SPACE GOVERNANCE AMID EMERGING TECHNOLOGICAL CHALLENGES

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FROM SOVEREIGNTY TO TECHNOLOGICAL GOVERNANCE: SPACE AS A HYBRID STRATEGIC FIELD

In June 2025, during the Paris Air Show, the French Ministry of Economy announced a major investment in *Eutelsat*, acquiring 29% of the company's shares[1]. Incorporating, among others, its subsidiary *OneWeb*, *Eutelsat* is developing a European constellation of satellites dedicated to telecommunications in low and geostationary orbits, particularly military telecommunications, and is aiming to be a European alternative to *Starlink* (US). This new public investment is the result of a special partnership between the state and subcontractors working to develop the country's strategic capabilities. This interdependence between public and private interests in a sensitive sector implies a hybrid mode of governance.

Generally speaking, the concept of "space governance", pertaining to outer space, refers to the way in which actors–both public and private–invest in, organize, and regulate their activities beyond the Earth's atmosphere. This governance is based on technology, its use, and the standards it generates. It is essential to any activity in the space domain and follows a legal framework built on international treaties, the 1967 Outer Space Treaty being the most important one[2].

Recent technological developments in the domain benefit from a grey area in the regulation that various actors may seek to exploit. As a result, space, like the cyber domain, the information environment, and electromagnetic fields, is both a place and a means through which states can decisively exercise their operational superiority.

International governance[3], particularly in the space domain, has experienced fluctuating political enthusiasm in recent times. Initially stalled by the onset of the Cold War, space governance took advantage of the period of "*Détente*" during the 1960s and 1970s to establish the main regulatory frameworks that still shape space activities today. With the Soviet Union's collapse in 1991, the paralysis of the international system came to an end–as evidenced by the renewed activity of the United Nations Security Council–ushering in a new golden age for space governance.

Military international relations were not spared by this renewed interest in governance. Absent from the French Army's strategic "*Livres Blancs*" (White Papers) of 1972 and 1994, it made its first appearance in the 2008 edition before becoming a recurring theme in subsequent editions. While governance addresses new fields of contemporary conflict, it manifests itself through particular modalities depending on the domain or field considered.

More independently, every state organization now seeks to adapt its positioning in critical areas according to its needs and strategy. This positioning is achieved through a combination of sovereign means, international partnerships or acquired from private companies. In this respect, space governance stands out as an interesting case study where

the resources and strategic objectives of states, international organizations, and private companies intersect.

Once centered around the US-USSR duo, space governance has increasingly followed an oligopolistic and transnational logic, driven by the combined effect of the proliferation of technical capacity and the emergence and democratization of space services at the turn of the 2000s. The factors driving this transformation illustrate the significant influence of technical and technological considerations in shaping exo-atmospheric governance. At the same time, these considerations raise a number of issues at both international and regional levels and prompt states to question the sustainability of their own governance models.

1. FROM A BINARY TO OLIGOPOLISTIC ORDER: CHANGES IN SPACE GOVERNANCE

a. The Cold War duopoly: orbital power and normative monopoly

Space governance during the Cold War appears to have been intrinsically multipolar. In 1959, the UN created a "Space" Committee with the ambition of promoting peaceful uses of space[4]. This body is responsible for overseeing compliance with the main treaties regulating how states explore and use the extra-atmospheric domain. These texts confirm the *res communis* nature of space[5] and affirm that humanity, as a whole, should work towards its proper governance in the interest of the common good. At the same time, several countries began developing their own national capacities.

Although space governance is legally established as multipolar, it remained dominated by the American-Soviet duopoly throughout the Cold War for obvious strategic reasons. The omnipotence of Moscow and Washington is illustrated by their near monopoly on launch capabilities, which gave them considerable influence over the definition of space governance rules. This duopoly was behind major international treaties relating to outer space and the limitations placed on its militarization. Ultimately, space governance appears to be determined by the evolution of their military, technical, and technological balance of power.

b. Towards a multipolar and functional governance in response to the emergence of "space services"

The influence exerted by the American-Soviet duopoly on space governance waned with the end of the Cold War and the emergence of new actors. This seems to be the case, for instance, with India, Japan, and above all China, whose stated ambition is to become the world's leading space power by 2045.

Other traditional actors in space governance, active since the early days of human exploration in the domain, continue to have outstanding authority in the field. The Committee

on the Peaceful Uses of Outer Space (COPUOS) exerts influence or, at the very least, provides an undeniable framework for international space diplomacy. Similarly, some space services are supervised by agencies or joint international organizations in some specific areas. For example, the International Telecommunication Union (ITU), established in 1856, has taken up the issue of radio frequency allocation, notably for space communication tools. Additionally, NORAD (North American Aerospace Defense Command), a supranational agency in North America created in 1957, carries out aerospace monitoring and warning missions in cooperation with other space power's systems. These latter entities are responsible for ensuring the safety of the International Space Station (ISS).

Multinational institutions are also working to join their efforts in the space sector. For instance, the European Union (EU) established the Satellite Center (SatCen) in Torrejon de Ardoz to exploit data from the various space capabilities of its member states, in an effort to pool resources and expertise. On the African continent, the African Space Agency–under the jurisdiction of the African Union–promotes cooperation among states while also enabling a better representation of the continent's interests on the international stage.

At present, the democratization of access to space and the use of associated services may seem to embody the distinctly multipolar nature of space governance. This multipolarity applies to access to space services. However, the ability to provide such services seems to remain, in practice, oligopolistic, limited to a subset of stakeholders.

Indeed, at the state level, nearly a dozen countries now have sufficient technical and technological expertise to build, launch, deploy, and operate their own satellites. States that have not yet acquired this capacity can call on "traditional" space powers' launch capabilities or take advantage of the growing number of "space services" offered by private actors. The latter option is particularly popular today and is breaking down the monopolies once held by few powers.

Without launchers or spaceports, countries such as Argentina and the United Arab Emirates now operate dozens of satellites and can thus claim greater legitimacy in international debates. This is also the case for African countries. While only a fraction of them possesses their own satellites, others opt to subscribe to private services to compensate for their limited social and economic capital. Moreover, their coordination efforts within the framework of the African Space Agency bolster their political influence in governance forums.

At the same time, states' growing interest for space services increases the influence of private actors within space-governance mechanisms. The way some public actors are fighting each other over frequency allocation at the ITU Space Services Department reflects the interests of private companies involved in low-orbit mega-constellation projects. There is no doubt that the deployments of *Starlink* (Elon Musk) or *Kuiper* (Jeff Bezos) now have a significant impact on space governance.

c. Spatialization: a governance challenge in its own right

The multipolarization of exo-atmospheric governance practices reflects not only the global emergence and adoption of space services but also the "spatialization" of human activity and contemporary societies. For instance, a French citizen uses on average nearly 40 satellites a day. This reliance is even more pronounced among military personnel, which are, in most cases, the primary users of such tools.

The growing relevance of space technologies in everyday life reinforces the strategic nature of the domain. Once perceived as auxiliary, space assets and services have now become essential prerequisites for the effective functioning of organizations and for achieving operational superiority in conflicts. Even a momentary interruption in access to these services can have considerable effects, as illustrated by the (deliberate) interruptions of *Starlink* over parts of the Ukrainian territory in the Summer of 2025.

This increasing dependence on space technologies therefore translates into a key governance issue, encouraging stakeholders to raise and address the topic in international fora[6].

2. THE SPATIALIZATION OF THE WORLD: GOVERNANCE, DEPENDENCE, AND CONFLICT

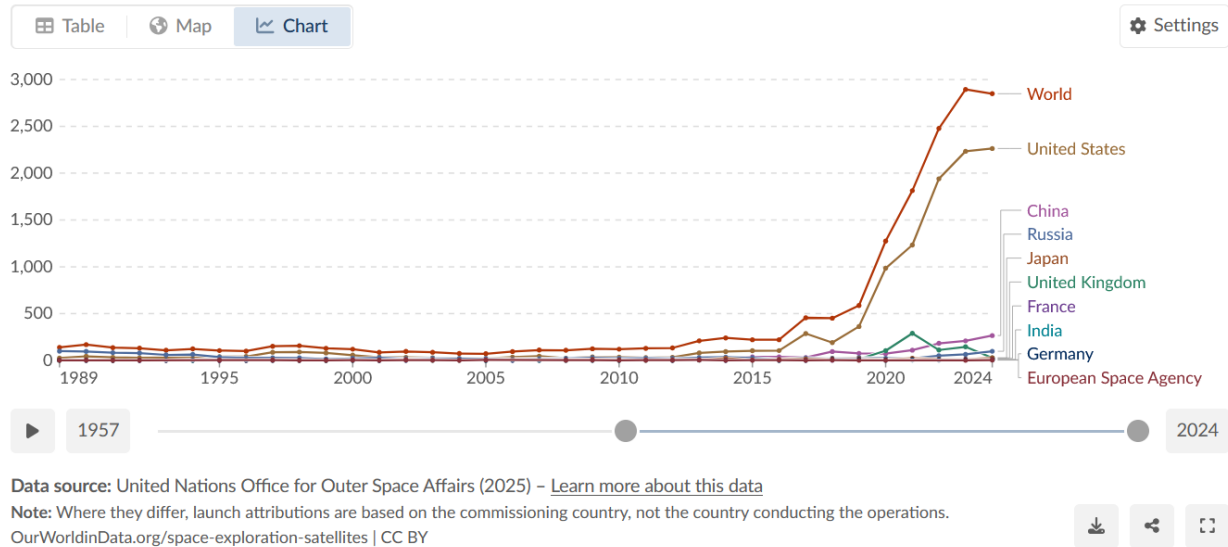### a. "Territorialization," orbital congestion, and challenges to legal foundations

Improvements in launch technologies and payload miniaturization techniques have fostered the emergence of low Earth orbit nanosatellite constellations. For instance, the American company *Starlink* currently operates 6,300 satellites and is aiming to increase this number to 42,000 in the long run. Meanwhile, the French operator *Eutelsat* is working on an architecture of approximately 600 satellites. Not missing out on this strategic trend, China is also preparing to deploy its own constellation–named "*Guowang*" ("*national network*")–which is expected to include nearly 13,000 units. All these actors establish the efficiency and availability of their services on the redundancy and concentration of their orbital capabilities.

However, the exponential growth in the number of launches and deployments is causing congestion in low Earth orbits (between 400 and 2 000 km). This tendency is increasingly akin to a phenomenon of "territorialization.[7]" A similar observation can also be made for the geostationary orbit, where positions are limited and highly sought after by states[8].

Annual number of objects launched into space
This includes satellites, probes, landers, crewed spacecrafts, and space station flight elements launched into Earth orbit or beyond.

Data source: United Nations Office for Outer Space Affairs (2025) – Learn more about this data
Note: Where they differ, launch attributions are based on the commissioning country, not the country conducting the operations.
OurWorldinData.org/space-exploration-satellites | CC BY

This trend thus constitutes a challenge to the principle of "non-appropriation," which has underpinned exo-atmospheric governance since the 1970s and served as a basis for the elaboration of the main Space law treaties. Orbital congestion also increases the risk of incidents and debris. Their proliferation could render certain orbits unusable and, according to some worst-case scenarios[9], disrupt access to space, which would contravene the principles of free use and exploitation of the domain enshrined in the legal framework established during the Cold War.

In addition, orbital congestion is likely to increase as some states seek to assert themselves as space powers. This is the case of several "Global South" countries, some of which having openly expressed their long-term intention to challenge the dominance of traditional space powers. Emblematic of this posture is Rwanda, which has requested a frequency allocation for a constellation project called *Cinnamon-937,* projected to gather 337,320 satellites[10].

b. International law lagging behind: rapid technological progress, normative inertia, and strategic circumvention

These blind spots outline the legal issues the current space governance model must grapple with. The five major treaties governing exo-atmospheric activities were concluded between 1967 and 1979 and reflect the strategic and technological particularities of their time[11]. Their provisions could not have anticipated the upheavals that this environment would undergo because of technological progress.

Several actors deliberately exploit the legal grey areas or the absence of established norms to strengthen their positions or gain a strategic advantage. The militarization of space–called against but not strictly forbidden by the treaties–is coupled in several countries with a

process of weaponization that pushes the boundaries of the rules of law[12]. The most widely publicized cases involve Russia and China. For instance, Moscow and Beijing could be working on developing strategic "orbital" weapons systems–also known as Fractional Orbital Bombardment System–that would circumvent the ban on placing weapons of mass destruction in orbit (Article 4 of the 1967 Outer Space Treaty)[13].

States are not the only ones benefiting from the outdated nature of space law. Companies benefit from it even more, as Cold War treaties largely underestimated their current roles of space powers in their own right. Beyond the question of compatibility between public and private international law, the economic competitiveness of private actors is driving new interpretations of space governance regulations–some of which are at odds with the principles currently in force[14]. For example, by seeking to deploy a constellation of 42,000 satellites in Low Earth Orbit, *Starlink* contributes to frequency congestion, which other actors may perceive as an encroachment on the freedom of exploration and use of outer space–a cardinal principle of the 1967 Treaty.

c. The example of sanctions: national law as a palliative for the shortcomings of international governance

Space actors nevertheless have a few binding legal levers at their disposal to constrain the production and economic activities of those seeking to aggressively exploit governance weaknesses. Sanctions imposed by one or more states can serve as effective tools to disrupt the operations of another country's aerospace industrial and technological complex.

Following initial sanctions in response to Russia's annexation of Crimea in 2014, the invasion of Ukraine in February 2022 prompted the United States–along with several of its European partners–to increase pressure on the Russian industrial ecosystem in order to restrict its supply of rare-earths elements, electronic components, and semiconductors. Although Moscow is deploying circumvention strategies to mitigate the effect of these measures, they nevertheless come at a significant financial and economic cost[15].

3. FRAGMENTATION PUTTING THE GLOBAL SPACE SYSTEM TO THE TEST: EUROPE AND THE REQUIREMENTS OF TECHNO-STRATEGIC GOVERNANCE

a. The need for greater European cooperation in a context dominated by the United States…

The international space market remains overwhelmingly dominated by American companies. They provide the majority of space services and still hold a competitive edge in several sectors. As of today, *SpaceX* and *Rocket Lab* are the only companies to have mastered reusable launch technology.

The appeal of American solutions raises questions about the actual state of space governance at the European level. It encompasses an institutional reality–embodied by the European Space Agency (ESA), established in 1975–and several concrete achievements: the *Vega* and *Ariane* launchers, the *Galileo* global navigation satellite system (GNSS) program, and the shared SatCent in Spain. The EU is formulating a structured "space policy" designed to reinforce governance frameworks in the domains of security and defense across its member states[16].

Similarly, for several years now, the European space governance also took the New Space turn and is increasingly opting for private-sector companies–Airbus Defence & Space, Thales Alenia Space, Leonardo...[17]–to successfully carry out its various programs. Finally, ESA is adopting a governance model quite similar to that of NASA, while adapting it to its own political, economic or military realities.

b. …adapting to an oligopolistic system favored by BRICS and other emerging countries

The ubiquity of space services and the diversification of off-the-shelf solutions are encouraging countries without national space capabilities to turn to different actors and to select the offer best suited to their needs. This trend marks a departure from a more traditional "partner of reference" model, which featured a certain consistency in partnerships and international cooperation, with countries selecting their foreign "supplier of choice"–generally based on geopolitical alliances–and sticking with it. Today, partnerships and cooperation in the field of space services are increasingly diversified, often going to the highest bidder or to the service most tailored to the specific needs of states and companies.

This poses a significant challenge for traditional powers, which must ensure the competitiveness of their applications compared to solutions from other state actors and assert their position within this oligopolistic landscape, lest they lose markets once secured through historical or exclusive diplomatic ties. Moreover, states are nowadays also competing with private actors. Beyond satellites and launchers, the state's comparative advantage in the allocation of launch sites is gradually challenged by the ability of certain private stakeholders to rent shooting ranges at unbeatable costs. This was, for example, the case of *SeaLaunch*, a private company that operated a sea-based launch platform until 2014. Today, the American company *SpinLaunch* claims to be able to put satellites into orbit using an electromagnetic catapult, which would not only eliminate the need for a launch site but also (partially) for a launcher[18].

c. Between shared ambitions and competing sovereignties, should European cooperation follow the French model?

Despite concrete progress, European space governance remains fragmented. It encompasses a mix of national aspirations and a multi-tiered structure of bilateral and

multilateral cooperation evolving at varying speeds. The slow pace of EU programs also clashes with the urgency of needs and the attractiveness of readily available external solutions.

The clearest example of this is the IRIS² program, which aims to deploy a connectivity constellation in orbit (300 satellites) and is expected to become operational around 2030. Despite this shared ambition and the existence of European connectivity services (such as France's *Eutelsat*), the urgency of crises or threats to their interests is leading some states to favor non-European–most often American–solutions. Paradoxically, this is the case for France, which, faced with the need to restore connectivity in Mayotte after Cyclone Chido struck in the winter of 2024, dispatched 200 *Starlink* terminals to restore essential communications[19].

Material and technical aspects play a fundamental role in shaping how space governance is conceived. The maturation of so-called "disruptive" technologies–nuclear propulsion, quantum communication, artificial intelligence, lasers…[20]–will have a considerable impact on how space actors approach governance at the national, regional, and global levels. To that regard, the IRIS² program serves as a good example since it transcends these geographical levels, combines commercial (*Eutelsat*) and state (European Space Agency) interests, and makes it possible to explore potential opportunities offered by disruptive technology (quantum communications) for space activities.

A space power since the 1960s, France wishes to maintain its position and influence in the governance of a domain it considers essential to the defense of its interests and to international stability. For France, remaining a leading player means maintaining a balanced "space model" that combines its ambition to be a driving force in governance with the reality of its resources. To this end, the country has developed a virtuous model in three concentric circles–patrimonial capabilities, shared capabilities and those acquired from private actors[21]–which enables it to meet its autonomy needs, to contribute to European governance, and benefit from a diversified and secure supply of space services.

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CONCLUSION

Contemporary space governance has become one of the clearest markers of the ever evolving technopolitical reconfiguration of the world. The rapid expansion of space capabilities–both public and private–is redefining strategic balances, power dynamics, and normative frameworks related to access, use, and control of outer space.

From its origins in the bipolar model of the Cold War, space governance is now evolving toward a system that is multipolar in terms of access, but deeply oligopolistic (both publicly and privately) in the provision of the most critical services. This shift further illustrates a twofold movement: on the one hand, an increasing "spatialization" of all human activities, making societies and armed forces structurally dependent; on the other hand, a *de facto* "territorialization" of several orbits, at odds with the historical principles of non-appropriation.

The challenges stemming from this transformation are exacerbated by the slowness of international legal frameworks, which are powerless in the face of rapid technological progress and the agility of private actors. Europe and France in particular, are grappling with a double injunction: maintaining their technological sovereignty while navigating internal fragmentation, the US domination in space services, and the emergence of new technological hubs (BRICS, Japan, the Gulf and Africa).

In this context, several recommendations emerge: rethinking dependency indicators, initiating an early review of treaties, reinforcing intra-European preferences, adapting national models to a rapidly evolving techno-economic environment, clarifying the governance model and dependencies of international space agencies and, finally, facilitating reciprocal knowledge between service providers and their users.

These six concrete levers for strengthening the robustness of space governance amid technological shifts, geopolitical fragmentation, and the rise of private actors reflect solely the views of their authors, and in no way those of their affiliated institutions or academic bodies.

1 – Raise awareness of the vulnerabilities created by space dependencies. As reaffirmed by the new French *National Space Strategy*, the unavailability of space tools is a negative-sum game[22]. Space program specifications must incorporate this risk factor as an objective in its own right and include measures to guard against it.

2 – Initiate a major international debate on updating the rules of space governance (UN or ad hoc). These discussions should involve both traditional and new space powers as well as private actors and adopt a resolutely forward-looking approach. Anticipating trends and possible disruptions brought by the arrival of new technologies (laser, nuclear propulsion, etc.) will make new space governance rules more robust and sustainable.

3 – For Europe, focus efforts on developing a common strategic vision among space powers and promote the choice of European services, for member countries to design, finance, and use. Europe can first seek to boost its internal market by offering a diversified range of solutions at the regional level, before aiming to integrate its applications into the geo-economic and globalized landscape of space services.

4 – Space applications and exploration programs of European space powers must hold their own in the international oligopoly. As such, they can serve as credible alternatives to current suppliers, despite a strong US dominance.

5 – Consider the relevance of building the governance model for international space agencies along the lines of the "concentric circles" approach. European strategic autonomy in the space domain could be structured around capabilities financed by the European Space Agency, others developed and operated in partnership with other regional space agencies (African Space Agency, Asia-Pacific Space Cooperation Organization, etc.), and contracts with private suppliers to help refine the balance of the governance model.

6 – Develop a clear doctrine of use of New Space at the regional level in order to coordinate supply and demand by clarifying expectations between suppliers and users. The French «Space Pact», launched in October 2025, whose aim is precisely to improve mutual knowledge between military needs and industrial supply, could inspire this effort.

[1] « Eutelsat, concurrent européen de Starlink, prépare une augmentation de capital qui fera de l'État français son premier actionnaire », *Le Monde* with AFP, 19/06/2025.

[2] Also known as « Treaty on principles governing the activities of States in the exploration and use of outer space, including the moon and other celestial bodies» which came into effect in October 1967. It was followed by several other key texts such as the « Agreement on the rescue of astronauts, the return of astronauts and the return of objects launched into outer space » (1968), the « Convention on the international liability for damage caused by space objects » (1972) or the « Convention on registration of objects launched into outer space » (1975).

[3] The notion of "governance" emerged in the late 1970s in an entrepreneurial context. It has since gradually expanded its scope and now encompasses, among other things, the study of the mechanisms—both formal and informal—that regulate international relations. For a definitional approach, see « La gouvernance – Sélection bibliographique », *École Nationale d'Administration*, 2021, p.15.

[4] Also known as the « *Committee on the Peaceful Uses of Outer Space* » (COPUOS).

[5] In public international law, "the common good" refers to property that cannot be exclusively appropriated and remains accessible for use by all.

[6] « Quatrième Commission : la dépendance « critique » de l'humanité aux systèmes spatiaux requiert une gouvernance mondiale de l'espace renforcée », *United Nations*, CPSD/788, 24/10/2023.

[7] HAINAUT Béatrice, « La course à la commercialisation de l'espace », *Annuaire français de relations internationales*, 2023, pp. 823-838 ; « 2. Vers la territorialisation de nouveaux espaces : océans et espace exo-atmosphérique », pp. 14-24, BATTISTONI-LEMIÈRE Anne, *Tout comprendre de la géopolitique. 1 200 concepts pour réussir vos concours et examens*, Paris, Armand Colin, 2022.

[8] DE NEVE Alain, « Crowded and Dangerous Orbits European Space Governance at a Time of Potentially Saturating Programs », *Études de l'Ifri*, February 2022.

[9] KESSLER Donald J., COUR-PALAIS Burton C., « Collision Frequency of Artificial Satellites: The Creation of a Debris Belt », *Journal of Geophysical Research*, Vol. 83, No. A6, 01/06/1978, pp. 2637-2646.

[10] FALLE Andrew, WRIGHT Ewan, BOLEY Aaron, BYERS Michael, « One million (paper) satellites », *Science*, Vol. 382, No. 6667, pp. 150-152.

[11] Previously cited in footnote 2.

[12] CROIZET FONTANE Romane, « La réglementation internationale des armements dans l'Espace, entre blocage et instrumentalisation. Analyse des récentes proposition en matière de désarmement aux Nations unies », *Institute of Applied Geopolitical Studies (Iega)*, Paris, 31/07/2024.

[13] On this subject, see PAPPALARO David, « Hypersonics : Between Rhetoric and Reality », pp. 40-41 ; in CESA (dir.), *Vortex. Studies on Air and Space Power*, No. 3 (« Air Power and New Technology »), 06/2022.

[14] « Les nouveaux défis du droit de l'espace », *Lettre 3AF*, 2024 ; RENAUD Cédric, BERNARD Claude, BURGER Nicolas, « La synchronisation du droit et de l'innovation. Regard sur les objets connectés. Approche pluridisciplinaire des phénomènes : interrogation croisée du droit, des sciences dures, humaines ou sociales », *PhD*, « Law » doctoral school, Lyon III University, 2017.

[15] See RUTH Olivier, « The Impact of Sanctions and Alliances on Russian Military Capabilities », *The Royal United Service Institute for Defence and Security Studies*, 10/01/2017.

[16] « Politique spatiale de l'UE », *European Council*.

[17] These three companies have decided to merge their space activities to improve their competitiveness at European and international levels. See « Airbus, Leonardo and Thales sign Memorandum of Understanding to create a leading European player in space », *Thales,* 23/10/2025.

[18] See HENRY Hugo, « Projet SpinLaunch : peut-on catapulter les satellites ? », *Institut polytechnique des sciences avancées*, 12/01/2023.

[19] « Cyclone Chido : quand le réseau Starlink d'Elon Musk vient au secours de Mayotte », *France info*, 27/12/2024.

[20] On these questions, see the publications of the *Centre d'études stratégiques aérospatiales* on its Calameo website. For the question of quantum, see more particularly « Quantum under the service of the third dimension », pp. 55-71; in CESA (ed.), *Vortex. Air and Space Power Studies*, No. 3 (« Air Power and New Technologies »), June 2022 and CESA (dir.) *Vortex. Studies on Aerospace Military Power*, No. 9 (« Space Issues »), 11/2025.

[21] By way of illustration:
- First circle: *Syracuse* communication satellites, satellites from the Optical Space Component (CSO), GRAVES radar-based space surveillance system…
- Second circle: Italian (Cosmos-SkyMed) and German (SAR-Lupe) intelligence satellites, Franco-German ground pace radar RITA…

- Third circle: Contract between the French Direction Générale de l'Armement (DGA) and *ArianeGroup* to use the company's *Helix* network, which specializes in the detection, tracking, and characterization of space objects…

22 Secrétariat général de la défense et de la sécurité nationale, Stratégie nationale spatiale, 2025-2040, 12 novembre 2025.