THE FUTURE ESA PROGRAMME IN EARTH OBSERVATION: THE CATALYST FOR THE GROWTH OF THE EUROPEAN SPACE EARTH OBSERVATION INDUSTRY

EUROSPACE POSITION PAPER – APRIL 2025

TABLE OF CONTENTS

Empowering Europe's ambitions in Earth Observation

The European Space Agency (ESA) and Eurospace, the trade association of the European space industry, organised a high-level ESA-industry dialogue to review the key aspects of the future ESA programme proposals in Earth Observation (EO), in view of the ESA Ministerial Council Meeting in November 2025.

The event took place in two steps:

- On November 18th 2024, an online preparatory session allowed ESA to present the key aspects of the future ESA programme proposals in Earth Observation, in view of the ESA Ministerial Council Meeting in November 2025;
- On December 4th 2024, Industry and ESA convened in ESTEC for the high-level ESA-industry seminar to review the key aspects of the EO Programmes for CM25.

More than 100 participants from over 70 different companies participated in at least of the two events.

These events provided the opportunity for Industry to consolidate its recommendations for sharpening the ESA EO programme proposals, explain what are its main areas of interest and express its general support for the proposals elaborated so far.

The European space industry is **strongly convinced** that the renewed ambitions put forward by the ESA Directorate of Earth Observation Programmes (D/EOP) for the next Ministerial Conference will allow **Europe to further strengthen its Earth Observation assets** in support to the traditional and emerging need of European institutions and citizens, with the dynamic commitment and support of ESA Member States. In particular:

- In general terms, the proposals promote schemes that **support industry competitiveness** (e.g. with activities contributing to demonstrate the value of EO, with the integration of digital technologies, de-risking activities and procurement of activities that are relevant also for the security and defence sector);
- The package (and in particular the technology developments proposed e.g., in FutureEO) is contributing to a **much-needed de-risking of activities for industry**; it also includes the development of **dual-use technologies** that is timely and relevant for the European industry. The proposals also support the development of products that have a commercial potential and could open **new market perspectives** outside of Europe;
- The European space industry also welcomes the potential of the programme proposals to have a "**multiplier effect**", not only by preparing activities for operational missions like in meteorology or for Copernicus, but also through the Science missions under FutureEO (i.e., the Explorers) that could become operational ones in the future.

Ensure ESA's continued leadership in Earth Observation

Just three years ago, during the ESA Council at Ministerial level in Paris on November 22nd and 23rd 2022, government ministers from ESA's Member States, Associate States, and Cooperating States made a commitment to enhance Europe's space ambitions, ensuring a sustained collective effort to better serve European citizens.

In particular, and beyond budgets, **CM22 recognised the vital role of Earth observation in addressing major challenges**, including climate change; an issue of high priority for ESA Member States (with 2,7B€ devoted to ESA's Earth Observation programme).

This included *inter alia* funding for FutureEO (ESA's Earth science, research and development programme) – which supported new ambitious missions such as a new Earth Explorer mission (Harmony), NGGM, and Scouts – as well as supporting Aeolus-2 and committing to further develop the space component of the Copernicus programme to address newly identified needs.

Today, the European space sector tackles some of the most pressing challenges of our times, such as understanding climate change and its effects, biodiversity and pollution. **Earth Observation from space is today the unfailing ally to Europe's ambitions to react as much as possible to the effects of ongoing environmental global changes**.

Universally recognised on the international scene, European Earth Observation systems continuously deliver an enormous quantity of data responding to the needs of a vast ensemble of users worldwide (from public administrations and scientific research groups, to private companies and citizens) who utilise European Earth Observation-satellite gathered data and services with full confidence in their quality, reliability, availability and durability. They represent a high-level reference for any application or even new satellite data calibration; this is a reason why cooperation with ESA EO projects is welcomed and sought by the worldwide community (e.g., NASA, JAXA).

For example, in the last decades, European Earth Observation systems have proven to be essential for:

- Feeding environment and climate models with ever growing data sets, reflecting the changing context of Earth as a system;
- Supporting accurate meteorological forecasts, and building up improved meteorological models with updated and continuous data sets;
- Macroscopic analyses of human and natural Earth phenomena, such as vegetation cover, crop yields, soil moisture, sea temperature, winds monitoring, urban spread and land occupation, ice and polar regions monitoring;
- Enabling situation assessment/monitoring and decision-making at local and regional levels as seen with the activation of a rapid mapping service to support rescue and recovery efforts during the recent flooding in the Spanish region of Valencia, or with the forest fires in Greece in the summer of 2024.

More recently, **the role of Earth Observation is becoming increasingly essential for Europe's strategic autonomy**. The current geopolitical environment, notably the war in Ukraine and the evolving relationship between Europe and the USA, should become a driver for increasing Europe's sovereignty for civil (and military) Earth Observation. In addition, various climate-related crises underline more than ever the need for Europe to have enhanced intelligence and situational awareness capabilities. Those capabilities underpin our individual and collective resilience, autonomous decision-making and capacity of action in the security domain. 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.

The ambitions of Europe to be stronger in the Earth Observation domain require that it has at its disposal the necessary global infrastructures for independent assessment, decision-making and action, and that it prepares their evolution today.

In November of this year in Bremen, ESA will propose an array of programmes for the next three years, including a new package for Earth Observation.

The European space industry would like to highlight how the ESA EO programme that will be proposed in November will be key in fostering its competitiveness and excellence and promoting its products and services throughout the world, while reinforcing the European autonomy. This is the reason why Europe needs to continue proposing and developing new initiatives.

The European space industry is **strongly convinced** that the renewed ambitions put forward by the ESA Directorate of Earth Observation Programmes (D/EOP) for the next Ministerial Conference will allow **Europe to further strengthen its Earth Observation assets** in support to the traditional and emerging needs of European institutions and citizens, with the dynamic commitment and support of ESA Member States.

A structuring programme for the competitiveness of the European space sector

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

The ESA Earth Observation programmes are a central asset for the European space supply chain. It has provided one of the **largest growth opportunities for European space systems manufacturers**, worth 4B€ of industry consolidated sales in the past decade[1], and supported the development of a supply chain that spreads through all ESA Member States. The wide array of missions enabled by the ESA EO programmes, ranging from small to large missions, in particular with the continued strand of the Earth Explorer missions of the FutureEO programme, have combined scientific excellence with frequent flying opportunities. Furthermore, EO data act as an 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.

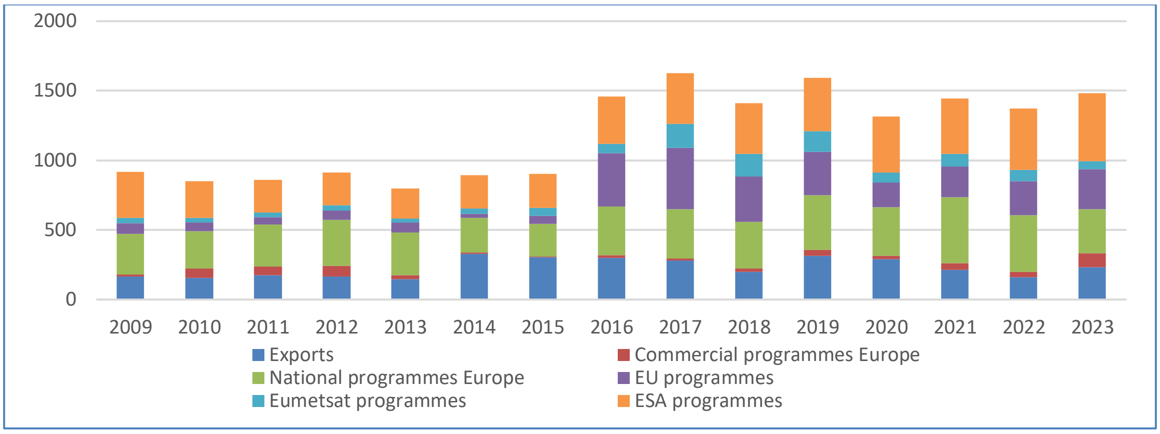
ESA EO Programmes are also a driver for established European downstream companies and a catalyst for SMEs and start-ups to develop added value services and products, and to develop business in Europe and abroad. With the long-term approach, companies can invest in the upstream developing complementary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

Indeed, the cutting-edge technologies and products developed in the frame of the ESA EO 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. The exports of Earth Observation systems represented 2,6B€ in the past decade, they are the second export segment for the European space industry, making Europe the world leader of EO systems (and EO-based services and products) on the export market.

ESA’s Earth Observation programmes also enhance national reconnaissance and defence by fostering advanced technologies and operational synergies as part of FutureEO or InCubed; innovations developed under these initiatives also integrate into high-performance systems, such as those developed as part of Copernicus, strengthening national and European resilience and security.

In addition to being a key asset for Europe to position itself at the cutting edge of Earth science, the ESA EO Programmes 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).

[1] *Source: Eurospace Facts&Figures annual survey*



European EO space systems sales (M€) by customer segment (source Eurospace Facts&Figures annual survey)

Direct feedback on programme proposals

The ESA EOP programme proposals for CM25 are wide-ranging and ambitious, seeking to promote the role of EO in providing actionable information. This is an admirable target, and industry hopes that it will consider all spatial scales including Very High Resolution. ESA's programmes combine this with activities to develop capabilities in industry that will support both institutional programmes and other industrial targets in export, security and commercial domains.

Generally speaking, **it is essential that industry-driven and market-driven ideas are put at the centre of new ESA initiatives**, in addition to the few Phase 0 studies that are planned for selected or pre-selected missions. This is particularly important in a CM25 that faces a substantially changed industrial landscape with respect to the last one: thanks to the investments done at national level for the implementation of several national EO constellations, new primes are emerging with increased engineering and manufacturing capabilities, broadening the active actors in the domain.

The mix of major activities proposed by ESA includes the completion or continuation of already-initiated programmes. In the upstream, these include Sentinel-2 & -3 NG of the Copernicus Space Component programme, TRUTHS, Earth Explorer 11, and NGGM in FutureEO. Such continuity should be prioritised. The Earth Explorer programme elements deserve specific attention because of their success over many cycles and their potential for supporting new capabilities and future operational missions. Industry fully supports ESA’s approach of maintaining flexibility in Earth Explorer mission costs, including a price buffer, rather than enforcing a strict cost cap from the initial call for ideas/missions. The mission selection process should strike a balanced compromise between scientific value, technological readiness, and financial/programmatic feasibility. To establish a budget cap effectively, a dedicated workshop at the start of Phase 0 - bringing together ESA and industry with a co-engineering approach - would help secure this balance.

Additionally, given the rapid evolution of our planet and its challenges, industry believes that the overall Earth Explorer mission procurement process should be significantly accelerated to better align with end-user expectations and needs, including alignment with the ESA Earth Observation Science Strategy. The same approach, moreover, can be also extended to the next generation EO mission cycles, such as Scouts, a relatively new entry in the FutureEO programme.

New activities in the ESA context are, of course, extremely welcome. NGGM, part of the FutureEO programme, represents an advancing continuity of capability in gravity mapping missions and a bridge towards future missions that may eventually incorporate quantum sensing technologies. A clear path towards the exploitation of such quantum sensing is welcomed in the ESA planning. Furthermore, a view towards the next generation of operational meteorological missions and payloads is extremely timely and welcome.

Other specific technological focuses that would enable opportunities both within the Earth Explorers and much more widely include lidar sensing, and again, the inclusion of such activities within the proposed programme is extremely welcome.

A clear focus on ESA's role in supporting business-led opportunities for missions within a regulatory environment to support climate change policy is welcomed ("Stepping Stone" missions). It represents an opportunity for "pooling and sharing", allowing industrial players launching these new constellations to secure institutional anchor customers and addressing commercial markets. The advantage for these clients is that they would pay for a minimum portion of the constellation's cost while benefiting from high revisit rates without compromising on performance and responsiveness over their areas of interest. But while ESA's expertise in both satellite development and data quality will be extremely valuable, it must be recognised that the burden remains on industry to secure viable business plans, support risks and, in this sense, the concept differs profoundly from some past experiences of ESA (e.g., with the Arctic Weather Satellite). ESA shall therefore provide an opportunity for industries to validate their concepts and demonstrate their market potential. This is the required enabler before moving to the deployment and full operational phase that would then become much more attractive for private investors. **This funding strategy not only reduces financial barriers but also fosters the development of new businesses and economic models in the space sector, helping to turn innovative ideas into marketable realities**.

InCubed will help strengthen IOD/IOV with more ambitious "mission" demonstrations beyond just "technologies". Industry believes that the programme can encourage industrial players to develop and demonstrate integrated systems in orbit. A dedicated funding line for IOD/IOV "missions" that showcases not just technologies but also operational concepts and an associated business model would be particularly relevant. This approach would essentially function as a set of precursor missions, where the Agency gives companies an initial boost to help them validate their models.

The Earth Action Pillar of FutureEO could be an appropriate framework to support downstream companies in adapting their existing algorithms to make them more efficient and suitable for onboard processing, and enable the demonstration of AI-based solutions onboard existing space infrastructures already equipped with sensors and computing capabilities.

A noticeable gap in the proposed set of programmes for CM25 concerns the relevance of High-Altitude Platform Station (HAPS). Such platforms may provide contributions to mission preparation and validation, and also in the development and demonstration of compact low-resource payloads. **Industry suggests that they are considered more explicitly in the programme proposals**.

It is also recommended to consider introducing a bridging phase to facilitate the integration of constellations already established by several Member States. This would enable their contribution to other ongoing and planned ESA missions, using an approach similar to that of the Copernicus contributing missions, or promote their federation in partnership with the supporting Member States. Furthermore, **industry-driven initiatives should be encouraged** to propose ideas for synergies and joint exploitation of existing constellations in collaboration with ESA missions, and these initiatives should be actively supported in the EO Programme proposal.

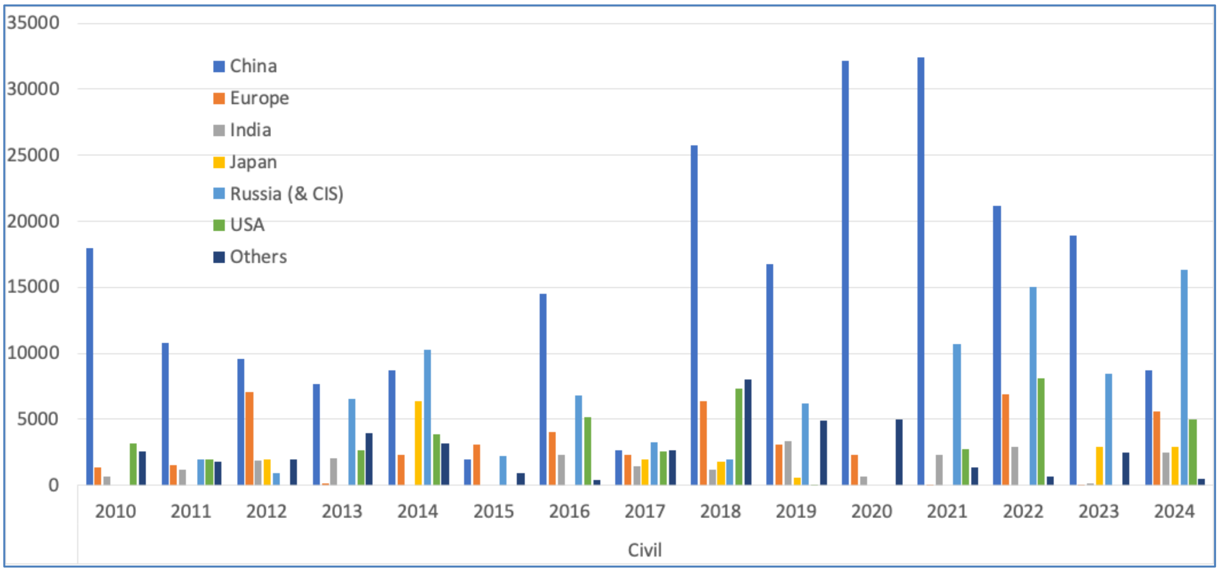
Finally, the European space industry welcomes the new optional Programme on security and resilience: the **European Resilience from Space** (ERS). The current geopolitical environment, notably the war in Ukraine, as well as the various climate-related crises, underline, perhaps more than ever, the need for the Europe to have enhanced intelligence and situational awareness capabilities. Those capabilities underpin our individual and collective resilience, autonomous decision-making and capacity of action in the security and resilience domain.

Key considerations for the future ESA EO Programmes

1) Setting the scene: the Earth Observation space infrastructure landscape

Public entities worldwide are still today the main users of space activities. The Earth Observation sector is no exception.

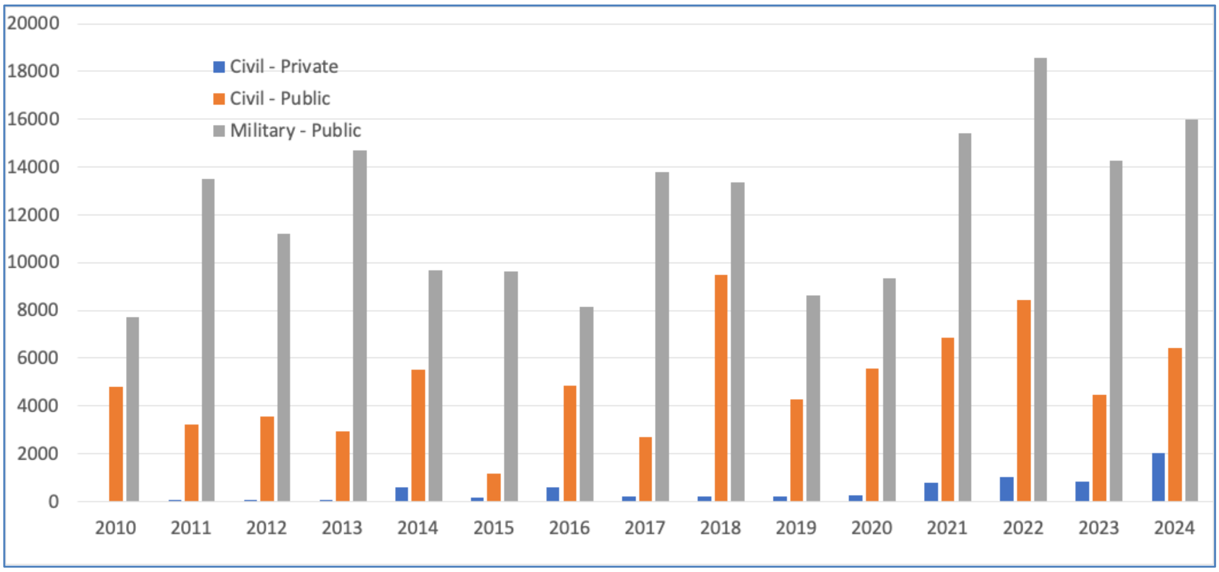
Governments, space agencies, and international organisations are increasingly investing in EO programmes to address pressing environmental concerns, such as climate change, natural disasters, and resource management, while also bolstering security capabilities for both civilian and defence applications (as seen in the chart below). Additionally, the rapid expansion of digital services, artificial intelligence, and big data analytics has amplified the value of EO data and services, making them indispensable for industries such as agriculture, energy, urban planning, and disaster response. These factors have contributed to a solid institutional EO market, with ESA and other public entities committing significant resources to the development and deployment of advanced satellite missions.



Mass launched (kg) - Civil institutional Earth Observation programmes - by customer region (source Eurospace Launch Events Analysis Tool - LEAT)

Despite this growing institutional demand, **the commercial EO market is facing notable challenges, with declining exports and diminishing demand for privately-funded EO solutions**, leading to a situation where government-backed programmes dominate the landscape: EO remains largely dependent on institutional funding.

The global EO satellite demand from private entities is extremely small, at less than 1B$/year in the past decade (see chart below). It is also significantly funded by the military/intelligence community in the form of anchor demand. The main promoters of EO satellite infrastructure are indeed the military and intelligence communities. They own most of the satellites in orbit, and are the main customers for “commercial” satellite data. The global market opportunity for EO satellite build is in average 15B$/year for military customers, and less than 3B$/year for commercial (private) customers. The launch demand is rather small, even considering the premium paid by military/intelligence customers (<3B$/year).



Market estimate (M$) for Earth Observation systems worldwide by main market segment (source LEAT)

From a global point of view, the USA still dominates, but China is catching up fast in both civil and military domains. Europe, despite its commitment to Copernicus, is 4th in the line.

In Europe, ESA is one of the most influential customers of the European EO industry, shaping the sector's sustainability and growth trajectory. While this reliance on public funding ensures a steady stream of projects and technological advancements, it is not enough to ensure the long-term commercial viability, as EO companies struggle to secure recurrent revenue streams.

2) Improved data and services through improved technology advancements

For industry, it is important to continue to invest in technologies that are supporting long-term operational space programmes which are driven by policy and user-needs. These programmes have generally a long-time horizon, and they are beneficial to industry as they provide a baseline of activity on the long-term.

Copernicus, meteorological and FutureEO are among the programmes which enable delivery of missions critical for observation of Earth Systems which are needed for accurate forecasts of the weather, of extreme weather events, environment parameters (e.g., atmosphere, air quality, oceans, ice) and for the detection and monitoring of climate change.

In this domain, thanks to the partnership between ESA and EUMETSAT, Europe is a world-leader, relying on the excellence and innovation of the European space industry. The new generation of such systems is currently being deployed, with new programmes like Meteosat Third Generation (MTG), EPS Second Generation (EPS-SG), EPS-Aeolus or EPS-Sterna, all based on the ESA/EUMETSAT cooperation model, which benefits industry competitiveness.

It is however time to start preparing for the future and for ESA, working together and based on requirements expressed by the European Commission and EUMETSAT respectively, to support the definition of highly innovative future European remote sensing and meteorological programmes, which will guarantee the continuation of core observations needed by the community.

These programmes are and will continue to be challenging, as they need to be innovative in delivering observations with an operational focus, calling for cutting-edge technologies, miniaturisation at an affordable cost, something that, if well prepared by ESA technology development programmes, including Pillar 1 of FutureEO, European industry can deliver.

The Earth Observation industry is undergoing rapid technological transformation, with advancements in real-time data processing, and constellation deployment. These innovations are shaping the future of EO missions, improving efficiency, reducing costs, and expanding the range of applications.

In this aspect, **the FutureEO Programme shall underpin the development of all future ESA EO missions including operational satellites, and has to remain a key vehicle to nurture industrial return, competitiveness and growth**.

One of the most significant trends in space applications, with potentially a tremendous added value for EO programmes, is the **development of architectures relying on the proliferation of systems in LEO with small, medium and large constellations**, taking advantage of smaller platforms, to distribute more sensors and gather multiple layers of information within a single system approach, but also enabling more frequent observations with higher data freshness and enhanced global coverage. This trend is supported by the serialisation of platform production and the increased availability of small to medium platform designs, with higher degrees of standardisation and simpler interfaces, with potential for lower costs of procurement and operations. In parallel, improvements in payload performance and costs, such as sensor resolution and size (smaller size, lower power needs), array antenna components, reflector designs, are made available thanks to the introduction of new technologies at component and building block levels. Thanks to advances in processing capabilities — driven by innovations in integrated circuits and microcontrollers — satellites can now run more sophisticated algorithms, including machine learning and AI, directly on board. This has led to highly efficient missions using smaller satellites that still deliver high-quality data and offer more frequent revisits. The extension of usable frequency bands for observations in both optical and radar domains has also provided additional benefits for remote sensing missions.

Advances in sensor and RF technology

There is currently a push in EO sensor technology towards higher spatial, spectral, and temporal resolution that shall be reinforced.

Optical payloads, including advanced technologies such as interferometers, spectrometers, and hyperspectral imagers, continue to push the boundaries of science and information, enabling unprecedented insights into various domains. Additionally, LIDAR systems are opening new frontiers in remote sensing, offering high-precision 3D mapping capabilities that drive innovation in fields such as environmental monitoring, autonomous navigation, and urban planning. Additionally, research into Very Low Earth Orbit (VLEO) systems is gaining traction, as at these lower-altitude the same sensors can capture higher resolution images without increasing the size or cost of satellites. On the downside, VLEO architectures have narrower swath, and shorter lifetimes due to increased atmospheric drag and ATOX.

In parallel to optical advancements, Synthetic Aperture Radar (SAR) technology is evolving through digital beamforming, which enhances imaging resolution and reduces latency. In SAR, the advantage of deploying multiple satellites operating at the same frequency is very notable, especially in terms of improving the overall signal to noise ratio, and thus giving more performance to the system overall. Higher-frequency RF sensors, both active and passive, are being integrated into EO platforms to provide more detailed and accurate measurements, particularly useful for environmental monitoring and security applications. The downside of active RF systems (Radar and SAR) is the increasingly tense competition for RF spectrum allocation for space applications. A concern that is not shared by optical systems.

Multi-mission platforms hosting both optical and radar sensors, allowing satellites to switch between different sensing modes depending on mission requirements, are also worth being considered. There is also a recognised need for enhanced platform agility to enable repointing to different targets within the same pass, along with improved Line-of-Sight management (AOCS, thermoelastic control, microvibration control, and payload alignment) to achieve more accurate and stable pointing in both optical and RF missions.

Beyond CM25, the development of next-generation Earth Observation technologies will be crucial for ensuring European sovereignty and strengthening the competitive position of European industry in the global EO market. Key areas of focus include advanced radar and optical sensors with higher resolution and sensitivity, AI-driven data processing for real-time insights, and quantum-based sensing for unprecedented measurement accuracy. Additionally, reconfigurable satellite platforms will enhance mission flexibility and sustainability. Investing in these innovations will not only secure Europe's independent access to critical EO capabilities but also position the European industry at the forefront of emerging commercial opportunities.

Advanced data processing

Another trend to be pursued is related to advanced data processing and interconnectivity.

Earth Observation satellites are today incorporating edge computing and inter-satellite communication to improve mission efficiency. Onboard processing allows satellites to analyse images in real-time, transmitting only the most relevant insights rather than raw, and potentially useless, data. On the user segment side, there is a need for enhanced data processing for the identification of relevant or useful information to feed real-time analytics and machine learning models, to automate the classification of remote sensing information, to detect changes over time and to predict environmental trends based on time relevant series.

In addition, first-in-class platforms will play a pivotal role in accelerating the growth of the application market, fostering innovation across various sectors, and boosting the availability of actionable information for decision-making. By enabling more precise, timely, and diverse data, these platforms will unlock new applications in areas such as environmental management, urban planning, agriculture, and security.

Data transfers, inter-satellite links

Inter-satellite links (ISL) and direct-to-device solutions are key to add value to satellite observation systems, opening the possibility to deliver the data and analytics directly to the users, and for the users to directly task the satellites in orbit. Optical high data rate solutions for orbit-to-orbit and orbit-to-Earth are also potential game changers for observation systems, with growing demand across a variety of customer segments (civil institutional commercial, and military). Inter-satellite links allow satellites to communicate directly with each other, relaying data without the need for distributed ground stations across the whole Earth. This contributes to simplify data access for users and customers, and promotes data freshness with a high added value, particularly for time-sensitive applications like disaster monitoring and security surveillance. In particular, relying on ESA programmes (such as HydRON) will provide the required building blocks. Finally, active antennas are a trend, substituting traditional pointing mechanisms.

Security developments

Technological innovations like flexible digital platforms and cloud-based ground segment are generating new vulnerabilities and threats. Consequently, the increase of new services and applications will create a wider array of access point vulnerabilities.

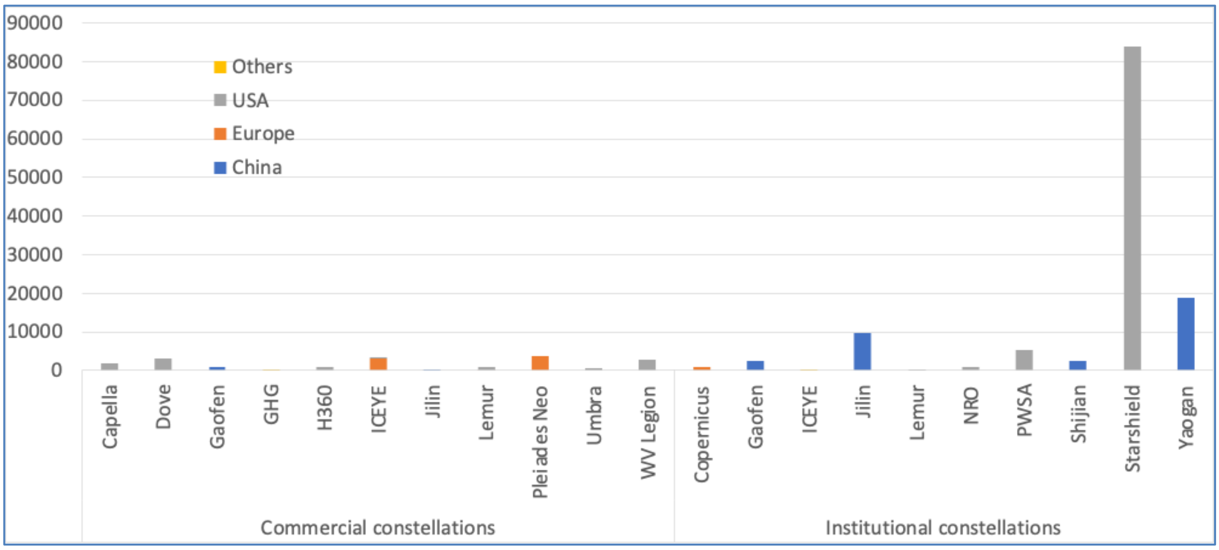
Cyber-security and resilience through the mission and control data chains, from ground to space assets, is a must-have if one wants to bring certainty in missions' continuity, guarantee system resilience whatever the cyber vulnerabilities and compliance with security requirements, regulations and certifications are. In addition, a resilient architecture of ground and space systems which leads to persistent and robust space services, serves as a deterrence factor, especially if it leads to technical advantages that cannot be countered by potential opponents.

It is thus necessary to:

- Protect the ground and space systems from electronic and cyber-attacks (i.e., cyber-electronic warfare) that can happen on ground and in space. Such protection shall be achieved by cooperating and mutually complementing passive capability;
- Protect the ground-to-space command link, space-to-ground telemetry link and any cross-links (ISLs, uplink & downlink) by deploying protected waveforms and, whenever feasible and cost-effective, exploiting optical links;
- On top of the ICT network, protect the industrial supply and development chains from compromise;
- All stakeholders in the value chain, starting with the customer, need to implement secure software development procedures (by collaborating throughout the software development lifecycle to proactively identify and mitigate security risks, but also following security standard and doing security validation and testing), following the principle of security by design;
- Include cybersecurity requirements on-board all satellites to ensure proper detection, recovery, and response to the related intentional (and not-intentional) threats. This is achieved by establishing and applying cybersecurity criteria that relate to the satellite characteristics (including customer(s)) and the consequences (risk likelihood and resulting impact) of a cybersecurity attack. For legacy satellites, due to the high costs and difficulty to update on-board, it is really important to be able to have a realistic view of the attack surface and the obsolescence to manage the risk on a case by case basis;
- Ensure that a space or ground system is not put in service without appropriate plans to ensure operation in security conditions to prevent cyber risk to space or ground asset and ensure resilience of services;
- Ensure appropriate budgeting for cybersecurity (including R&D) and associated maintenance in security conditions in line with the asset cybersecurity scope (i.e., benchmark indicates maintenance of critical operational system is around 10% Capex/year).

The particular case of EO constellations

The number of EO satellite constellations is rapidly growing, with both national and commercial players expanding their fleets. EO constellations are becoming more specialised, targeting applications such as disaster response, climate monitoring, and security.



Mass launched on behalf of main EO smallsat (<1t) and constellations 2010-2024 (source LEAT)

One of the biggest advantages of EO satellite constellations is their ability to provide near-continuous global coverage thanks to reduced revisit times, enabling operational continuity (reducing mission risks), enhanced data series, more data to feed algorithms and ML tools, and more consistent long-term datasets (critical for climate monitoring and scientific research). It is also important to note that constellations can be multipurpose thanks to their configurability. In this frame, cognitive and autonomous platform and payload could significantly improve satellites constellation capabilities.

For industry, constellations based on standard, recurrent designs allow for batch or series production, larger volumes of procurement for components, equipment and sub-assemblies, eventually reducing average satellite manufacturing and integration costs. More importantly, as constellations require frequent replacement/replenishment cycles, **they ensure long-term production cycles and stabilise revenue streams for industry players**.

But if it lowers the financial risk for industry, constellation development means scaling up industrial capabilities. In this respect, the initial phases require heavy cash investment, and the role of ESA to support the industry is key (in part, on a smaller scale, it has been already pursued through the national constellations managed by ESA). The shift towards “Satellite-as-a-Service” (SaaS) and “Data-as-a-Service” (DaaS) models (over direct satellite ownership), where customers pay for insights rather than owning satellites, will also increase the need for large upfront capital investments from the private sector (always bearing in mind that public capital investments remains mandatory for a sustainable Earth Observation market). Furthermore, the sustainability of the mass production capabilities established by the industry must be ensured after the constellation deployment, for example, through constellation replenishment, updates, and expansion.

For the launch sector, **the rise of constellations increases demand for launch services**, creating new business opportunities. It also drives the ground segment in providing crucial support for supporting operational agencies (e.g., EUMETSAT) in the provision of data and support services, as more satellites mean higher data volumes, driving investment in ground stations, cloud storage, and data processing infrastructure.

CM25 will play a key role in shaping the future of the European space sector by fostering innovation and enabling new capabilities, particularly through initiatives such as hybrid constellations, Stepping Stone missions proposed as part of the FutureEO programme and the InCubed programme. Hybrid constellations, combining public and commercial assets, will enhance resilience, data continuity, and responsiveness to emerging needs, ensuring Europe remains at the forefront of Earth Observation. Meanwhile, the InCubed programme will act as a catalyst for innovation, supporting the development of cutting-edge technologies and business models that strengthen the European industry’s position in the evolving EO market.

On a side note, several national EO programmes (from Italy, Greece, Poland, Spain, and Portugal) have been entrusted to ESA by some Member States for implementation. These initiatives have fostered the growth of a space manufacturing and services economy over the past three years, which was not anticipated at the time of CMIN22. At CMIN25, ESA shall foster a synergistic data exchange and operation between these constellations, as well as with Copernicus and other ESA/EC constellations.

3) Increased impact of EO data through an improved role for ESA

The data market/service model has yet to prove its worth, and to demonstrate its capacity to sustain (and pay back) the investment in data acquisition infrastructure. This is mostly due to the underdevelopment of the demand segments, both commercial and institutional. The slow spread of applications and the uneven development of downstream market segments, particularly in EO, are also a concern for the sustainability of the data supply chain, from data provision to storage, distribution and analytics.

Moreover, maybe lacking proper metrics, the downstream segment suffers from the pervasive, and probably wrong, notion that satellite data is underused.

According to our understanding of the EO downstream market today, it seems clear to us that EO data are, worldwide, used predominantly for public services applications while commercial customers represent a smaller, secondary market. Even for pure “commercial” operators in the segment (e.g., Maxar, Airbus Services, Planet, Iceye), demand from public customers (sometimes with anchor tenancy) represents the core of their demand.

Regarding ideas to increase private entities’ data market, **improving data accessibility and commercialisation** (e.g., using tiered pricing model, where basic data remains free while premium, value-added services could be sold) could be an avenue to pursue. As many businesses outside the space sector lack the expertise needed to interpret raw EO data, cloud-based platforms, artificial intelligence, and machine learning can make EO data more accessible by providing pre-analysed insights. Finally, many industries, such as logistics, real estate, insurance and finance underutilise EO data simply because they are unaware of its potential. **Demonstrating the value of EO data through case studies, pilot projects, and targeted outreach can help these industries understand its applications and benefits**. In this regard, ESA can help in the on-board of final users as ESA could be seen as a trustable an impartial entity, helping to speed up the process of transforming EO in a commodity for the non-space industries.

Regarding ideas to support the use of space data and services by national public authorities and taking into account the very fragmented nature of the downstream market, the European space industry recommends investigating further some avenues of thought.

As a first prerequisite, **a comprehensive space industrial strategy at European level is needed**. 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. Space-based data are a key element for independent decision-making, policy and action. Accordingly, these critical capabilities must be consistently sourced in Europe and under the control of European entities. A few space assets should also be owned by Europe and European Member States to ensure the sovereignty and high availability of secured services (with ESA certifying the information, relying on a unique heritage in Europe and with an independent perspective) that can then be complemented by European commercial solutions. An industrial strategy for space shall aim first at tackling the issues of the fragmentation of the demand and of the supply, the dependence on critical technologies and systems, and the drop of profitability throughout industry.

Second, and building on the earlier notion that the data demand segment remains underdeveloped, ESA and the European Commission (for Copernicus) could consider **expanding the current Dynamic Purchasing System (DPS) to the procurement of services**. Copernicus (or any other European EO programme) base services would thus be augmented by commercially-provided data similarly to the current DPS. Adding the EU and ESA as new anchor customers may help the European downstream industry closing the business case for their commercial solutions. With a still fragile and fragmented market demand, the role of ESA as anchor customer remains important, together with the need to make a stronger connection to the market and to future perspective.

Third, **collaboration between industry and science** is crucial for translating scientific discoveries into practical applications, aligning with the EO Science Strategy 2040’s goal of delivering high-quality, actionable information. ESA should promote R&D activities to maximise the benefits of Earth Observation and address specific user needs through joint industry-science collaboration. Both the industrial operational frameworks and support for advanced policy, regulation, and certification must be tackled by defining specific missions tailored to the needs of the European Commission, Member State institutions, and industrial processes. These missions and programmes will serve a dual purpose: on one hand, they will help develop services and prepare the industry for operational implementation; on the other, they will demonstrate their value to decision-makers.

4) Increased cost-efficiency through improved procurement approaches

As industry has matured in its capabilities (i.e., products and missions), it **appreciates the growing flexibility shown already by ESA in procurement and management of space and ground segments system design and development**. Tools such as full-consortium procurements have shown their strengths to accelerate programme development. Building on this, **higher delegation by ESA of the contract execution** (after a "freezing" of the mission definition and requirements) would be welcomed, linked to a shared division of risks between ESA and Industry.

Furthermore, the schedule and cost benefits of allowing industry to optimise its planning, resources and facilities across manufacturing runs of several identical satellites could be very important, provided that a continuity in the funding and procurement scheme and more flexibility in the geographical distribution can be envisaged. **Such a longer-term stability would ensure a more stable base for the whole European supply chain, allowing industry to deliver high performance, innovative and inclusive technological developments**.

While it did help overcoming important institutional constraints, industry notes that the (although smart) parallel procurement of several missions (e.g., for Copernicus) was challenging, mostly linked to its complexity and length. Nonetheless, it showed, reassuringly, that it is possible to combine procurement approaches satisfying at the same time the expectations from Member States in an ESA framework and the ones of the EU; and the creativity of the institutions to overcome the existing constraints was greatly appreciated.

Looking ahead and to further improve the balanced participation of smaller entities[2], strategies to **remove the barriers** (financial, administrative…) that are preventing their participation will help to enrich the proposed consortia with relevant new players, tailoring and qualifying their technologies for space environment.

Finally, a certain lack of stability of the public funding needs to be addressed as it creates more industrial risks and a more complex procurement scheme, leading to otherwise unnecessary milestones rather than reflecting the long-term commitment of the institutional customers. **A longer-term funding stability would ensure a more stable base for the whole European supply chain**, required to deliver the high performance, innovative and inclusive technological developments that Europe demands. It would also ensure a decrease of industrial costs thanks to an optimised manufacturing, assembly, integration and test approach.

Service procurement (with, or without, anchor tenancy) instead of infrastructure ownership is gaining traction for the provision of space data and services. In this scenario, the definition of service level agreements (SLAs) and high-level service requirements (including considering risks or liabilities within those service levels) should be the focus, rather than providing detailed specification of the system design perspective. This is true across the value chain – launch, data/service delivery, and product development. With respect to services, industry needs a sufficient level of service continuity and committed business volume to guarantee investment in new applications.

A progressive shift towards procurements for operational (or pre-operational) services could be applicable for instance for activities with a certain predictability of commercial success. Anchor tenancy is considered an interesting approach to financially de-risk investment and development, and lead the way to operational

[2] Looking ahead, industry considers that if procurement policies are put in place with the aim to secure the involvement of different company typologies (namely Large Space Integrators - LSIs, subsidiaries of LSIs, independent midcaps, SMEs), with target business shares, then they should be as consistent as possible with the respective weight of these segments in the European space sector business and employment.

services. There will however still remain a need for public support for future development/riskier technological acquisition and for strategic programmes. Institutional partners keep a critical role in this regard.

Continuity of programmes is however key: it is very doubtful that one can switch from one extreme (fully funded R&D and initial infrastructure deployment by public sector) to the other (full anchor customer procurement of services when there is commercial potential) right away in one go. Transition periods must be considered and support for infrastructures funding needed since not all companies are ready to shift their business models overnight in response to this potential paradigm shift. One key problem is for ESA to create the conditions for ensuring the geo-return when it is not having design authority on the infrastructure providing the service.

Regarding technology developments for EO within ESA programmes and future needs, it would be beneficial to **increase visibility for the European space sector**. This would allow for more strategic planning with clear information on what is needed and who is responsible for what.

The particular case of standardisation and interoperability

The European space industry is increasingly advocating for standardised satellite platforms rather than custom-built solutions for each mission. This shift is driven by several factors:

- Cost reduction: developing custom satellites for every mission is expensive and time-consuming. Standardised platforms can lower costs by enabling economies of scale and avoiding multiple non-recurring activities which can be limited to satellite missionisation and delta-qualification;
- Faster deployment: a standard satellite platform allows companies to integrate different payloads quickly, reducing mission lead times;
- Consolidated supply chain: standard platforms make use of reliable and consolidated suppliers which in turn can grow up in terms of series production and thus ensure delivery and lower costs;
- Interoperability and flexibility: standardisation of equipment and interfaces simplifies system design and integration, and could enable different payload providers and operators to share the same platform, facilitating multi-mission capabilities. Further standardisation, for data transfer, or inter-satellite links, would accelerate the take up of shared ground segment approaches, and create more value from assets in orbit (e.g., multi-sensor, shared data relays);
- Modular design approach: a modular approach for platform subsystems and key functions allows for easy upgrades without requiring a full redesign.

In the space domain, **ensuring interoperability is paramount** for mission success, operational efficiency, risk mitigation, adaptability, and international collaboration. Interoperability is a mean to ensure that different systems and components can communicate seamlessly and securely, allowing for effective coordination and operation.

Interoperability must be integrated from the outset of any system's design. This is particularly critical in the rapidly evolving landscape of technology where seamless communication between diverse systems is paramount. By integrating interoperability considerations into the initial system design, industry will be able to build robust and future-proof solutions that seamlessly interface with existing and emerging technologies.

Finally, a standard platform approach for different satellite classes (i.e., small, medium, large) is very attractive and beneficial for an important cost, risks and schedule reduction in the missions' deployment. Nevertheless, this should imply an optimisation of the current instrument approach; already at the preparatory phase, ESA shall put some constraints on payload solution definition in order to grant compatibility with common platform(s).

5) Increased ESA added-value through improved relationship with industry

In its effort to increase ESA's value for citizens and society and pave the way for a long-term ambition for Europe in space, ESA Agenda 2025[3] outlines five specific priorities with clear targets for 2025. The last one, "*complete the ESA transformation*" is all the more important that it directly impacts the European space industry's ability to be competitive.

To achieve competitiveness, balanced risk management, strong supply chain and good financial industry health are pre-requisites that do not need to be neglected by ESA at a time where proposal costs are eroding a good portion of the possible Gross Margin of industry (that is becoming thinner and thinner in several programmes).

Accelerating time to contract, reducing the number of procurement constraints that make proposal preparation extremely expensive will allow industry to offer high-quality and innovative products in a cost-effective manner, while putting less pressure on an already-low profitability in an ESA context. The digitalisation of ESA processes, at all stages of the procurement process, will be a key support to this endeavour.

Profit is used for self-investment and innovation, which paves the way for the future of industry. Hence, the European space industry sees profitability as a prerequisite to sustainability and an important contributor to one of the major objectives of ESA, which is to increase the competitiveness of the European space industry on the international market. In a context where little or no profit will force industry to reduce investments levels in a highly demanding business, cause some companies to go bankrupt with very significant impact on programmes, or prevent new actors to enrich the European space industry due to lack of attractiveness, streamlining industry's ability to be more agile and cost-effective in an ESA context is an urgent necessity.

Against the soaring of the costs of proposals in an inflationary context that are further eating low profitability margins, the European space industry recently shared its eight steps[4] of an agile and cost-effective ESA procurement process. This includes, in particular:

- Simplification of tender, including:
  - Better scheduling of Invitations to Tender (ITTs) to avoid delays, workload peaks, and inconvenient publication periods;
  - Faster clarifications to optimise response times;
  - Earlier and more equitable dissemination of information on opportunities and procurement rules, including interactive industry days:
    - As a best in class example, for LEO-PNT IOD, ESA organised a physical industry day that allowed many interactions between industry and ESA. Such transparency and discussions, several weeks before publication, allowed solid and balanced consortia to be built.
  - Right-sizing documentation requirements based on the added value at each ITT stage;
  - Full and fair ESA funding of phases 0/A/B to support concept maturation;
  - Streamline of ITT reviews reducing process complexity based on Technology Readiness Level (TRL), and granting more delegation to industry;
  - Simplify required prices scheme to be, in principle, based on FPV at the actual proposal time economic conditions.

- Flexible handling of the risks across complex programmes:

[3] *https://esamultimedia.esa.int/docs/ESA_Agenda_2025_final.pdf*
[4] *More details are available in the Eurospace Position Paper "Streamlining industry's ability to be more agile and competitive in an ESA context", published in 2024 here.*

- The Class C mechanism[5] used for Copernicus and Earth Observation Programmes shall remain, and must be made more dynamic;
- Shared-risk approach for technologies with a below 6 TRL;
- Manufacturing risks to be identified and negotiated with ESA;
- Streamlined procurement system for low-risk items.

- Improve supply chain resilience:
  - Strong need to increase supplier's industrial maturity;
  - Dedicated funding is necessary to support suppliers to invest in tools & means (e.g., digitalisation, modernisation of their manufacturing infrastructure);
  - Better define and implement in the ITT draft contract co-prime scheme which can be also beneficial for the reduction of allocated management reserve;
  - Promoting double source of equipment/assemblies to incentive competition and allow entry of newcomers in already mature technologies (if budget allows).

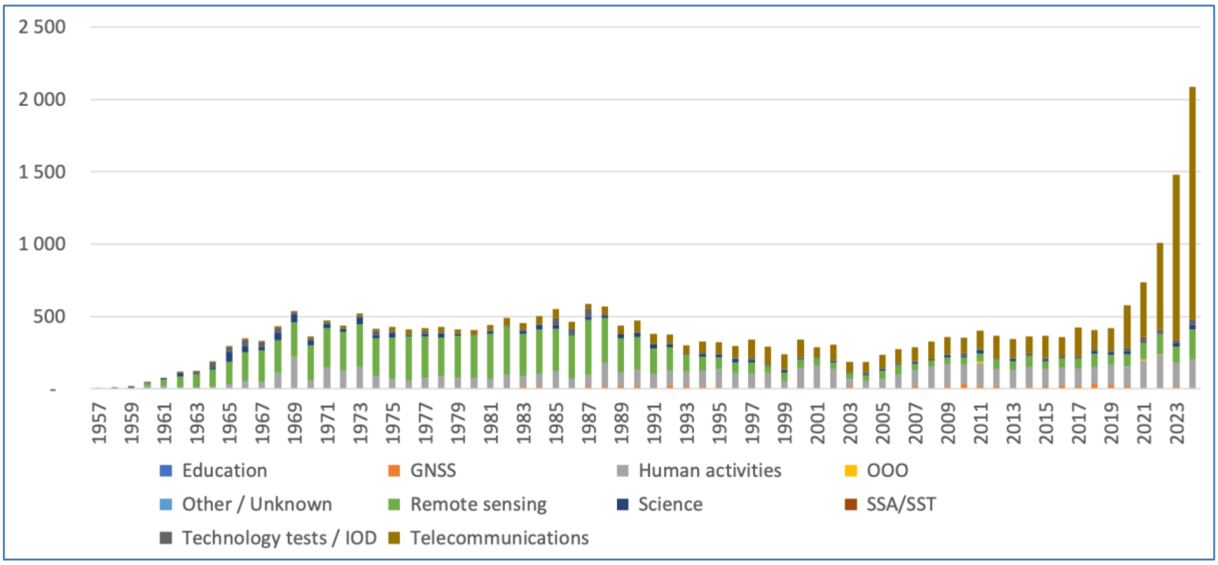
- Speeding and simplifying time to contract:
  - More and more companies are fully digital and manage their contracting process accordingly. This limits administrative efforts and allows for a focus on the key elements;
  - In recent years, ESA has also taken good steps to simplify contracts and digitalise the contracting process for certain funding lines;
  - The European space industry fully supports this trend and encourages further enhanced approaches as a standard across all ESA programmes.

[5] *i.e., ESA/Industry risk sharing mechanism excluding contractually a set of pre-identified techno or manufacturing risks which if occurred, consequences thereof will be financed by ESA.*

Annex – The Earth Observation space infrastructure landscape

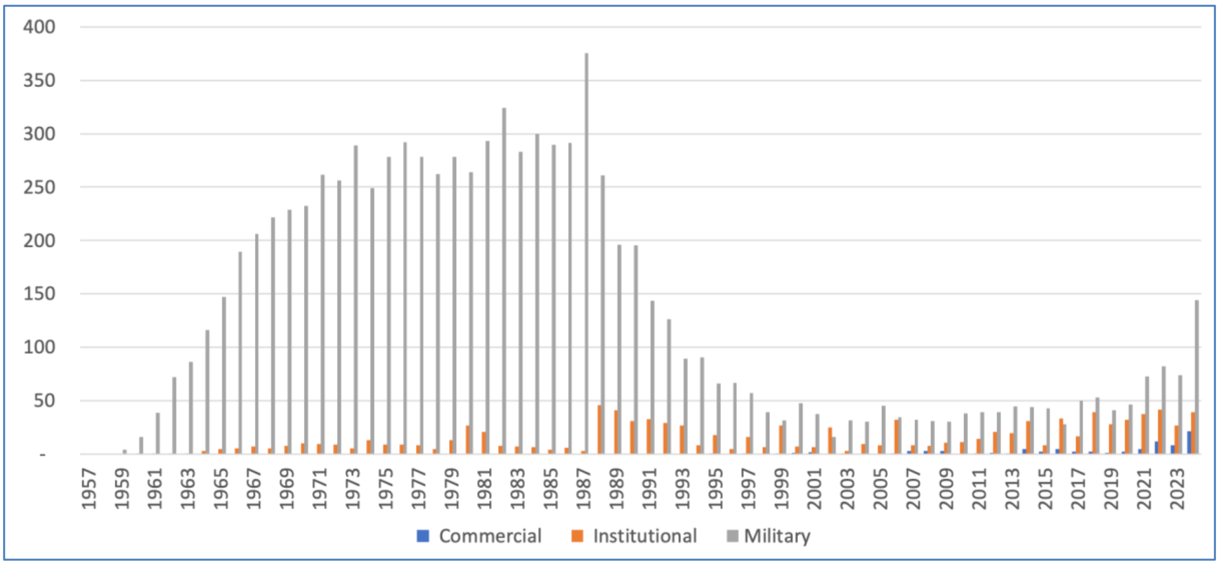
The following Annex is using data from Eurospace Launch Event Analysis Tool (LEAT), Eurospace's database of each spacecraft that has ever been launched to orbit since 1957.

Earth Observation was the leading satellite application until the 1990s. It has been progressively displaced by TLC (Broadband) and Human programmes. Since the start of the space age, mass of remote sensing spacecraft launch represents 36.5% of total mass output.

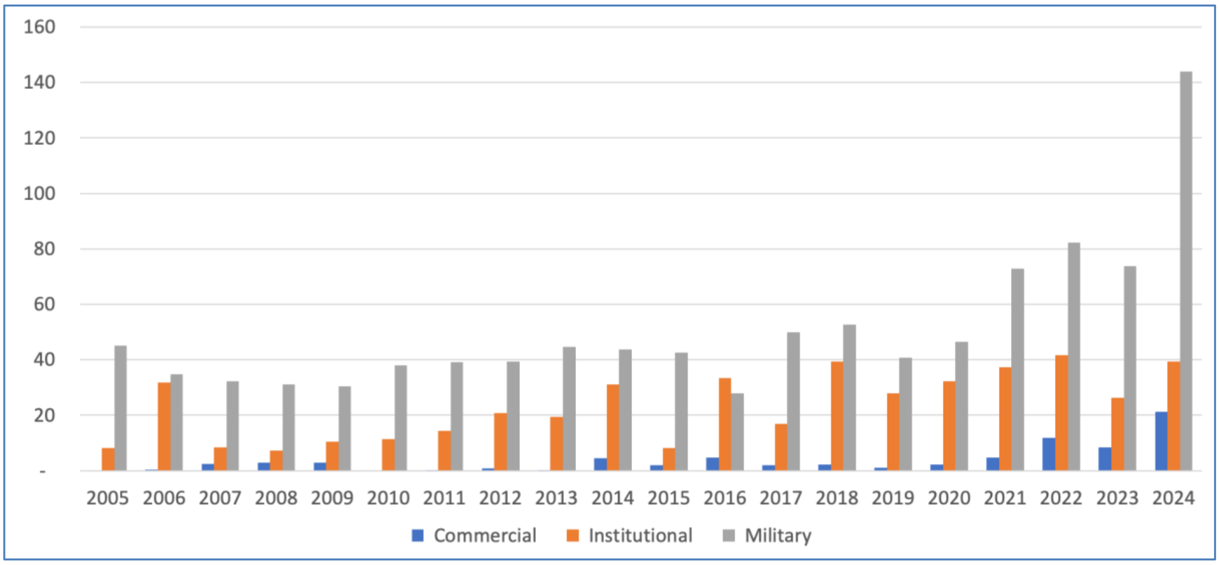


Spacecraft Mass (tons) launched by activity

Earth Observation systems customers are predominantly institutional actors (9966 tons versus 78 tons for commercial). More than that, they are predominantly military institutions (with a total of 8962 tons). This was especially true until the early 1990s before a period of decrease). With the current geopolitical context, military EO is increasing again (as seen in second graph below).

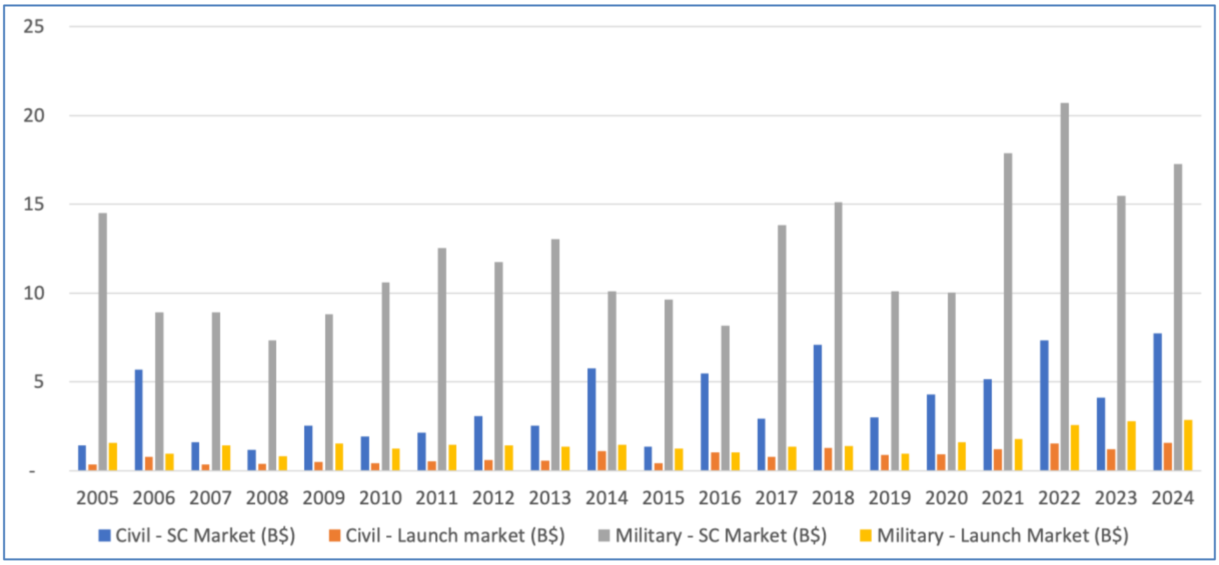


Spacecraft Mass (tons) launched by customer



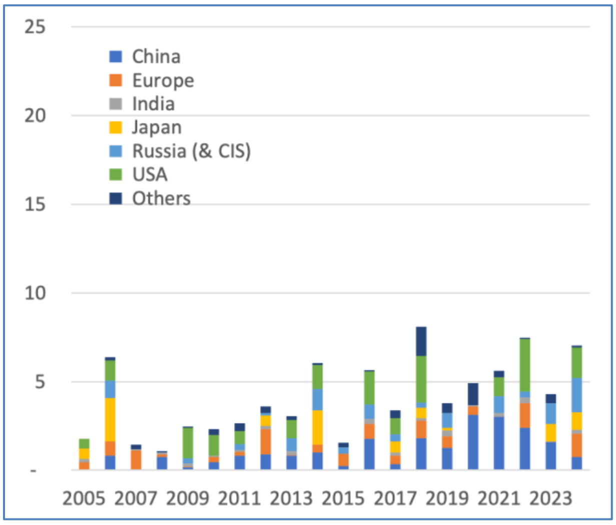
Spacecraft Mass (tons) launched by customer (last 20 years)

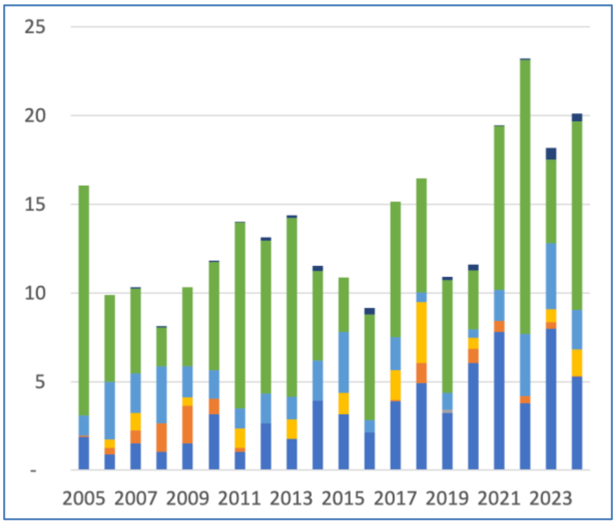
The military spacecraft market segment is the most attractive of all EO segments: largest satellites, massive budgets, exquisite technology. The average yearly EO spacecraft market is valued at 12.2B$/year (military) and 3.8B$/year (civil). The average yearly EO launch market is valued at 1.5B$/year and 0.8B$/year.



EO infrastructure and launch market (B$) by customer

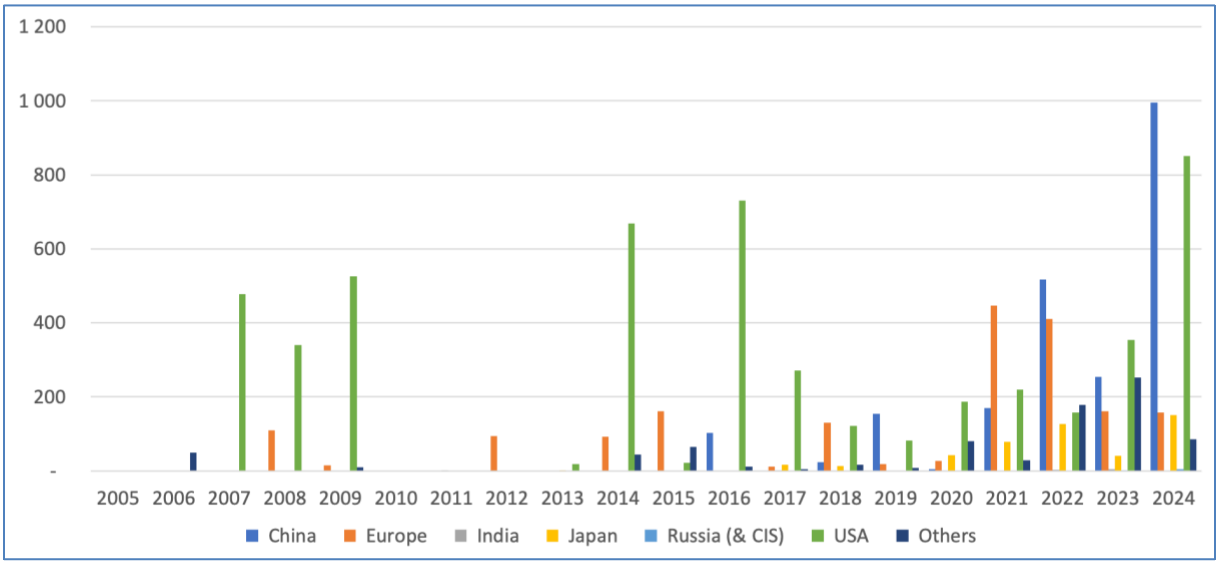
US and China programmes dominate the institutional EO landscape in both military and civil domains as seen in the graph below. Total Institutional civil: China = 26.7%, USA = 22.9%, Europe = 14.3%, Russia = 13.1%, Japan = 10.7%. Total Institutional military: USA = 51.8%, China = 24.6%, Russia = 14.1%, Japan = 4.8%, Europe = 3.4%





Institutional EO markets by customer region (B$) – left civil, right, military

Commercial EO is a very small niche market segment and its largest component is fuelled by PPP with military anchor customers. Historically, USA is the largest provider of commercial EO system (USA: 48.3%, China: 21.4%, Europe: 17.6%, Others: 8%, Japan: 4.5%)



EO markets M$ – supplier region