broader global efforts to ensure responsible and sustainable space activities. A successful implementation of this initiative would boost the EU's capability to influence global standards in this field, potentially shaping and inspiring endeavours by non-EU countries that aim to regulate the safety, sustainability and resilience of space activities. This would provide EU industry with a competitive advantage in the global space market and assert the EU's leadership in the space domain.