SPACE, THE FOUNDATION FOR EUROPE TO UNDERSTAND AND ACT IN THE WORLD: HOW THE NEXT MULTIANNUAL FINANCIAL FRAMEWORK CAN MAKE IT HAPPEN

EUROSPACE MANIFESTO FOR A REALISTIC BUDGET FOR THE NEXT EU SPACE PROGRAMME (2028-2034)

Preamble

"*This will be an investment Commission*".

On July 18th 2024, in view of her re-election as European Commission President, Ursula von der Leyen published her Political Guidelines for the next European Commission 2024-2029. Among the priorities, from protecting our democracies to entering a new era for European Defence and Security, is a clear call for increased investment; the space sector, considered as one of "*the next wave of frontier and strategic technologies*" and as a "*high-technology sector*"[1], being one of the domains targeted by the President of the European Commission.

Today more than ever, the European space sector tackles some of the most pressing challenges of our times, from understanding environmental changes and backing mitigation policies to helping to stimulate technological innovation and making new economic activities possible. Institutions, citizens and companies increasingly rely on space technology, data and services for communication, positioning systems and Earth observation, enabling the delivery of a nearly infinite range of essential services[2].

The way space permeates and brings added value to humanity is growingly recognised and confirmed by EU institutions. Moreover, beyond the essential role of space activities for civilian uses, the defence and military dimension of our European space policy has several times been acknowledged at the highest levels. The **strategic nature of space** and the need to have a plan on how to enhance our resilience in and from space has notably been embedded in the Communication, in 2023, about "the EU Space Strategy for Security & Defence".

However, the current European space landscape is a story in contrast. On one hand, the level of interest in space systems has never been higher, borne out of the rising awareness of our modern societies' reliance on space systems and services for strategic, economic and environmental reasons. Galileo and Copernicus have become Flagship programmes in support of key European policies such as the Green Deal or the Digital Agenda, and the number of emerging private European space ventures has never been higher despite market uncertainties. On the other hand, the European space industry is at a critical juncture, having to face very aggressive competition from American companies benefiting both from a robust domestic institutional demand and a vibrant private funding ecosystem focused on technology investments, both of which are still largely missing in Europe. The Mario Draghi Report on "The Future of EU competitiveness"[3], released in September 2024, states that the EU's industrial base suffers from chronic underinvestment over forty years. From an industry standpoint, the current situation in Europe can thus be characterised by high interest but low demand for space and a tendency towards industrial fragmentation shaped by national priorities instead of cooperation at European level.

In short, in an increasingly globalised world, **Europe needs to have at its disposal tools to understand independently what is happening on the planet, and to be able to communicate freely all over it** – and this is precisely what space is about.

But there is also an economic and industrial dimension to space. The European space industry contributes to the development, production and deployment of European critical infrastructures for communications, meteorology, transportation and strategic applications. The manufacturing arm of the sector is strong of 62000 highly qualified workers, and generated 8.4B€ of consolidate sales in 2023. Beyond the contribution to European space programmes (both EU and ESA), **the space sector has also been a positive contributor to the European trade balance with an**

[1] *Communication "A Competitiveness Compass for the EU"* https://commission.europa.eu/document/download/10017eb1-4722-4333-add2-e0ed18105a34_en?filename=Communication_1.pdf

[2] *Such as immediate information and on spot communications when disasters strike, support live coverage of global events and real time news, as well as cost effective multimedia broadcast, enable precise weather forecasting, provide tactical intelligence and constant monitoring of earth resources, track moving vehicles in the air, sea and on ground, but also animal migrations, and, last but not least, space gives us in depth knowledge of our planet, our galaxy, and the universe beyond. These are among the many added values provided by space infrastructure.*

[3] https://commission.europa.eu/document/download/ec1409c1-d4b4-4882-8bdd-3519f86bbb92_en?filename=The%20future%20of%20European%20competitiveness_%20In-depth%20analysis%20and%20recommendations_0.pdf

average net surplus of more than 1B$ per year in the past decade, thanks to its performance in exports of both satellite systems and launch services[4]. Furthermore, while the European space infrastructures provides unmeasurable – though vital – social, scientific and strategic benefits via the provision of free public services, it also creates more than 200B€ of revenues through its value chain thanks to the induced markets for applications and terminals.

Space based applications and services (the so called "downstream"), that leverage signals and data generated by satellites and constellations, represent the tangible sign of the pervasiveness of space in the daily life of institutions, corporates and citizens, an essential enabler of a huge list of activities that are today unavoidable and vital for the most critical functions of our society, including law enforcement, safety and security. Demand for space services and applications remains largely untapped, in particular from institutional customers, hampering a significant economic potential and, in some cases, the same effectiveness of policy implementation, to which space technologies provide a unique and unmatched contribution. **A more intense use of space-based services and applications** would also represent a decisive stimulus contributing to sustain the investment to develop new and innovative infrastructures.

Finally, international relations are essential to foster global cooperation and address common challenges. In the context of space, they become even more paramount due to the inherently collaborative nature of space activities, characterised by high costs that countries could not bear alone, disruptive technologies making space a hazardous activity, and the necessity to share a common resource. Europe's international cooperation in space (for instance with countries such as USA, India, Canada, Australia, Japan…) is therefore essential for advancing innovation, scientific research, future innovative systems, and addressing future technological global challenges. By partnering with public and private stakeholders from third countries, Europe can therefore capitalise on mutual benefits for the future. Moreover, **joint efforts in space bolster diplomatic ties, ensure a rules-based order in space activities, and improve resilience against emerging space threats**, benefiting both Europe and its international allies.

Encompassing all sectors our economy, providing tangible benefits for our citizens and business, while providing the means to ensure the strategic autonomy and the resilience of Europe, space has an essential dimension to the functioning of our society that must be supported politically and financially in the next EU long-term budget.

The present document is not a list of the topics that Industry would like to see financed by the EU budget: it is merely an Industry estimate of the budget needed by the EU to implement the ambitions already expressed in numerous official documents, and covers what we consider necessary to maintain current EU space assets and services and to initiate a growth strategy for the sector in the EU.

[4] *Even if this figure will probably be lower in the next years due to the shrinking traditional commercial markets (geostationary satellites for broadcasting).*

Maximising the impact of space at EU level

Build on the current EU Space Programme

The current EU Space Programme was established by Regulation 2021/696 encompassing for the first time all EU space activities in one single Regulation. It was embedded with a budget of 16B€ for a period of seven years (2021-2027).

The Programme is composed of:

- Galileo and EGNOS for positioning, navigation, and timing services. The Galileo space infrastructure is based on a constellation of satellites in medium Earth orbit, working in conjunction with a global network ground-based stations and user receivers. EGNOS is a satellite-based augmentation system (SBAS) providing users with improved positioning information. EGNOS is composed of a constellation of at least three geostationary telecommunication satellites and a network of ground infrastructures;
- Copernicus for Earth observation data and services, which is served by a set of dedicated satellites (the Sentinel families) and contributing missions (existing commercial and public satellites). In addition, Copernicus relies on many environmental measurements collected by data providers external to Copernicus, from ground-based, sea-borne, or air-borne monitoring systems, as well as geospatial reference or ancillary data, collectively referred to as “in situ” data;
- SSA to enhance capabilities to monitor, track and identify space objects and debris, increasing the performance and autonomy of capabilities under the Space Surveillance and Tracking (SST) subcomponent, providing Space Weather Events (SWE) services and mapping and networking Member States capacities under the Near-Earth Object (NEO) subcomponent;
- GOVSATCOM to ensure the long-term availability of reliable, secure and cost-effective satellite communication services for EU governmental users. GOVSATCOM will use the capacities and services provided by existing national satcom systems and accredited private operators. The access to these existing infrastructures will be provided through one or several operational Hubs.

The Regulation also sets up EUSPA as an evolution of the European GNSS Agency (GSA), with an extended mandate, particularly as regards the management of the exploitation of Galileo and EGNOS, the security accreditation as well as market and downstream applications development for all components. In relation to security in particular, the Agency is responsible for the security accreditation tasks for all the Union actions in the space sector through the Security Accreditation Board (SAB).

In March 2023, the Regulation 2023/588 established the Union Secure Connectivity Programme for the period 2023-2027. The objective being to develop a state-of-the-art connectivity system to offer enhanced communication capacities to governmental users as well as to business users with the IRIS² Satellite Constellation.

MFF 2028-2034: an overall target of [40 up to 60B€] for the EU Space Programme

Public entities worldwide are still today the main promoters of space activities. As a consequence, all over the world, the space industry is highly reliant on institutional programmes and their associated financing (it is also true in Europe, although to a lesser extent than in other space powers).

If the European institutional market is growing each year thanks to the demand coming from the European Commission, ESA and the national institutions, they are, compared to the other space powers, relatively modest (NASA's annual budget is approximately 19B$, with an additional 13B$ allocated to the US Department of Defence for space programme). This unequal situation *de facto* creates a huge capability and technology gap between Europe and its direct competitors on the commercial and export market. According to Mario Draghi's report "The Future of European Competitiveness", while sales to European public entities increased, commercial and export sales have decreased since 2017. The space industry's combined sales have decreased from 8.6B€ in 2021 to 8.3B€ in 2022, a level that is close to the 2009 figures.

Because of the unequal situation highlighted above, the European space industry is compelled to be very active on the very small segment of open and export markets, characterised by hazards and competition – and forecasted to be increasingly smaller in the future – to maintain its competitiveness.

As a result, it makes it more challenging for the European space manufacturing industry to sustain its current level of excellence since the exposure to the hazards of commercial markets is much more important than for the other space powers, which benefit from large volume orders on the captive market allowing to apply low price offers on the export market, thus creating a non-level playing field.

Enhance the funding for the space sector in the upcoming Multiannual Financial Framework will not only be needed to finance the ambitions of the EU, it will also help maintaining Europe's competitive edge and strategic autonomy on the global stage. Investing robustly in space technologies is crucial for fostering innovation, ensuring security, and addressing key societal challenges such as climate change and digital connectivity. By prioritising space sector funding, the EU can spur economic growth, create high-quality jobs, and strengthen its position as a leader in space services. This commitment is essential for enabling ground-breaking research and maintaining Europe's independence in critical space capabilities, ensuring that the EU remains at the forefront of technological advancement and global competitiveness.

In this context, four guiding objectives need to drive European public policies regarding space as a domain of strategic and economic importance:

1) **Enforce a strict European preference**: in accordance with the overreaching objective to promote the EU's strategic autonomy in space, a clear eligibility framework shall be put in place to govern procurement for access to space by all relevant European entities, ranging from Member States to all Agencies entrusted with public service missions for European stakeholders. Precise and unequivocal definitions of what constitute a European actor and European technologies shall be defined and enforced, building upon existing legislative texts[5]. The definition of European technologies shall in particular centered on notions of design authority, manufacturing capabilities and test facilities located on EU territory in order to strengthen the European space & defense technological and industrial base (made in Europe by Europeans, to serve European ambitions and policies);
2) **Grow the institutional space market by aligning resources with European policies' long-term ambitions**: the European Union needs to act as an ambitious customer for space services to grow and strengthen the internal market using competitive procurement procedures for eligible European actors. Firstly, as strategic space infrastructures providing critical dual-purpose services to the EU and its Member States, the Galileo, Copernicus, SSA and IRIS² Flagship Programmes should be sustained as anchor points for the development of the internal space market. Secondly, it is necessary to start anticipating developments in Flagship

[5] *Art 24 of the EU Space Regulation, Art 22 of the Secure Connectivity Regulation, Art 22.5 of the Horizon Europe Regulation*

programmes and new requirements in line with expanded EU ambitions in space, particularly in connection with Act in Space (In-Space Operations and Services - ISOS, logistics, refuelling) and Space Traffic Management (improving in-flight safety, protecting critical infrastructure and space intelligence);

3) **Creation of a European Space Capability Development Roadmap to sustain long-term technological sovereignty**: technological developments funded by the EU's various financial instruments such as Horizon Europe and the European Defence Fund should ultimately focus on delivering capabilities in order for Europe to stay in the game from a geopolitical standpoint. The funding and development of short-term technological building blocks should more deliberately serve clearly defined long-term capability objectives in differentiating areas such as dual-use mobility in space, In-Space Operations and Services or space-based Space Situational Awareness (SBSSA). As part of this comprehensive space capability development roadmap, increased and coordinated investment in space R&D is needed: investment in Europe by the EU, the ESA and major European countries amounted on average to 2.8 B€ per year between 2020 and 2023. At the same time, investment in the US amounted to 7.3 B€. The situation of China – based on estimated "expenditures" – is vastly underestimated. The Chinese have quadrupled their spacecraft deployment in a decade, testimony of an increased governmental investment in space;
4) Develop a virtuous loop by providing **a long-term institutional space service acquisition policy** in order to support the investment of private investors in European space commercial assets (e.g., Earth Observation constellations) that would then contribute to complement institutional investments.

Building on the successful implementation of the current EU Space Programme and the necessary continuation and enhancement[6] of its components, the European space industry fully supports the high ambitions of the European Commission for the EU Space Programme 2028-2034 and believes that **a budget of 40B€ up to 60B€ constitutes an ambitious but realistic target** – and still way below the level of public spending in space of other space powers. This budget shall be used to:

- Ensure the full continuity of the four current components of the EU Space Programme (GNSS with Galileo and EGNOS, Copernicus, IRIS², and SSA, including the necessary enhancement of EU Space Surveillance and Tracking capabilities);
- Development of a Space Traffic Management policy to contribute to safeguard space operations, with the EU Space Surveillance and Tracking Partnership (EUSST) being its operational pillar to be enhanced (in budget and capabilities);
- Prepare the future with new programmatic lines (Space Domain Awareness, In-Space Operations and Services, Access to space, Earth Observation Governmental Service);
- Ensure dual-use pre-development (Key Innovative Demonstrators), meaning adequate investment in both research and development for preparedness of the space programme, including IOD/IOV.

As highlighted by the Mario Draghi Report on the future of European competitiveness, Europe faces new challenges and opportunities that **require a shift in priorities**, particularly in areas like **security**, **sovereignty**, and **technological autonomy & competitiveness**. The budget increase of the EU Space Programme 2028-2034 is therefore a **necessary investment** to build a robust foundation that ensures Europe can safeguard its interests, reduce dependency on external powers, and foster innovation in such a critical sector. **This is not just a financial adjustment and the continuation of "business as usual": this is a strategic realignment aimed at strengthening Europe's global position for the future**.

This budget of [40 up to 60B€] could be divided into eight components, as follows:

- Navigation (including launch services): [14-20B€]
- Earth Observation (including launch services): [11-17B€]
- Earth Observation Governmental Service: [2-3.5B€]

[6] *Also taking into account that the cost of all components of the EU Space Programme are expected to increase due to the implementation of safety/security measures from the EU Space Law.*

- Space Situational Awareness: [1.5-2.5B€]
- Secure communication (including launch services): [7-9B€]
- Access to space: [2-3.5B€]
- In-Space Operations and Services: [0.5-1B€]
- CASSINI 2.0: [2-3.5B€]

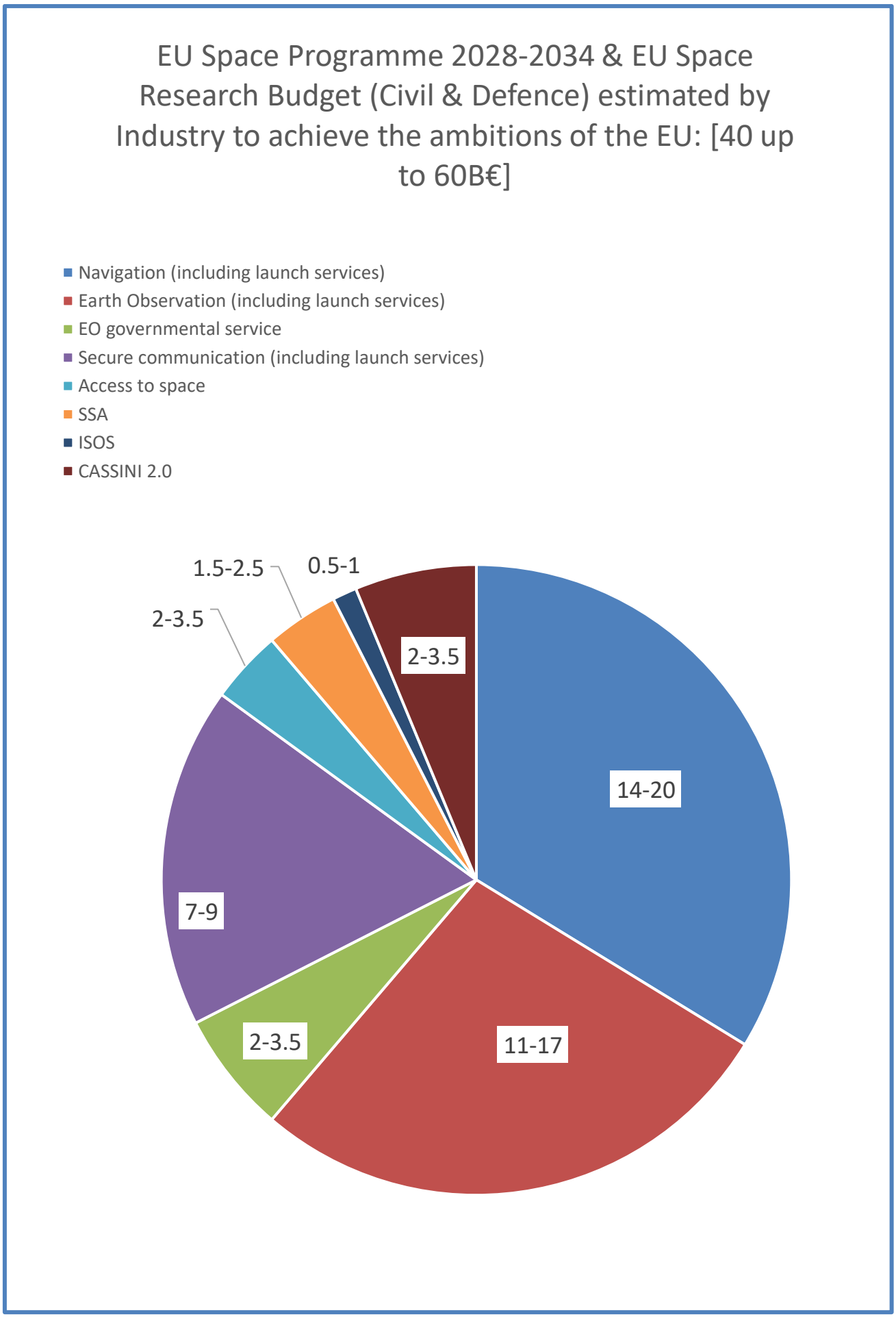
Although located outside of the remits of the EU Space Programme, additional EU budget for space could be found in synergy with other sectors (notably defence and research), and is included in the figures above. In particular:

- Depending on the level of interest from Member States, and their willingness to invest together in new developments, space defence capabilities could be addressed as part of the new European Defence Industry Programme (EDIP), allowing for further cooperation between Member States within European Defence Projects of Common Interest (**up to 5B€**);
- The budget of the European Defence Fund (EDF) is expected to be enlarged (in light of the current tense geopolitical developments). Tabling on a budget of 15B€ for the EDF, the space sector could legitimately grasp 20% of it (i.e., **3B€**);
- The successor to the Horizon Europe Framework Programme could offer up to **4.5B€** for space activities, among which **1.5B€** for the Space Partnership (see p.25).

Further to these programmatic considerations, it is key to ensure:

- Strict eligibility conditions to the EU Space Programme in order to preserve the technological and strategic European autonomy;
- Streamlined governance between EU (European Commission and EUSPA), ESA, and Member States to ensure swift and efficient implementation of actions, from development to exploitation;
- Reinforce the user-oriented approach of the EU Space Programme through EUSPA (including definition of EUSPA operational roadmap, fostering of the downstream market ensuring the synergies among all space components, more efficient and flexible management of projects by EUSPA, reducing bureaucracy and risks);
- A coherent European industrial strategy (see p.23) to define a common roadmap of priorities (which should not be the simple addition of national interests);
- Key procurement principles to empower industries, drive innovation and support competitiveness in the whole supply chain;
- Non-dependence on key technologies;
- Synergies between space and defence;
- Agile procurement and budgetary flexibility mechanisms to take into consideration contingencies such as hyperinflation or shortages in the supply chain, which disrupt the ability of the industry to deliver on time on budget;
- Cross-fertilisation with other DGs to increase the exploitation of space capabilities in support to the implementation of a wide range of sectoral policies.

A ring-fenced and predictable EU space budget in the next MFF is essential to ensure the uninterrupted operation of Europe's flagships. Securing continuity of service requires sustained investment in operations, maintenance, upgrades, and user support, which can only be achieved through a dedicated and stable funding line within the MFF.


EU Space Programme 2028-2034 & EU Space Research Budget (Civil & Defence) estimated by Industry to achieve the ambitions of the EU: [40 up to 60B€]
Navigation (including launch services)
Earth Observation (including launch services)
EO governmental service
Secure communication (including launch services)
Access to space
SSA
ISOS
CASSINI 2.0
1.5-2.5
0.5-1
2-3.5
2-3.5
14-20
7-9
2-3.5
11-17

Eight components, Eight priority areas

Navigation

Political justification

The European Global Navigation Satellite System (EGNSS) allows users with compatible devices to determine their position, velocity and time by processing signals from satellites. It enables efficient management of critical infrastructure, including transportation, energy, and telecommunications, fostering economic growth and improving public safety. For instance, GNSS supports intelligent transport systems, reducing congestion and emissions while increasing road safety. In agriculture, precise GNSS applications enhance productivity through precision farming techniques. Moreover, GNSS contributes to disaster management by providing accurate data for emergency response and recovery operations.

The European Global Navigation Satellite System is based on two Flagships:

- *Galileo* is the first Global Satellite Navigation System (GNSS) designed specifically for dual-use purposes, available worldwide and delivering multiples services towards a variety of public and private actors. It provides Europe with independence from the other GNSSs but remains interoperable with them, in order to facilitate GNSS combined use and offer better performance. Galileo also delivers Public Restricted Services (PRS), for EU27 governments use only, supporting the European Union security needs;
- *EGNOS*, Europe's regional Satellite-Based Augmentation System (SBAS), monitors and improves the quality of open signals from the US Global Positioning System (GPS) and (soon) Galileo to enable their use for critical and regulated commercial users, such as aviation. It therefore completes European sovereignty over its navigation infrastructures. As adoption of GNSS technology grows and new services are created, EGNOS integrity concept will need to be re-adapted to maritime, rail, road and also modern use of aviation, as it is the case for electric Vertical Take-Off and Landing (eVTOL) vehicles.

By reducing dependency on non-EU systems, Galileo bolsters the EU's strategic autonomy and technological sovereignty, ensuring that European users have access to uninterrupted and high-quality satellite navigation services. This is furthermore applicable to the governmental users, where robust and sovereign navigation sources are paramount to develop a European defence vision.

In order to foster private investments into the EGNSS and its market adoption, continuity and stability over long-term vision are paramount. This is achieved through:

- A commitment to maintain continuous provision of legacy services with a level of performances at least as good as experienced until now, and for the foreseeable future;
- The completion of implementation of services already committed and under development (e.g., Public Regulated Service) and the introduction of new ones as announced (e.g., Galileo High Accuracy Service or EGNOS for Maritime applications) based on legacy infrastructures (Galileo 1st Generation, EGNOS V2);
- The completion of the development and deployment of a new generation for both systems: Galileo 2nd Generation and EGNOS V3, to seamlessly carry on the delivery of legacy services and support enhancement, whether at system (security, flexibility, operations improvement) or services (i.e., new or with improved performances) level;
- The preparation of future evolutions through advanced Research and Development projects (e.g., Horizon Europe topics for upstream and downstream navigation and fundamental Elements for base components). It is essential to continually evolve Galileo by integrating emerging technologies (e.g., optical technologies for ranging and accuracy, on-board computing for autonomous Orbit Determination & Time Synchronisation, new generation of miniaturised and lightweight atomic clocks) to enhance its performance, security and autonomy.

LEO PNT:

In a context of Navwar (Navigation Electronic Warfare) and a growing number of critical applications and economy relying on high quality and robust Positioning, Navigation and Timing (PNT), it is necessary for Europe to continue to increase resilience of its sovereign Navigation & Timing system. In this context, it is also necessary to make existing communication more robust, resilient and secure. This requires redundant technology based on optical communication. On the other hand, existing optical systems therefore shall be adapted and verified for navigation purposes.

The value chain and economy surrounding this critical information can only rely on European warrantied infrastructures, in which Galileo is the basis. Meanwhile, Positioning-Navigation-Timing solutions from LEO satellites are emerging as a trend of evolution for space-based PNT, relying on multi-layer architectures. LEO PNT shall become the third pillar of the EGNSS, with Galileo remaining the backbone, providing a more resilient component.

In this context, it is essential to develop and integrate emerging technologies (i.e., on board processing, antenna techniques, optical communication) to support multi-layer/multi-orbit navigation systems (Galileo + LEO PNT) and its integrity component, making them more robust, resilient, and secure.

In synthesis, the goal is to increase the maturity of these technologies, ensuring a competitive time-to-market and delivering enhanced navigation performance at both the system and user levels.

As a matter of fact, Galileo needs to continue evolving towards upgraded services in line with a fast-growing demand in terms of accuracy, availability and resilience.

Industrial justification

In the course of the current MFF, concurrent implementation of activities has faced a combination of challenges which resulted in budget prioritisation likely to extend the completion of some of the initial targets beyond the current mandate. Amongst the main difficulties identified were:

- Unpredictable and out of control factors (e.g., COVID-19, Ukraine, hyperinflation, launcher crisis), each of which required dedicated mitigations which contributed to dry up any available reserves;
- Surge in costs of operations exceeding the forecasted budget, whether for Galileo or EGNOS, in particular due to the increased level of effort required to operate and maintain ageing systems (e.g., obsolescence management, continuous increase in complexity, raising impact of security);
- An under-estimation of activities related to ground segments, in particular with respect to the Galileo Ground Segment, creating and progressively growing a technical debt which full resolution will require a significant increase in the effort to catch up with;
- An increase of security requirements and constraints, which affect all development and deployment schedules and efforts, which also will require a very significant focus along with the continuous increase of threats, such as cyber-attacks or jamming and spoofing.

Concurrently to these challenges, additional use cases (such as rail, road, unmanned aerial vehicle), are also driving requirements towards more capabilities which may need deployment of new infrastructures, such as for instance the provision of PNT services from Low Earth Orbit or the implementation of advanced concepts in current ones (e.g., Quantum, Optical Inter Satellite Link). System definition and maturation for these new users or incorporation of breakthrough technologies have to be pursued in a concurrent approach to the achievement of the main priorities as below defined:

- Operations continuity:
    - To deliver the mandatory operational continuity, the budget should incorporate sufficient margins to accommodate potential drift of operations and maintenance efforts during the MFF, as based on the lessons learnt during previous exercises. To provide stability to this priority and towards the

others, the distributed and undistributed budget for operations should be firewalled from any cut during the programme with potential mechanism to release reserves during the course of the MFF;
    - The recommended budget for Exploitation of Galileo and EGNOS through 2028-34 is circa 5B€. This would include:
        - The costs of both operations contracts (GSOP and ESP);
        - The ancillary operations costs for both systems (e.g., hosting fees);
        - The costs of transponders for EGNOS services.
- Completion of the infrastructure renewal:
    - In order to secure the future operational continuity, recover some operational margins and support the introduction of new services, the effort initiated in the current MFF should be pursued and achieved. Although it will inevitably result in the overlap and transition from one system generation to another, it is also the only way forward to accommodate both the required growth in capability and keep the impact of systems obsolescence under control:
        - Galileo Constellation shall achieve its replenishment, with the order of 2 additional batches of satellites for a total of 20 and associated launches;
        - Galileo Ground Segment shall initiate transition to a completely new infrastructure in order to support the new capabilities of the constellation, but also and foremost to improve the operations lifecycle efficiency;
        - EGNOS V3 shall achieve the implementation and operational acceptance at the beginning of the next MFF, yet, additional releases such as for instance the implementation of Authentication for security, the development of a “Galileo Only” mode for sovereignty or the development for new users such as railway;
- Prepare the future:
    - In parallel to the current systems, the MFF shall also support the preparation of their evolutions in order to support both the continuous technological refresh and the introduction of new capabilities:
        - Next Generation systems, such as EGNOS NEXT, Galileo 3rd Generation, and the concept of “Multi-Layered Navigation” should be matured, through studies and preliminary developments of their various segments;
        - The current frame of Research and Development, through Horizon Europe and Fundamental Elements actions dedicated to Navigation, should be preserved and extended. A consolidation of the technologies and system maturity through demonstration, and possibly In Orbit Demonstration, should enable the European industry to reach TRL 7 to 9 before any new concept is introduced into operation;
        - Concurrently to the above, the provision of PNT Services in LEO is potentially a good candidate to enter into a pre-operational phase during the MFF, as such a significant provision should be considered in order to support a mid-term instantiation.

In order to support the continuous preparation of the future of PNT in Europe, the recommended budget is typically 3B€, within which 2.5B€ could be dedicated to LEO PNT.

Concretely, [14-20B€] is the amount needed to:

- Ensure the exploitation of the Galileo constellation by EUSPA (**1.8-2.7B€**)
- Ensure the development of G2G space and ground segment (**5-6.6B€**)
- Ensure new developments and missions including LEO PNT constellation (**3B€ from which 2.5B€ for LEO PNT**)
- Management costs (**2-2.8B€**)
- Ensure the exploitation of the EGNOS (**1-2.4B€**)
- Ensure the evolution of EGNOS (**1-2B€**) to serve additional user communities and provide additional value-added services such as high accuracy through a new channel in E5b;
- Construction and verification of Galileo Optical Inter Satellite Links, for robustness and resilience (**200-500M€**)

Earth Observation

Political justification

Copernicus[7], one of the most prestigious European Space Programme, is today the unfailing ally to the European Union's ambitions to be the first climate-neutral continent by 2050.

Universally recognised on the international scene[8] as an unrivalled space system, Copernicus continuously delivers an enormous quantity of data responding to the needs of a vast ensemble of users worldwide (from private companies and citizens, to universities and public administrations) who utilise Copernicus services with full confidence in their quality and durability. It therefore directly contributes to addressing and finding solutions to some of the major challenges of the coming decades for all European Union citizens, and to supporting Europe's role on the world stage.

As a very few concrete examples, Copernicus is essential for:

- Farmers, to optimise the total amount of resources employed (water, fertilizers, pesticides) as well as to benefit from requirements specifically tailored on the crop types, resulting in a great benefit for the environment;
- Ship captains, in Arctic regions, to significantly improve navigation safety with key information on sea ice parameters;
- Civil security services to alert the population in case of floods or forest fires and organise evacuations;
- Local coastal municipalities to rely on the monitoring of harmful algal blooms to prevent potential negative impacts on activities linked to tourism;
- Public health authorities to share air quality and UV forecasts to citizens for them to adjust their behaviour according to their personal situation;
- Supporting the EU itself on the implementation and monitoring of the EU regulation in specific areas where Earth Observation can be a supportive tool (e.g., EU Emissions Trading System, Common Agricultural Policy, Forestry,) promoting services beyond the Copernicus core services.

Copernicus continuously delivers an enormous quantity of data and information products responding to the needs of a hundred of thousands of worldwide Copernicus users. The excellence of the Copernicus services is directly linked to the very high-quality set of Copernicus observations and measures that can only be provided by the state-of-the art of this space system. As a result, Copernicus has become the globally-accepted standard for science-grade imagery and EO data quality as well as state-of-the-art earth observation and change monitoring system.

Industrial justification

From an industrial perspective, Copernicus is a structuring programme for the European space sector as it enables it to master world-class technologies for operational and reliable remote sensing.

More precisely, on the one hand, it allows equipment suppliers to develop and maintain performant and reliable products, featuring technological innovation and recurring models with mini-series, contributing to ensure a "critical mass" of activities to space satellites manufacturers, and providing continuity to the EO manufacturing industry; this in turn positively impacts industry's product policies. On the other hand, Copernicus data act as enabler and enormous accelerator for all kinds of value-added EO products and services based on latest AI developments, cloud computing and mass data processing, for-real time monitoring of the earth system and all its constituents.

Copernicus is also a driver for established European downstream companies and a catalyst for SMEs and start-ups to develop added value services and products, develop business in Europe and abroad. With the long-term approach, companies can invest in the upstream developing complementary capabilities or in the downstream in the processing of data and the delivery of services or products creating jobs and expand internationally.

[7] https://www.copernicus.eu/

[8] *As an example among many, climate services products have been identified as a reference and are now regularly relayed by CNN, and Europe can be rightly proud of it.*

Indeed, the cutting-edge technologies and products developed in the frame of the Copernicus programme can then be used for future commercial and export customers as state-of-the-art and "ESA proven" branded products, making a qualitative differentiator. It is probably not a coincidence that, today, Europe is the world leader of EO systems and EO-based services and products on the export market.

In addition to being a key asset for Europe to position itself as a world leader in environmental monitoring, Copernicus is also an excellent showcase for the European space sector on the open markets, as well as for supporting political recognition of space in Europe.

In addition, the development of low-cost radar (or other) systems and their integration on satellite platforms as part of a global sensor data network can supplement and enhance existing systems. A possible connection to constellations such as IRIS² could thus provide a relay function. The integration of AI modules can also significantly reduce management costs. The verification and application of automatic AI systems with intelligent recognition systems on multi-purpose processors provides the Copernicus programme as well as security-relevant programmes such as IRIS² with additional added value.

According to the 2016 study of the European Commission "Study to examine the socioeconomic impact of Copernicus in the EU", "*the EUR 1.4 B invested in Copernicus over 2008-13 is estimated to have increased employment by around 15,580 person-years",* giving the results that each 10 K€ spent in EO activities generates 0,11 person-years in highly skilled workers.

Concretely, [11-17B€] is the amount needed to:

- Build Copernicus satellites – Sentinels (**4-6B€**):
  - Copernicus Expansion development and launch;
  - Sentinel NG development (S1, S2, S3 TOPO, S3 OPTO, S6);
- ESA and EUMETSAT ground segment and operations (**respectively 2.5B€ and 2B€ as the number of operated satellites will be tripled in the next MFF**);
- Copernicus contributing Missions + Hybrid constellations (**1-3B€**);
- Copernicus service and in situ to support the implementation and monitoring of the EU regulation in specific areas where Earth Observation can be a supportive tool (**1.5-3.5B€**);

It is assumed that MFF 2028-2034 Copernicus activities will be co-funded in the frame of future ESA programmes (to be voted at next CMINs – i.e. CM28, CM31, CM34). Any new initiative or measurement need that could be identified during the MFF course is therefore not included.

Earth Observation Governmental Service

Political justification

The current geopolitical environment, notably the war in Ukraine, as well as the various climate-related crises, underline, perhaps more than ever, the need for the EU and its Member States to have enhanced intelligence and situational awareness capabilities. This need is clearly identified at EU level as one of the objectives of the EU Strategic Compass. Those capabilities underpin our individual and collective resilience, autonomous decision-making and capacity of action in the security and defence domains.

Reliable, fast, secure and global situational awareness is indeed most effectively enabled by space-based Earth-Observation systems and by the processing of the associated data, combined where available with other data, to generate added-value services and intelligence insight.

Industrial justification

As identified in the EU Space Strategy for Security and Defence, the European Commission has the ambition to develop and implement a potential new dual-use EU Earth-Observation service for governmental use in the MFF 2028-

2034. The EOGS system shall provide EU Member States with a space-based Earth Observation asset for intelligence applications (surveillance and recognition). The EOGS system should be composed by a mixed set of sensors housed in small satellites, including a ground segment capable of handling various types of sensor payloads. The EOGS new assets to be developed will complement the actual and planned Member States high-performance EO governmental assets, without duplicating national and commercial high-end systems offer.

Only authorised users within the EU and MS (and possibly third countries and international organisations, under certain conditions) would have access to this service which aim at increasing our collective and individual resilience, in the areas of security and defence.

Concretely, [2-3.5B€] is the amount needed to:

- Implement the Earth Observation Governmental Service (**2-3.5B€**):
  - Platform, European commercial data and services (**1B€**);
  - Development (PPP or patrimonial) of assets (including payloads) to fill identified gaps (**1-2.5B€**).

Space Situational Awareness

Political justification

The Earth orbit is today populated by a large amount of space objects (whether they are operational satellites or space debris). The trend towards an increase of space activities (e.g., CubeSats, deployment of large constellations in LEO) has already led to a congestion of the space environment in certain orbits[9], thus increasing collision and interferences risks and the complexity of decision-making processes concerning the evasion and collision avoidance manoeuvres.

Global initiatives and decisions regarding Space Traffic Management (which shall mean the planning, coordination, and on-orbit synchronisation of activities to enhance the safety, stability, and sustainability of operations in the space environment) are likely to create a challenging environment for European actors, notably on:

- The sustainability of the European model of autonomous access to space and its use:
  - Because of the inherent dependency to the US, especially in light of a possible introduction of stringent requirements only reachable through the use of data exclusively available from the US;
  - Because of the need to comply with a set of guidelines and best practices defined by and for US bodies operating in space, potentially affecting EU sovereignty, interests and needs.
- The competitiveness of the European space manufacturing industry:
  - Insurance companies will most likely push for the adoption of the highest level of services, in order to better manage their financial risk, thus promoting the use of US-defined and US-provided "enhanced" services:
    - The European satellite manufacturers' competitiveness on exports markets could be threatened if forced to resort to US SSA data, or even having to file for a US STM license with the possibility to having it denied;
    - The European launch service providers could suffer from a competitive disadvantage of not having their launch window and collision launch avoidance certified by US authorities (and potentially subject to an extra fee as non-US companies).
- SSA data sharing agreements with the US could potentially be subject to the fees, under the pressure from US taxpayers, determined by the secretary of Defence;
- The European industries might fall behind the US companies when acquiring critical market shares, as US companies are likely to dominate the bidding SSA/STM market thanks to anchor contracts to develop a fee-based "enhanced" level of services supplementing basic levels of service;

[9] Space_Environment_Report_latest.pdf (esa.int)

- STM is strongly influenced by and depending on SSA capabilities which are still way more developed in the US than in Europe, particularly when taking into account their strong dependency on military endeavours;
- Taking note of the growing importance of the issue at the strategic and commercial level, the EU Space Strategy for Security and Defence has highlighted the need to address Space Situational Awareness holistically. The regulatory aspects of STM must therefore be treated jointly with the operational aspects of SSA, on a civil and commercial level (improvement of in-flight safety) but also in terms of security and defense (protection of critical infrastructures, enhanced autonomy in space domain awareness).

Industrial justification

As the number of active orbital objects increase alongside the need for a more sustainable use of the space domain, timely and accurate SSA data is becoming a valuable asset of strategic and economic significance. However, there is as of yet no purely commercially-driven market for SSA data, as the regulatory and anti-collision imperatives remain under the purview of institutional bodies.

There is thus a need for institutional anchor customers and contracts in order to sustain the ability of industrial actors to develop SSA capabilities (i.e., ground infrastructure, sensors etc.) and services answering to the strategic needs of institutional customers and those of the commercial market, to include emerging needs such In-Space Operations and Services which will require enhanced safety procedures. While US companies benefit from frameworks contracts with the DoD, the US Air Force and the Department of Commerce, European SSA providers do not benefit from European public demand at such level.

As the congestion of the space, especially in LEO, is continuously increasing notably in the light of mega-constellations projects (already launched or in planning), the so-called “human in the loop” (i.e., defined as a model that requires human interaction) decision processes tend to become more difficult and riskier. Consequently, a new generation of services in support of decision making for manoeuvres and collision avoidance actions is needed. This will be an accessible business for European companies as long as SSA data is also accessible in a sovereign way and without intermediaries.

Space traffic monitoring capabilities currently available in Europe are not enough to answer the increasingly dense space traffic and are not adapted to deliver the level of performance required by a full operational monitoring space traffic within the current critical set timeframe. The European SST model needs to increase its ambitions with the necessity for the EUSST Partnership to make a significant leap forward (in budget and capabilities).

In this regard, further development and support to the emergence and profitability of a market of technologies and services in support to institutional assets is needed.

Concretely, [1.5-2.5B€] is the amount needed to:

- Enlarge the budget allocated to the purchase of commercial SSA data via the EUSST.
    - Today, this budget is still too low to be on a par with “heritage” sensors, which benefit from more substantial national funding. In the future, it should represent around 50% of the funding allocated to the EUSST.
- Further increase, via R&D, SST capabilities:
    - Prevention Capabilities: In order to prevent any misuse of space and allow for an optimised space traffic management, monitoring capabilities are very important. These include institutional and commercial ground-based sensors (e.g., radars, telescopes, passive RF, laser stations) to monitor not only space objects but other critical elements such as frequencies; and might also eventually need the use of space-based sensors;
    - Protection Capabilities: Protection capabilities include all those related to STM services, such as e.g., collision avoidance, active debris removal, “Cleanspace” initiative, fragmentation analysis, re-entry analysis etc.;

  - New designs to enhance safety: Promoting new designs and use of materials that offer a more sustainable use of space should be also one of the key elements in the mid-long term for Europe (New materials, components, new processes and protocols, new satellite and mission designs (active systems e.g., ADS-B, beacons).
- Support the development of an SDA pilot project, as presented in the 2023 "EU Space Strategy for Security & Defence":
  - The idea of an SDA pilot could be to articulate an EU ambition regarding the more security & defence-oriented elements of SSA, focused on protection of critical space assets and enhanced space intelligence capabilities. The overall aim could be to articulate a strategic vision between EU SST's more civilian-driven SSA roadmap focused on data and services and the capability development actions carried out by Member States within the EDF framework (SAURON, INTEGRAL and EMISSARY projects). The pilot project could be initiated by a "wargaming" phase with the EU and the Member States to help draft a CONOPS and launch an architecture study taking into account the results of the EDF projects, in particular the Command & Control (C2) prototypes currently being developed.
- Exploitation of the synergies among the various components for enhancing the space safety and sustainability;
- Support of the activities of the EU Space ISAC;
- Definition and implement of the rules and regulations at EU level necessary for Space Traffic Management (STM).

Secure communication

Political justification

In terms of secure satellite communications, the European space industry is aware of the existing needs of the European Union and its 27 Member States. The Union has indeed expressed its need for secure satellite communication through the proposed GovSatCom programme and the ongoing work on the Quantum Communication Infrastructure. The main focus of the EU for space based secure low latency communication programme needs to remain on IRIS². Overall, secure satellite communication projects aim at responding to the Union's objectives in terms of security, autonomy, non-dependence and leadership; in a world where data and information is becoming a key primary resource, and where hybrid threats are growing, the need for secure communications are more essential than ever. The current geopolitical context underlines the need for Europe to build its sovereign, secure satellite communication system.

Broadband connections are now the prerequisite for home working, home learning and for new important services. In addition, applications like maritime, aviation, unmanned aerial, key infrastructure, communications backhaul and in general any application in areas where no access to a ground network is available will be accessible and largely improved. Without broadband connections, it is now barely possible to build or run a business effectively. This is a huge opportunity and the prerequisite for revitalising rural areas. The European space industry is aware that the expansion of 5G, 6G and fibre is a first step to bridge the digital divide. The deployment of these new networks will most likely start by privileging large cities and highly populated areas. It has therefore to be complemented by a space-based system for ubiquitous connectivity that will allow to bring secure broadband connections in support of all European businesses and citizens, anywhere in the world.

The European space sector, in this sense, can be a major promoter of Europe's new ambitions to bridge the digital divide. Indeed, satellite networks can bring the latest technology on an accelerated basis to everyone, everywhere, including areas that 3G and 4G have not reached yet. This has been demonstrated during the Covid-19 crisis where satellites were being used to support a range of services including the rapid establishment of direct broadband connectivity to new medical facilities and to support tele-education and teleworking to otherwise disconnected

groups at home and elsewhere. The satellite technology allows these services to be available to all citizens, regardless of country, population density, or economic.

Furthermore, the need for secure broadband communication is also expressed by an increasing number of European businesses and companies, particularly those who are active in strategic and sensitive sectors. This is an issue which was further exacerbated during the pandemic, when European companies had to rely heavily on communication assets and data links belonging to, routed through, or based in non-European countries. This constantly leaves the information exchange and flow between European businesses open to electronic eavesdropping and monitoring by foreign entities, thus constituting a critical strategic weakness as well as increased risk of intellectual property theft. This is why European Secure Satellite Communications are an enabler for new and strategic business cases such as autonomous flight, autonomous driving and quantum key distribution, but also in the defence domain for future capabilities such as the European Future Air Fighter system.

Industrial justification

On February 15th 2022, the European Commission issued in record speed its Proposal for a Regulation "establishing the Union Secure Connectivity Programme for the period 2023-2027"[10], responding to European strategic needs, already raised in the Eurospace October 2021 Position Paper "Industry Manifesto for a Resilient Satellite System for Secure Connectivity…to Make Europe Fit for the Digital Age"[11].

As already stated in October 2020, the European space manufacturing industry, represented by Eurospace, strongly supports the ambitious and ground-breaking space-based secure connectivity initiative.

An ambitious new strategic satellite system for global connectivity would, in an area where European industrial and design capabilities have already been demonstrated, therefore answer some of the most important policy challenges set out by the European Union. It will help the Union to remain a leading international player with freedom of action in the space domain, and will support the competitiveness and innovation capacity of space sector industries within the Union.

The development and implementation of such European connectivity system would also greatly contribute to ensure Europe's autonomous and affordable access to space in the coming years while having a critical and profound positive impact on the competitiveness of European launchers' exploitation models.

Strategic autonomy in secure communications starts at industrial and technological levels (to the operations and the end-user segment, including interoperability and fusion with non-space-based systems) in order to ensure non-dependency from third countries throughout the entire industrial value chain. It is therefore key that such initiative should be accompanied by an ambitious research, development and innovation policy to maintain the vibrant technological ecosystem of the industry existing in Europe that can only become reality with sustained long-term financial investments in cutting-edge space technologies.

In the context of creating European autonomy and creating infrastructures and systems that ensure diplomatic work and secure communication in times of geopolitical tensions, the development of quantum key distribution (QKD) systems with eavesdropping-proofed optical communication is groundbreaking and innovative. This stimulates companies whose data is system-relevant and system-critical and strengthens European sovereignty through its own civilian offerings as well.

Concretely, [7-9B€] is the amount needed to:

- Ensure the development and funding of IRIS² first generation, as the secure, resilient and sovereign hardGOV system for EU governmental users to strengthen EU strategic autonomy (**5-6.5B€**);

[10] https://ec.europa.eu/info/sites/default/files/proposal_regulation_union_secure_connectivity_programme.pdf
[11] https://eurospace.org//wp-content/uploads/2020/10/secured-connectivity-constellation_final_13102020.pdf

- Enable new European technological developments and product evolution of IRIS² second generation de-risking activities, to strengthen the competitiveness of European technology and industry (**900M€-1B€**);
- A side contract for meta-operator activities after the IRIS² concession & GovSatCom Hub are contracted (**600-800M€**):
    - The meta-operator will need to be agnostic and responsible for:
        - Operating the GovSatCom Hub (full development, growth, evolution, operational integration with IRIS²);
        - Delivering all services requested by governmental users through the GovSatCom Hub;
        - Procuring from the market the most appropriate satellite communication services;
        - Enable the development of hosted missions on Board IRIS² second generation, in order to build a real space backbone for future EU Space and defence programmes.
- Ensure the development of Quantum technologies and first-generation development & implementation (**500-700M€**).

Access to space

Political justification

Freedom of action in space starts with launchers. At a time when space is increasingly becoming a contested arena where powers assert themselves and challenge each other, to guarantee the safety of our citizens and the resilience of our space infrastructures, it is more crucial than ever for the European Union to have autonomous and cost-effective access to space. This need is even more compelling given that the European Union has experienced first-hand the consequences of the lack of launchers during one year, when the war in Ukraine prevented the operation of the Soyuz launchers that were to deploy Galileo satellites. The temporary absence of an alternative European solution due to an unprecedented combination of factors (Vega-C launch failure, delayed transition between Ariane 5 and Ariane 6) has highlighted the strategic dimension of access to space as an indispensable attribute of space power and a vector for Europe's political and commercial ambitions.

For decades, access to space and infrastructures in orbit weight respectively only 5% each of the global space commercial value chain, but the loss of their control in front of American or Chinese competitors could collapse the other 90% of value. For future space-based activities and industries, efficient access to space will similarly be a key enabler with probably even greater ratios.

The successful inaugural flight of Ariane 6 in July 2024 has restored Europe’s autonomous access to space but structural challenges remain, not least the size of the institutional market in Europe.

Since Europe gained access to space over 40 years ago, institutional demand for launches has been intrinsically limited, accounting for only 1% of the global market. Over the last ten years, on average, 3 institutional launches per year in Europe compared to 21 in the US. This low launch cadence for sovereignty missions prevents from building reliable and cost-effective launchers on the industrial scale, which is why commercialization was part of the equation for European launchers from the outset. However, international competition has intensified, and European players are not on a level playing field with players who benefit from robust and, above all, captive institutional demand. Indeed, the increased competitiveness of American launch service providers, as witnessed on the open market, largely stems from two main characteristics: 1) a trend towards vertical integration which allows the LSP to self-generate launch opportunities through its own satellites, thus optimising launch cost through cadence increase, and 2) a strong domestic anchor market for both civilian and military institutional missions in which launches are sold at a premium in the name of “national security”.

This means that the narrowness of the European institutional market is coupled with a restricted commercial market accessible to European companies: 70% of the world satellite launch market is captured either by countries’ own space institutions (in the US, China or Russia…), or by companies that develop both satellites and launchers. Nearly 20% of

total missions have already been contracted to national launch vehicles of non-EU governments, leaving only 10% open for the European launch providers during the 2023-2032 period.

Today, Europe remains the only institutional non-captive market in the world. If it is unthinkable today to procure Galileo satellites or MTG weather satellites from non-EU companies, the same reasoning must apply to launchers if the EU wants to have a vibrant and high-performance European launcher industry.

In fact, there are a growing number of launcher companies in Europe, which proves the dynamism of the sector and will give the EU the choice. However, this intra-European competition, decided by the Member States at the November 2023 Sevilla Summit, will also have the mechanical effect of tightening demand. If the EU wishes to sustain several launch service providers, it will be necessary to grow and strengthen the internal market using competitive procurement procedures for European actors.

To guarantee sustainable access to space, it is also essential to master the full range of technologies required for today's missions from LEO to GEO, and to anticipate future needs. This implies the testing and development of key technologies not currently mastered in Europe, most of which are relevant to both Access to Space and Act in Space as mission areas of strategic and economic interest for the EU. The EU Space Programme has a critical role to play in fostering the development of differentiating technologies in support of European capability objectives through deliberate capability decisions and targeted investment choices.

Industrial justification

In order to address the issue of the limited size of the European launch market when compared to the number of captive institutional launches in the United States or China, aggregation of all available launch opportunities for European stakeholders could be a useful first step. Considering the planning cycle of each MFF and the long-term visibility of its own programmes, the European Commission could also purchase launches in batches on preferential terms and allocate them according to its needs.

In addition to aggregating demand for launches, the rules governing access to procurement will be key: in order to support the European industry, precise and unequivocal definitions of what constitute a European launcher, European launch technologies and European launch service provider (made in Europe by Europeans for Europeans) shall be defined and enforced, building upon existing legislative texts[12].

During last year's Seville summit, ESA member states decided to create a "European launcher challenge", with the aim of selecting European players that demonstrate the technical maturity and competitiveness to be a credible Launch service provider. In time for the start of the next MFF in 2028, it would be coherent to organise a 2nd phase, under the authority of the European Union to encourage the emergence of a number of sustainable players in Europe to serve the EU's launch needs. Competition within the framework of the European Union should foster realignment of national endeavours around a common capability ambition and encourage, in the medium-term, European industry to reconvene around consolidated European champions for the long-term benefit of Europe.

Access to Space capabilities are critical enablers for all other Space Programme components. Technological developments thus need to answer today's mission requirements but also prepare for tomorrow's capability needs, such as enhanced performance or increased mobility in space for dual-purposes ISOS missions. This requires the testing and development of key technologies not currently mastered in Europe, most of which are relevant to both Access to Space and Act in Space as mission areas of strategic and economic interest for the EU. The EU Space Programme has a critical role to play in fostering the development of differentiating technologies in support of European objectives through deliberate capability decisions and targeted investment choices. In order to foster cost-effective synergies, the technological innovations financed through this component should focus on cross-mission functional requirements relevant to both Access to space and Act in space, for both civilian and potential defence-related applications.

[12] *Art 24 of the EU Space Regulation, Art 22 of the Secure Connectivity Regulation, Art 22.5 of the Horizon Europe Regulation*

In order to strengthen the European Union's position as a key player in Access to Space, the European Commission could devote some Space Programme funding to the ground components of the European launch infrastructure. Contribution to the maintenance and upgrade of the European spaceports (such as the refurbishment of the Diamant - soon to be - multi-launch pad in Kourou) could be complemented by support to the development of a robust test facilities network across Europe, particularly in order to facilitate access of launch-related European SMEs and start-ups to critical resources.

Concretely, [2-3.5B€] is the amount needed to:

- Aggregate the European institutional launch demand together with EU Member States and ESA and consolidate the European launcher landscape by funding a 2nd phase of the European Launcher Challenge under EU authority (**600M€-1.5B€**);
- Fund game-changing innovations for European launchers (**1-1.4B€**):
    - Flexibility under fairing solutions: development of kick-stages, motorised dispensers or standardised European launcher-satellite interface to increase mission flexibility for European launchers;
    - Reusable upper stage: in complementarity with ongoing technological programmes financed by the EU (SALTO), this would be a key technological milestone towards full launcher reusability;
    - Super-heavy launcher roadmap: for instance, a technological roadmap towards the concept of "single-stage to orbit" enabling breakthroughs in mechanical and structural integrity, propellant impulse;
    - Innovative orbital propulsion solutions: sustainable solutions for orbital propulsion in order to enable the development of space logistics within the frame of future ISOS and the development of a technological roadmap to explore new nuclear electric propulsion (NEP) and nuclear thermal propulsion (NTP) for long-duration missions or dual-use capabilities for sustained manoeuvre;
    - Responsive launch architecture: technological roadmap and CONOPS development for innovative fast launch concepts and leverage European launch facilities;
    - Demonstration of complete reusable cargo delivery service.
- Support critical infrastructures (**400-600M€**);
- Continuation of the IOD/IOV Programme.

In-orbit Servicing and Operations

Political justification

From satellite life extension to cargo transport and satellite payload upgrades or exchanges, In-orbit Servicing and Operations creates a wealth of possibilities for EU Space Programme.

With over 20 000 satellites expected to be launched in the next decade, various orbits are becoming increasingly congested, and the situation is especially pronounced in Low Earth Orbit. As space debris can go on to cause further damage, potentially taking out functioning satellites, solutions need to be found. ISOS entails Active Debris Removal (ADR) and in-Orbit Servicing (IOS) initiatives and help stabilise the growth of space debris thus contributing to the EU approach to Space Traffic Management.

ISOS capabilities can further enhance Europe's security and resilience in space notably by allowing it to monitor, upgrade, repair and reconfigure satellites in space.

The ISOS initiative from the European Commission stems from the heritage of the EROSS project series funded since 2016 in the frame of H2020 and Horizon Europe. It has evolved from the initial intention to support the in-orbit demonstration of rendez-vous and robotics technologies, demonstrating European capabilities by 2025 and unlocking the take up of an On-Orbit Servicing (OOS) market, towards a complete vision to be integrated as one of the pillars of the forthcoming European Union's Strategy for Space R&D&I (targeting OOS but also a different approach to space assets production and management).

Meant as a precursor to position Europe as a leader, ISOS is based on 4 components:

- A servicing component consisting of a demonstration mission + pre-operational services from 2028 on;
- A hub (platform component) that acts as a "service station" to resupply the servicer(s);
- A logistic component that allows to resupply the hub – that is expected to leverage on Cargo and other servicing initiatives developments;
- A set of elements that can be assembled and resupplied (i.e., SatApps).

In so far, ISOS has a clear dual-use character. As such, strong cooperation and/or coordination with EDF, national projects fostered by defence and space agencies and ESA activities are of the utmost importance.

Industrial justification

In-orbit Servicing and Operations is critical for the EU's sustainability of its infrastructure, governmental needs (including defence) and the expansion of the space industry. The US, UK and China have already developed such capacities and the EU should not lag behind. As part of ISOS, in-orbit servicing will contribute to the resilience of space infrastructure while in-orbit logistics will lower the launch costs and provide more flexibility to missions.

Concretely, [0.5-1B€] is the amount needed to:

- Fund the ISOS pilot mission announced by DG DEFIS during the ISOS Strategic Forum (aimed at demonstrating technologies and services by 2030);
- Deploy, via R&D, capabilities to sustain in-orbit assets:
    - Demonstrations of refuelling, maintenance, debris removal that includes development and testing of brand-new technologies (as autonomous rendez-vous and docking, AI applied to robotic manipulators).

Given the intrinsic dual nature of such a capability, Industry considers it an interesting candidate for a complementary financing through the EDF programme.

CASSINI 2.0

Political justification

The example of IRIS² showcased the need to mature technologies very quickly in the course of a current MFF. As promoted by Mario Draghi in its report on the "Future of European Competitiveness", the establishment of a multi-purpose EU Space Fund would allow the Commission to act as an "anchor customer" and jointly purchase space services and products on the EU market.

This would help Europe's industrial base increase its capacities, notably by financing and demonstrating collaborative projects and avoid a tendency for "renationalisation" of space policy, and accelerate innovation (e.g., avoid risky demonstration, help start-ups go through the industrialisation phase).

Demonstrating new innovative missions could prove a very interesting way to make the CASSINI initiative evolve into a "CASSINI 2.0" to further support innovation. As part of the initiative, Key Innovation Demonstrators (KIDs) could be implemented on the model of the US Space Development Agency's procurements: layers of budget are delivered based on the success of subsequent development phases. This would provide opportunities for European companies (notably for European start-ups and SMEs) to demonstrate their technologies in support of a political and strategic EU needs.

Industrial justification

Ensure adequate readiness and maturity of necessary technologies and operational concepts for EU Space Flagships through representative demonstrations, in particular where and contribution of space to defence is key. CASSINI 2.0 would make it possible to test several vectors of innovation in the space field, in an agile manner and to face increased and accelerated competition to stay in the technological race.

Concretely, **[2-3.5B€]** is the amount needed to establish a number of KIDs (e.g., demonstration of 5G mission, reusable space planes, resilient and scalable Network of Responsive Space Systems (RSS), constellation of satellites in enhanced LEO providing a range of additional functions and missions in the fields of observation, navigation and mission detection and tracking, space cloud technology enabling revolutionary in-orbit data storage and processing services).

Most necessary conditions for a competitive, sustainable and autonomous European space sector

The necessity of a space industrial strategy at European level

If at numerous occasions, EU institutions have indeed recognised that space is key for Europe's freedom of action and autonomous decision-making, and that space technology, data and services have become indispensable for European societies and economies, this is today strongly at risk.

Given that the entities which, ultimately, deliver the necessary infrastructures to provide data and services to public (civil and military) users are private industrial companies, and given the economic situation of the space sector in Europe and the disruptions happening for instance in the USA or China, there is a vital and urgent need for Europe to devise and implement a coherent, European-wide, industrial strategy for space.

Current threats on the European space sector:

- The issue of the fragmentation of the demand and of the offer, the low volume of the European institutional markets, the rapid disappearance of a significant part of our traditional commercial market and the constant decrease of Industry's profitability are threatening the sustainability of the supply chains, the retainment of expertise and, ultimately, Europe sovereignty;
- The acceleration of the innovation cycles that requires new mechanisms to deliver, de-risk and develop faster;
- In addition, the institutional markets of our competitors are several times larger than the European one, and mostly captive (i.e., non-accessible to non-domestic players);
- In parallel, SpaceX verticalisation is now currently completely disrupting the satellite industry, after having contributed to disrupt the launch service market.

There is an ever growing need to ensure that the public authorities have an unrestricted access to the space-based capabilities they need in order to implement public policies and enable the expected services, with the required level of independence; meaning that these critical capabilities can be consistently sourced in Europe and under the control of European entities.

An industrial strategy for space strategy shall aim first at tackling the issues of the fragmentation of the demand and of the offer, the dependence on critical technologies and systems, and the drop of industry's profitability.

Based on large world-class space programmes, the Strategy will contribute to guarantee the robustness and the excellence of European space industrial supply chains.

In parallel, European institutional actors also need to recognise the need to structure their ambitions for Space Research, Development and Innovation to maintain the technological readiness of the European infrastructure, support technological non-dependence and foster innovation. In addition, this will help maintain the high-level of expertise within industry while attracting new talents. Following the recommendations of the recent "Space Strategy for Security and Defence", there is a real necessity to leverage the complementarity between defence and civil capabilities to develop new technologies to be used for both commercial and defence needs.

The European space industry also highlights the necessity for Europe to reinforce the demand, and be able to establish long-term purchase commitments or recurrent procurement through innovative processes. A future space industrial strategy shall also encourage the commercialisation of new services, in areas where credible viable markets have been identified.

In order to remain competitive on the international scene, Industry also insists that a future dedicated industrial strategy will need to help Europe keep a level playing field with other partners. Such industrial strategy for space will

therefore be instrumental to reinforce European positions on the international scene and to promote European standards and rules of behaviour, in particular for sustainability and environmental impact mitigation.

Finally, Industry emphasises the necessity to better coordinate efforts among European space stakeholders – EU, ESA, their respective Member States and Industry – in order to reinforce and leverage their contributions.

It is more than time, for the European Union and ESA and their Member States, based on their respective competences, to devise key common principles for a future industrial strategy for space and to identify and reflect about the most efficient instruments they have at their disposal to implement it.

There is no "space power" in the world without an industrial strategy to implement its space policy.

Strengthening synergies between Space & Defence

As it is essential, on the one hand, to support DG DEFIS's ambition towards the EU Space Programme (developing EU capacities for civil use and control), it is equally important to reinforce, in line with the EU Space Strategy for Security & Defence, synergies with the defence sector and dual capabilities.

This objective requires the full integration of space issues into European defence programmes (i.e., European Defence Fund and European Defence Industry Programme), increasing its importance and funding level (building, when possible, on the EU Space Programme capabilities or developing new ones when needed).

- Although space is clearly identified in the European Defence Industrial Strategy (EDIS[13]), it does not appear in the Proposal for a Regulation for a European Defence Industrial Programme (EDIP)[14]. Whatever the final legislative text will be, it is of course of paramount importance that space projects contributing to defence capabilities are eligible in this framework (and in the next MFF);
- Second, it will be necessary to capitalise on the space domains already identified in EDIS in order to build a framework for European Defence Project of Common Interest (EDPCI) to finance, at European level, the necessary capability developments to fill current space defence gaps in the EU.

The European space industry has identified several possible space projects in key areas for defence where public significant investment in the frame of the EDIP will be needed:

- Space surveillance: in addition to the EUSST (focusing on civil activities), EDIP could develop a military SSA/SDA project (with space-based system surveillance) in order to give the EU and its Member States greater autonomy in assessing the space situation and to help strengthen a capability pillar in the field of space surveillance, which is the only way to give credibility to an EU Space Act;
- Space-Based Missile Early Warning (SBMEW): EDIP could finance the full implementation of a Space-Based Missile Early Warning System for Europe, following on from the research and development projects already ongoing in the frame of the European Defence Fund, such as the ODIN'S EYE I and II projects. The full SBMEW capability programme should be seen as a key component of the overall architecture of the European Air Shield, with the primary goal and direct impact in ensuring the safety and security of European citizens in years to come;
- Space assets protection: EDIP could finance the development of technologies and assets capable of defending space infrastructures of the EU and its MS from potential threats;
- Spoofing/Jamming (Navwar): in addition to European developments on Galileo, its Public Regulated Service and LEO PNT as part of the EU Space Programme, EDIP could help developing a Navwar component focusing in particular on preventing the risks of transmitting information on positioning and navigation through the coordinated use of space, cybernetic and electronic warfare operations, and on preventing jamming and spoofing;

[13] *EDIS is a joint communication of the Commission and the High Representative that sets a vision for the European defence industrial policy until 2035*

[14] *Proposed by the Commission to start implementing concrete measures identified in the European Defence Industrial Strategy*

- Maritime and underwater surveillance from space: the development of all-weather (cloud cover, day/night), high revisit space sensors could complement terrestrial technologies, including artificial intelligence solutions;
- Innovation programme: based on the American SDA (Space Development Agency) model, and capitalising on the recurrence of Iris², EDIP could encourage the development of a constellation of satellites in enhanced low-Earth orbit to perform a range of additional functions and missions in the fields of observation, navigation and mission detection and tracking. This model would make it possible to test several innovation vectors in the space sector, in an agile way, and to face up to increased and accelerated competition in order to stay in the technological race.

Several of the space projects mentioned above are already being developed in the frame of the European Defence Fund. However, most EDF-funded projects including in categories such as ground, naval, air, and cyber, foresee that Member States will be the ultimate customers and purchase the capabilities developed through the projects. For large-scale space defence projects including Space-Based Missile Early Warning, this is not feasible. Therefore, a dedicated framework for full implementation, and appropriate governance mechanisms among the EU Member States, shall be developed by the Commission and Member States, to fully implement these space defence projects serving common European security and interests.

Research and Development under FP10 (10th Framework Programmes for Research and Technological Development)

It is vital that Europe's growing reliance in space-based services is **accompanied by measures aiming at enhancing and driving forward its space-based capabilities and services**, that would follow three main objectives:

- **Ensure European technological sovereignty over its domestic market**:
  - Non-dependence for key technologies and critical infrastructure.
- **Ensure European competitiveness internationally**:
  - Through a dynamic European supply chain with efficient products that shall be made available at any time and be less expensive by reducing constraints and easing requirements (i.e., norms and standards).
- **Anticipate disruptions and generate our own European-led ones**:
  - Lead a harmonised usage of space, exploiting the convergence of multiple new technologies (e.g., Artificial Intelligence, automatization, cloud-based data access and distribution, real-time tasking enabling technologies) which will support new services or allow to develop new products for the benefits of end-users (e.g., emergency, health, financial services, telecom, sustainable usage of natural resources);
  - Fund a larger number of initiatives to validate the concept of innovative space systems where Europe could take the lead; then, past the validation of concept, increase quickly the support to concepts likely to create new markets;
  - Align investments with sustainability objectives, so as to reap the benefits from sustainable space activities (both in space and on Earth).

Today's investment in innovation will be the driver of tomorrow's competitiveness for the European space sector: maintaining Europe's leadership in space implies indeed the availability of a first-rank domestic industry, able to design, deliver and exploit state-of-the-art space systems, required by public and private customers worldwide.

EU funding in R&D&I is needed to boost European competitiveness and innovation, and contribute to job creation and growth. From this standpoint, the implementation of EU Framework Programmes, via relevant budgets, adequate tools and appropriate priority areas, shall ensure that Europe consolidates its leading position, and serve above-mentioned three main objectives.

The quality of the funding should be measured by key characteristics:

- **Consistency and predictability**: an ambitious and efficient R&D strategy, aiming at supporting European Industry competitiveness, maintaining the technological readiness of the EU-owned strategic infrastructures and preparing the development of the new components of the EU space programme has to ensure consistency, coordination and harmonisation among the various sources of funding for space R&D&I at national and European level (European Defence Fund, Horizon Europe, European Defence Agency and ESA funded R&D);
- **Persistence**: the European space sector needs the presence of a stable, reliable, persistent (i.e., long-term) investment plan to support any serious ambition;
- **Efficiency**, by:
    - Focusing investments;
    - Fast decision-making, agility and opportunism when needed;
    - Adapting the procurement rules so as to focus expenditure on the actual activities related to the targeted breakthroughs and avoid spreading investments over a large number of actors in the same area of expertise;
    - Supporting technology building blocks linked to competitive and mature technologies that have demonstrated their commercial viability on other markets.
- **Balanced positioning** in the global ecosystem: technological and component-level non-dependency shall be pursued to enhance European autonomy. At the same time, Europe should find niche key infrastructure and capabilities that are much sought-after and therefore valuable on the global market;
- **Specific coordination and synergy with ESA** on key infrastructure and services, and commercialisation policies.

Industry recommends a budget of no less than **4.5B€ for Space R&D** in the frame of the 10th EU Framework Programme for R&D, including at least **1.5B€ for the future of the "Co-Programmed European Partnership on Globally Competitive Space Systems"**. For detailed recommendations for the 10th Framework Programme, please refer to Eurospace Position Paper "Eurospace Initial Guidance Paper – Starting to pave the way for the future of EU Space R&I"[15] and the future one, in preparation.

[15] https://eurospace.org/download/6478/?tmstv=1718962899