Small Satellite Constellations, Infrastructure Shift and Space Market Regulation

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Abstract With the commissioning of the first constellations of hundreds or even thousands of small satellites, we are witnessing today an infrastructure shift. While it has not completely distanced the exploration and use of outer space from the dramatic geopolitical and military implications they once entailed for States, it is undoubtedly transforming this realm into a new economic frontier of competition, with its predominant players, this time being private profit-driven actors sensitive to market forces. As the exploitation of outer space becomes more economically viable, new commercial services should emerge through the deployment of SmallSat constellations and the provision of services by means thereof, creating a risk of increased dependency of the services consumed on earth on these new infrastructures. Therefore, new legal challenges pertaining to competition, foreign investment and the global economy as a whole do arise.

1 Introduction

With the deployment of the first constellations of hundreds thousands of small satellites in low orbit, is the world space industry to be gained over by the 'monopolization' movement that has been observed in many sectors in the United States, for the past few years? A few predominant operators, mainly American, would exercise exclusive control over critical infrastructures through which a large number of space services, data or commercial applications would transit. One must note that most of the same operators who launch these constellations and propose to operate them are today subject to a tightened vigilance by regulatory bodies, particularly in the United States, for the conditions under which they operate powerful digital platforms. This

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A. Froehlich (ed.), *Legal Aspects Around Satellite Constellations*,
Studies in Space Policy 31, https://doi.org/10.1007/978-3-030-71385-0_1

– the anticipation of limited profitability of second-generation American constellations in the face of the success of the 5G terrestrial networks deployed in Europe;
– the gamble on the development of commercial applications stemming from intelligent processing of space-derived data as opposed to the space infrastructure that carries them;
– pressure from regulatory bodies, including American ones, against vertical integration strategies that are less and less compatible with market rules.

Following on from these introductory considerations (1), this chapter looks back at the recent evolution of the world space industry over the last ten years (2) to highlight a movement of decoupling of space infrastructures (3). One of the consequences of this decoupling is the growing need for regulation of these infrastructures, which are primarily of a private origin and nature, and more particularly, for a definition of their status with regard to the major principles of international space law (4). This regulation requires the definition of a legal framework for which a wide range of solutions can be put in place, notably those stemming from competition law (5). A conclusion proposes the course of action to be taken to achieve this (6).

2 The Miniaturization of Satellites: A Silent Revolution

The miniaturization of satellites operates a silent revolution in the global space industry, less in itself because it is not in the nature of a disruptive innovation,[4] than by its effects: it brings the world space industry into the era of mass production and thus the "trivialization" of space techniques at the service of many terrestrial activities.

The miniaturization of satellites is not a big deal, otherwise one could object that the first artificial satellite, launched on October 4, 1957, the Russian Sputnik1 satellite, was already a small satellite. It is more a matter of mass: with a lower mass than the satellites of the previous generation, small satellites certainly have more limited capacities, including a shorter lifetime, but they are also cheaper to produce and launch than larger satellites.

Small satellite class	Mass range (kg)
Mini-satellite	100–500
Microsatellite	10–100
Nanosatellite	1–10
Picosatellite	0.01–1
Femtosatellite	0.001–0.01

[4]Please see Victor Dos Santos Paulino and Adriana Martin "*Satellite Miniaturization: Are new entrants about to threaten existing space industry ?*", SIRIUS, 2016.

Launched in constellations, they overcome the disadvantage of lower reliability by being redundant with other satellites, with resilience rates close to 100%. Built in large numbers, they allow the production of satellites in bulk, which facilitates maintenance operations by replacing faulty satellites. This is all the more efficient as their launches, which are less complex than those of large satellites, can be more frequent, most often in "rideshare" mode.

Positioned in close orbits, they have low latency and make possible Internet via satellite, thus meeting the expectations of more than half of the world's population, who do not have access to it. More difficult to jam, requiring a larger number of ground stations and mobilizing the skills of several industrial players, satellite constellations are less vulnerable than those of larger satellites are. They are likely to serve, better than they do, the expectations of defense and territorial protection; which may explain the growing interest they are arousing among armed forces and the military institution. They are called upon to play a major role in earth observation, environmental protection, and the surveillance of sensitive infrastructures, especially energy. In the long term, they will serve new clients from a number of sectors, who will see many opportunities in them: banking and finance in particular.

Benefiting greatly from advances in artificial intelligence, quantum computing and blockchain technology, the miniaturization of satellites introduces, more generally, a new culture and new industrial models. This is what we can call the "commoditization" of global space industry, which covers both the on-line production of space objects, at low cost, using or reusing products (materials, equipment, software) available "off the shelf" and the spread of the uses of space technologies in the economy and society. In so doing, it promotes the appropriation of space technologies by many sectors of terrestrial activities by forging new links between space operators and industrialists in the mechanical engineering, transport, energy, distribution and agricultural sectors. It thus opens up the market for space applications resulting from the exploitation of data of space origin, produced in large numbers, processed by the sophisticated means of machine learning and rapidly transformed into useful services for industry or commerce.

These advantages result in economies of scale, further reducing the costs associated with the production of these satellites and their launch. These developments have also prompted the emergence of cost-effective and higher-paced ways to deliver these satellites into orbit, such as the development of micro-launcher systems and spaceports (including sea launch pads) dedicated to their operation. The resulting lower entry barriers have, in turn, motivated the emergence of new space actors and facilitated local access to space. Portugal's proposed spaceport in the Azores archipelago is a shining example.

Miniaturization is thus significantly changing the economic dimension of the global market for space activities, by multiplying the number of satellites to be launched each year, by encouraging the emergence of new activities (the provision of in-orbit services for example) and by requiring the renewal of several other, more traditional activities (launch, space insurance in particular). It is not surprising that

the commercial applications they enable are multiplying, from satellite communication to earth observation, including a wide range of commercial data services for agriculture, energy and transport.

Inspired by Skybox imaging, Planet labs or OmniEarth, many specialized companies have announced their intention to launch constellations of small satellites and enter this new market. Around the constellations themselves, many others, like TrustMe, Maxar Technologies, Northrop Grumman, Rocket Lab, HyImpulse Technologies, Rocket Factory, Isar Aerospace, Black Sky Imagery, Spacebits, Satellogic, Momentus or Preligens … have also rushed into the open breach, positioning themselves upstream on their components or downstream on their applications.

3 Small Satellite Constellations, Decoupling and Competition

The commissioning of the first constellations of hundreds of small satellites causes a double decoupling: a decoupling of the global space infrastructure (3.1) made possible by a decoupling of the global space industry, shifting from public to private and, without anticipating the following developments, from an international regime to a national regime, today essentially American (3.2). Contrary to popular belief, however, this double decoupling may not be synonymous with increased competition (3.3).

3.1 Decoupling of the Global Space Infrastructure: Space Infrastructures as Enablers of New Industrial Ecosystems and of New Markets in the Space Value Chain

Space-based activities are often described as infrastructure-based, described as "critical" because of its vulnerability. In fact, it is the increased dependence of many terrestrial activities on satellites and, more generally, on all the services now provided from space, that create this vulnerability and fully justifies this qualification.

In any event, these activities and services can only be carried out, provided if they are based on means constituted by space objects, whatever their size or capacity, whether they operate in isolation or within constellations. These space objects themselves require for their operation design and construction capabilities, facilities for their launch, authorizations for their operation, terrestrial relay or control equipment, means for processing and making available space data, commercial agreements, computer systems, etc. This is what space infrastructure is all about.

This infrastructure has long been under the direct or indirect control of States and their space agencies or international organizations, including international cooperatives, which operated it. The value chain of the global space industry was reduced

limited to the activities of designing, building, launching and operating satellites, including the provision of imaging, positioning or observation services. For each segment of this value chain, there were only a small number of operators whose activities were linked, vertically and almost hierarchically, between a prime contractor and several layers of subcontractors at different levels. This industrial organization was all the more simple and easy to identify as the number of States in the space club was limited and the world industry had become highly concentrated, especially in the first decade of the 21st century. It described an industrial universe organized in sectors, of which one could list all the actors. These sectors were themselves part of national or regional programs, mainly defined and financed by States. Moreover, the latter were often present in the capital of the main industrial or commercial operators.

The miniaturization of satellites is likely to shatter this industrial organization, while the space club is growing significantly, from about thirty nations to more than eighty today. The industrial ecosystems that had prevailed until now are gradually being replaced by industrial ecosystems that are deployed around the infrastructure of the main constellations.

This new infrastructure has three characteristics that determine its specificity compared to the previous generation:

– it is designed to meet very terrestrial needs: those of emerging markets such as East and South Asia, those of additional broadband capacity in the era of 5G and the Internet of Things, and those still linked to the need for ubiquity (positioning, surveillance, communication), mobility (transport and logistics), and the mobilization of increasingly precise information in a global economy. In so doing, it widens the gap between the **near space** dedicated to terrestrial uses of space technologies (communication, earth observation, positioning) and the **deep space**, which remains an object of exploration; the former can be financed by private capital, the latter remains dominated by major public programs launched by States and conducted by their national agencies;
– it is a source of new needs in outer space itself, for the maintenance of constellations whose satellites have limited capacities and lifetimes, also referred to as "midstream" activities. It requires the mechanization of construction operations and the establishment of real production lines for small satellites. It presupposes their availability "in bulk" and their launch, in "rideshare". It calls for the multiplication of intervention operations and their perpetuation in space itself, in the form of dedicated services (in-orbit services). But it is also the source of new concerns, related to orbital congestion and the accumulation of debris in near space and the need for surveillance, if not joint space traffic management (SSA, STM), which do not yet exist and will have to be created;
– it produces space-derived data whose considerable mass and the possibility of processing it in large numbers with advances in artificial intelligence open up the promising market for many commercial applications of space technologies. These space infrastructures are thus evolving into enablers of industries and markets that rely on the data sets and imagery transmitted to provide applications spanning across very diverse sectors, such as navigation, the oil and gas industry,

communications, forestry, agriculture or even the military sector. As a result of the operation of such space infrastructure the markets for applications is becoming increasingly diversified.

The value chain has thus been considerably enriched. The number of satellite manufacturers has increased, while upstream many companies have emerged for the development of components (fuels) or equipment (articulated arms). We can no doubt anticipate that tomorrow's satellite assembly operations, stations and new platforms will take place in space and no longer on earth. Launch operations are no longer the prerogative of a few global operators. The number of the latter has increased significantly, with the development of vehicles or launch facilities adapted to the requirements of small satellite constellations. The vogue for "re-use" implies an improvement in materials or propulsion modes that favors the emergence of small companies. Obtaining the authorizations required for launch or in-orbit control has become a commercial matter, such as leasing frequencies or assigning filings with the ITU. The market for the maintenance of small satellite constellations is developing around a multiplicity of incoming operators who position themselves in it. The exploitation of space-derived data is emerging as an Eldorado whose mastery no longer only involves the mobilization of space resources: it is companies in the sectors of quantum computing, machine learning, big data, which are investing in it. Space activities are therefore no longer limited to specialized operators in sectors dedicated to the construction, launch or operation of satellites; they plunge deeply into many terrestrial activities, gradually blurring the boundary between space and terrestrial industries.

With the development of constellations of small satellites, the space infrastructure is diversifying beyond reason, branching out to excess, becoming commonplace, losing its specificity. But in doing so, it is also becoming dematerialized, privatized and internationalized, increasingly escaping the control of states. Perhaps tomorrow it will be totally externalized, spreading out in space itself, without any established link with States?

3.2 Decoupling of the Global Space Industry: Emergence of New Industry Trends, Innovative Business Models and Flexible Funding Schemes

Within a few years, several new companies have entered the global space industry. Observers generally focus on the successes of the American operator SpaceX (Starlink constellation), Amazon's projects (Kuiper constellation) or the problems with OneWeb, which was eventually taken over by the British government and the Indian operator Bharti Global.

But several other important companies were created in the wake of these companies which are today magnificent unicorns. On the American side, these include the operators Skybox Imaging, created in 2009, in which Google subsequently invested;

hold for a media, as is also provided for the mandates of independent directors in a commercial company. For example, in terms of terrestrial television, no person may hold more than two authorizations if the cumulative potential audience of the services in question exceeds 20% of the cumulative potential terrestrial audience of all authorized television services. For services broadcast by satellite, the number of authorizations that may be granted to the same person for the operation of one of these services is limited to two.

An anti-media concentration mechanism complements this mechanism designed to ensure external pluralism. It allows the regulator to exercise control over the accumulation by the same person of authorizations held in several media (terrestrial television services, radio services, national or regional daily press), according to a procedure for assessing their market power taking into account; for example, a criterion of cumulative potential audience as described above.

Moreover, within the context of access to internet provided via SmallSat mega-constellations, net neutrality issues will also need to be considered. Of particular concern would be the relationship between the internet service provider and the providers of content. Vertical mergers between such actors would accentuate these concerns, particularly if such mergers lead to the employment of competition-restrictive tactics that would render competitor access prohibitive, such as bandwidth throttling, restricting IP interconnection capacity, prioritization of one's own services, limiting access or restricting directly or indirectly the possibility of content providers to distribute their content, etc.

Drawing a parallel with the EU'S TSM Regulation (as amended),[16] providers of internet access services and other electronic communications should be obliged to safeguard open internet access, for example by ensuring sufficient network capacity for the provision of high quality non-discriminatory internet access services.[17] They should treat all traffic equally, without discrimination, restriction or interference and independently of its content, application or service.[18] Considering, thus, that the actors aiming to provide internet access via satellite mega-constellations tend to be vertically integrated (construction of satellites, launch services, internet access services), further downstream integration into the content provider industry (e.g. in the form of vertical mergers) would not be unlikely. As such net neutrality rules will also need to be transposed and applied in respect these actors.

It is undoubtedly in the latter direction that a system applicable to constellations of small satellites must be devised, where the operator, who is necessarily foreign in relation to the countries served, cannot obviously be subject to a limitation on the financial holdings of its own shareholders. Neither is it necessary to set up companies under local law to make its infrastructure available and/or to provide its services.

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[16]Regulation (EU) 2015/2120 of the European Parliament and of the Council of 25 November 2015 laying down measures concerning open internet access and amending Directive 2002/22/EC on universal service and users' rights relating to electronic communications networks and services and Regulation (EU) No 531/2012 on roaming on public mobile communications networks within the Union.

[17]See *TSM Regulation*, Recital 19.

[18]See *TSM Regulation*, Recital 8.

Once again, it is not a question of reproducing the complexity of these mechanisms, but only of laying down rules that are intelligible and useful, felt as such by all the operators concerned, simple to use and, consequently, likely to be applicable. Setting them at the European level to ensure an efficient regulation of the European territory, respecting the sovereignty of the Member States of the European Union, seems to be an indispensable precaution.

5.2 Constellations and Regime of Dominant Positions

The operator of a constellation of small satellites is in a dominant, if not exclusive, position in the provision of its infrastructure. Competition can only come from other constellations that are likely to provide the same type of service(s) from both a physical and geographical standpoint, or from terrestrial networks, cable networks or 5G mobile networks, provided that these terrestrial networks can be considered as substitutes for the small satellite constellation.

However, the possibility cannot be ruled out that:

- the market for connectivity will become more concentrated, that
- the number of small satellite constellations will be reduced, and that
- links will be established between terrestrial networks and satellite networks, through the provision of frequencies or capacity, exclusive agreements, or the exchange of shares, which could go as far as the takeover of a terrestrial operator by the operator of a small satellite constellation.

The hypothesis that the operator of a constellation of small satellites behaves like a digital platform and exercises access control cannot therefore be ruled out. It then becomes a gatekeeper, inclined to abuse its dominant position.

The European Commission recently reacted against this type of anti-competitive behavior by proposing two founding texts: a Digital Services Act and a Digital Market Act, of which drafts were made public at the end of 2020. These texts aim at the identification of practices by digital platform operators or online intermediation service providers, which are likely to constitute abuses of a dominant position.

These practices include, in particular, exclusive control of data collected for access to their infrastructures, preferential access rights for services promoted by these operators and suppliers to their infrastructures, and the marketing of applications provided by these operators and suppliers to the detriment of applications of companies using these infrastructures. The future European regulation focuses on ensuring trust and safety online by increasing responsibilities, obligations, and liabilities for digital services. It proposes also the establishment of an ex ante regulatory instrument to control the behavior of gatekeepers. This instrument includes prohibitions or restrictions of certain business practices that the Commission believes should be "blacklisted", reporting procedures, involving a new category of whistle-blowers ("trusted flaggers"), and obligations on platforms to modify their business practices

to facilitate competition against themselves and remedies that would be applied on a case-by-case basis to large on-line platforms.

It is singular to note that these texts are aimed at terrestrial digital platform operators and online service providers; and some of them, qualified as operators of "structuring infrastructures". They do not explicitly refer to the constellations of small satellites, which may incur the same reproaches and justify the same vigilance. However, perhaps the final version of the two texts in preparation will reserve the pleasant surprise of definitions allowing the inclusion in their scope of all the digital infrastructures concerned, including space infrastructures.

This inclusion is even more necessary since some of the operators of small satellite constellations are vertically integrated. They operate in several segments of the value chain: construction and launch, launch and provision of connectivity services, provision of connectivity services, and provision of content or application services to access them. As a result, they hold market power that can encourage anti-competitive behavior.

The means available to the country of service include, in particular:

- the qualification of the infrastructure itself as an essential facility;
- the establishment of a right of access for third parties, which can itself be part of a policy of unbundling the infrastructure and the services it carries;
- within the logic of unbundling, the establishment of an independent regulatory authority charged with intervening on an ex-ante basis to ensure access to the satellite infrastructure and non-discriminatory entry in the satellite services market;
- the development of competing terrestrial or even satellite networks;
- the correction of market asymmetries by ex-ante regulation of the data or applications market;
- the obligation to ensure the interoperability of access equipment to these infrastructures.

Essentially, one of the main questions that will arise in this respect is whether regulators should promote a facilities-based competition or instead designate satellite infrastructures as essential facilities and require the infrastructure-holders to grant access to them (e.g. via compulsory licensing). This decision will require several considerations, such as for example whether the input in question is essential to enter a market, or whether there are viable alternatives or substitutes for the infrastructure in question. If lack of such input is likely to preclude competitive entry, then the facility is more prone to be considered essential and vice versa. It should be noted that even intangible assets, such as information and data collected via satellite infrastructure, may even constitute essential facilities.

We should highlight, however, that there are several constraints that ought to be taken into consideration when applying the means presented in the list above, as well.

On the one hand, infrastructures deemed, as "essential facilities" must allow third party access and entail the risk of allowing their holders to control competitors' access to a market. If unjustified or unreasonable, such denial of access to the infrastructure

would indeed constitute an abuse of dominant position. On the other hand, however, the existence of objective justifications of denial need may plausibly include the non-availability of excess capacities, technical obstacles rendering access impossible, the existence of economically viable alternatives, or even the competitor's ability to provide reasonable remuneration.

Furthermore, will a facilities-based competition (in the form of requiring competitors to develop their own mega-constellations) actually increase efficiency? Alternatively, will it in reality reduce incentives to invest due to prohibitive market-entry costs? Additionally, recalling the issue of orbital congestion that is bound to be exacerbated with the multiplication of constellations, it might in fact not be sustainable to promote a facilities-based competition in the long run considering the limited availabilities of slots and frequencies.

Similarly, the existence of monopolies should not be interpreted as automatically implying abuse of dominant position, particularly when they do not impose unfair trading practices or prejudice consumers in other ways. Additionally, article 106(2) TFEU could also serve as reference in this respect since it states that undertakings performing services of general economic interest are subject to the rules on competition as far as the application of such rules does not obstruct the performance of the particular tasks assigned to them. Could the provision of internet access to remote areas be counted among these services? Regardless, care must also be exercised so as to avoid instances of regulatory capture that would facilitate abuse of automatic dominance.

Overall, dominant positions may reflect efficiencies and their regulation will need to balance free competition with the interest of safeguarding sufficient investments in such infrastructure.

5.3 Constellations and State Aid Regime

Some of the announced small satellite constellations benefit from the support of their governments or national space agencies, which directly finance their space industry through public subsidies or help their deployment through a very aggressive public procurement policy. These subsidies or contracts may distort competition in the markets for the provision of connectivity services.

This is a more general issue of interest in international trade law.[19] It has determined the European Commission to publish on June 16, 2020, a White Paper on establishing a level playing field for foreign subsidies.[20]

This White Paper proposes the establishment of new legal instruments, in the form of three modules covering respectively:

- the measurement of the effect of distortion of competition on the European Union market of foreign companies receiving subsidies or contracts benefiting them,
- the control of the acquisition by such foreign companies receiving subsidies or contracts, of European companies in the context of foreign direct investment operations, and,
- restrictions on access by these foreign companies to the market procedures launched by European contracting authorities.

These legal instruments must be applied to foreign operators of small satellite constellations wishing to provide connectivity services to European users both in their practices on the European market and in their investment operations in European companies; or even in their application for competitive tendering procedures on European soil. In this regard, particular attention should be paid to foreign investors, in particular State-owned or controlled ones, seeking to acquire, control or influence European undertakings carrying out activities that have significant spillovers on the European economy and society. That should be activities in sectors involving key assets and critical infrastructure (whether it is tangible facilities, such as networks, or intangible ones, such as information, technologies and other kinds of inputs). Certainly, the operation of SmallSat constellations could be comprised among them. The degree of operational and national security risk, such as access to sensitive information concerning critical infrastructure, will definitely have to be considered in those instances.

It should be noted in this respect that, while foreign State-funded acquisitions of such European assets are numerous, European companies cannot receive similar subsidies or support from their domestic governments due State aid rules. In addition, they do not enjoy similar acquisition or control opportunities in foreign markets, either. In fact, they might even face discrimination and differentiated treatment in foreign procurement bids. When competing in the American market for example, they have to deal with regulations such as the "Buy American Act" that requires the U.S. government to prefer U.S.-made products in its purchases.

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[19] This issue is covered by the Agreement on Subsidies and Countervailing Measures concluded on April 15, 1994 under the Marrakech Agreement establishing the World Trade Organization (Annex 1A, 1869, U.N.T.S.14). However, certain OECD reports indicate that despite this agreement and the obligations it imposes (in particular the obligation to notify these subsidies and countervailing measures), these subsidies continue to grow, sometimes reaching very significant amounts (between US$20 and US$70 billion in the aluminum sector between 2013 and 2017). Moreover, the prohibited subsidies and countervailing measures only concern imports of products from third countries; in the case of the European Union, they leave out of their scope the intra-Community trade in services provided by foreign companies established in the territory of the Union.

[20] 17 June 2020, COM (2020) 253 final.

The European space launch industry specifically has been particularly impacted due to foreign competitors operating in such institutionally "captive markets" that favor domestic operators. For example, American, Chinese, Japanese, Russian and Indian launch service providers can benefit from exclusive access to their governmental markets, "generous" institutional contracts and long-term procurement contracts, which, in general, is not the case for the European market, putting European operators such as Arianespace at a competitive disadvantage compared to their foreign counterparts.[21] The question may thus be raised whether the EU should promote similar national preference rules when it comes to such key sectors.

Based on these considerations and in light of these challenges, the other side of the "State-aid coin" must thus be also considered by the EU: State aid and government procurement can serve as a stimulus to foster competition against existing monopolies and oligopolies. For example, the success of SpaceX, which has evolved into a fierce competitor in the launch service provider industry, might not had been effected had NASA not encouraged entry into the launch sector by SpaceX and other private companies with its Commercial Orbital Transportation Services program. Relaxation or at least a more flexible application of State-aid rules must definitely be enacted for such a strategic sector as space and the satellite industry.

From an EU law point of view, the public funding of such ventures, such as the development of satellite constellations and satellite-based services, may be justified in light of Article 107(3) TFEU. At least, as far as it concerns, for instance,

- "aid to promote the execution of an important project of common European interest," or
- "aid to facilitate the development of certain economic activities," or even
- "aid to promote the economic development of areas where the standard of living is abnormally low or where there is serious underemployment" such as the provision of internet and other satellite services to very remote areas.

These provisions relate also to the principle of "juste retour" applied by the European Space Agency: under this approach, domestic space industries are granted ESA contracts based on their respective State's financial contributions to ESA programs.[22] This approach may, actually, be considered as an indirect State aid, considering that contractors are not chosen on competitive grounds (e.g. value for money) but simply on grounds of their nationality.[23] Nevertheless, this practice has been exempted from the EU Commission's State aid rules due to the special, highly strategic, and highly

[21] ASD—Eurospace, *Aggregation of European institutional launch service levels*, Position Paper, 2018, available at: https://eurospace.org/wp-content/uploads/2018/07/eurospace-pp-on-aggregation-of-european-institutional-launch-services_july-2018.pdf.

[22] F. von der Dunk, "International organizations in space law," in Fabio Tronchetti and F. von der Dunk (eds.), *Handbook of Space Law*, Cheltenham, UK and Northampton, MA, USA: Edward Elgar Publishing, 2015, p. 312.

[23] F. von der Dunk, "European space law," in Fabio Tronchetti and F. von der Dunk (eds.), *Handbook of Space Law*, Cheltenham, UK and Northampton, MA, USA: Edward Elgar Publishing, 2015, pp. 265-266.

cost-intensive nature of the space industry and the fact that it serves overarching European interests.[24]

These considerations demonstrate the need to apply European State aid rules in a more flexible manner so as not to hamper the growth over European space operators.

6 Conclusion: Towards a Space Market Act

It is therefore desirable that a body of specific international rules be gradually put in place to organize competition on the emerging space activities market. This body of rules could consist of ten or so principles including a list of potentially unfair practices that could be committed by operators of small satellite constellations following the model of the list drawn up by DG COMP in the preparation of the Digital Market Act on anti-competitive practices of so named terrestrial "Gatekeepers Platforms".[25]

The forthcoming entry into service of the first constellations of small satellites could provide an opportunity to do so. Their activities are part of a major change in space infrastructure and global space industry. However, most of these constellations are under American jurisdiction. And we could expect that the U.S. Government and its agencies, including the market regulatory bodies in charge of antitrust in the United States, have no interest in proposing rules that could appear to their operators as constraints incompatible with their international development.

The initiative must therefore come from the European Union. On the model of the Digital Market Act that the European Union is about to adopt, one could easily imagine a Space Market Act. This Space Market Act could just as easily be an appendix to the Digital Market Act, unless it is included in its provisions.

The Space Market Act would mark the will of the European States not to allow private constellations of small satellites to replace yesterday's space infrastructures and to provide their commercial services, without a regime that respects both elementary rules of competition and the universal principles that the Space Treaty has laid down since the beginning of the conquest of space.

In the same way that NASA conceived and proposed the Artemis Agreements in mid-summer 2020, the European Union could suggest to the other spacefaring nations to join them by expressing their adherence to the Space Market Act or by concluding bilateral treaties with it.

Better yet, each State-member of European Union—including Luxembourg and Italy, which have already joined, but could express European solidarity here—could make its adherence to the Artemis Agreements conditional on the reciprocal adherence of the US Government and US agencies to the Space Market Act. However, the Artemis Accords are open to signature to individual States only, and not to international organizations (as per Section 13(3) of the Accords), what does in fact illuminate certain challenges and constraints that the European states would have to overcome first prior to being able to adopt this approach and promote a Space Market Act.

These challenges and constraints are essentially fourfold:

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[24] Ibid.

[25] DG CNECT/GROW Informal Working Document, DG COMP, 18 September 2020.

- The Union will have to draw up a European space policy that incorporates elements of competition law or requires the application of competition law to space activities, with the aim to establish a unified European approach in respect to the commercial and competition concerns relating to space matters.
- The Member States, in turn, would have to coordinate with each other and apply the rules set forth individually as well, which however could prove to be problematic considering that space is not an exclusive competence of the EU. In addition, Article 189(2) TFEU excludes any harmonization of the laws and regulations of the Member States in respect to measures taken to promote the objectives of a European space policy.
- Moreover, convergence between the legal orders of the EU and ESA will also be required, so as to strengthen a European stance even further. The lack of a unified European approach is magnified by the fact that ESA and the EU are two separate institutions, the one not subject to the legal order of the other, and not all ESA member States are EU members and vice versa. This will entail challenges in respect to the promotion of the EU and ESA's objectives and the application of EU law to space activities or even the promotion of a European space economic diplomacy. So, for the EU and ESA to promote a Space Market Act that could pave the way for a future international space economic law, these issues will need to be dealt with first.
- Overall, the aim will not be to create a legal and normative Cerberus that would overregulate the operation of satellite constellations or the provision of services by means thereof, but to institute a competitive, transparent and efficient international environment that will promote innovative uses of small satellite constellations, with the end-goal being the maximization of consumer welfare and economic growth.

Such an initiative should not be incompatible with a more offensive policy, based on the mobilization of European industrial capacities, in a sector where several European States have historically occupied a prominent position. Yet, the European Union has decided to lead the charge in the field of space activities, by launching the project of a European constellation of satellites competing with constellations Starlink and Kuiper. May we hope in this way that, thanks to the legal and economic challenges posed by the commissioning of the first American mega constellations, space Europe could finally be back?

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