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THE UPCOMING OF IRIS²: BRIDGING THE DIGITAL DIVIDE AND STRENGTHENING THE ROLE OF THE EU IN INTERNATIONAL SPACE LAW

Abstract

The arrival of thousands of satellites posed in large constellations is providing the possibility to offer ubiquitous internet connection, offering connection anywhere in the world and bridging the disparities between connected and unconnected. Such opportunities pushed for the commercialisation of space, with the advent of a vibrant satellite connectivity market. However, the trend has been lately led by private parties deploying satellites in the name of self-regulation, therefore putting at risk the safety, security and sustainability of orbits in outer space. In this scenario, the EU decided to launch its governmental satellite constellation the Infrastructure for Resilience Interconnectivity Security by Satellite (IRIS²) to offer broadband internet connection and safe communication throughout Europe while at the same time offering opportunities to take the lead in the dialogue on the formation of guidelines in the deployment of such complex systems. The article introduces the reader to the benefits that satellite communication can provide for society while exploring the legal and technical challenges following the advent of thousands of satellites in orbit. Moreover, it navigates the responses required by the international community to the legal and policy challenges. Finally, it envisions a new approach that the EU can play with its space policy in order to foster the debate for a much more coherent legal response to the challenges posed by the advent of large satellite constellations.

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SUMMARY

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1 Introduction

In the fast-paced era of space exploration and technology the EU has embarked on an ambitious endeavour to bridge the digital divide and strengthen its position in the international space community through the implementation of the IRIS² constellation. This article aims to provide an in-depth analysis of the opportunities, challenges, and implications of IRIS² on the EU's role in the international scenario as well as its potential to foster connectivity and equal access to digital services for all citizens.

The article is structured in six sections, it begins with providing a background on the importance of satellite communications and the opportunities that they offer, such as addressing the digital divide, fostering economic growth, advancing technological innovation, and providing safe communications. The first section concludes by showing the major participants offering services in the satellite connectivity market. The second section provides an introduction to IRIS², its objectives, and its relevance for European industry and citizens. The subsequent sections delve into the challenges faced in terms of legal, technical, and regulatory aspects given by the establishment of different large satellite constellations in Low Earth Orbit. The article further examines the potential for the EU to leverage IRIS² as a catalyst to assert its role in international space law-making and its implications on the global space community.

The penultimate section conveys recommendations to address the legal challenges faced by the international community regarding the deployment of large satellite constellations and ensure their safe, secure and sustainable implementation in outer space. The article closes by showing that the EU is adopting a stronger stance in its space policy approach. Indeed, the EU has the potential to bridge the digital divide and strengthen its position in international space law-making through the IRIS² project if it effectively addresses the challenges and adopts strategic solutions on the wave of the publication of its Space Strategy for Security and Defence and other space law-related documents. The work tried to examine the scenario in which the EU is launching its constellation alongside calling on the need for stronger international cooperation to face the challenges posed by the launch of satellite constellations providing internet services.

2 Satellites as enabler for the functioning of the society

Space activities have long played a pivotal role in our society, not only as a testament to technological advancement but also as a catalyst for progress across several aspects of different industrial sectors. Indeed, operating in the unforgiving environment of outer space requires a level of reliance and resilience far surpassing terrestrial standards.

Satellites, in particular, have evolved into critical enablers for a diverse range of essential services. These orbiting assets have become lifelines, connecting people

worldwide through broadband data services and supporting various functions, such as television and news distribution, space exploration, Earth observation, and navigation.

In essence, many aspects of our daily lives now rely on the continuous functioning of satellite-based services.

The strategic importance of satellite communication and broadband services was evident in the wake of the Ukrainian conflict, where governments recognised their role in the seamless functioning of the internet and, consequently, society itself. The intervention of Space-X, which ensured the functioning of the internet network on behalf of the Ukrainian government, highlighted the critical role of satellite communication.[1]

Consequently, the intersection of space and technology has proven instrumental in addressing numerous societal challenges. The benefits derived from space activities are now widely recognised and appreciated by a vast audience, leading to significant growth in awareness surrounding the space sector in recent years.

In addition, the unfolding of new space engineering and technological capabilities has opened up exciting opportunities. We can now build and launch an increasing number of space assets equipped with advanced software and features that facilitate the collection, processing, and sharing of data. This convergence of space assets, data applications, and artificial intelligence is poised to revolutionise multiple domains, offering the potential for enhanced efficiencies and novel solutions.[2]

One crucial outcome of this merge lies in the ability of space assets to provide ubiquitous connections, supporting the proper functioning of the Internet of Things (IoT) in all facets of terrestrial life.[3] The seamless integration of terrestrial and spatial infrastructure can unlock a realm of possibilities and synergies, transforming industries and enabling unprecedented innovation.

As a testament to the importance of satellites, the European Union (EU) has decided to launch its own large constellation of satellites, named Infrastructure for Resilience Interconnectivity Security by Satellite (IRIS²),[4] in the coming years. This initiative aims to offer secure communication and develop the capability to provide internet access in every part of the continent. The deployment of large satellite constellations like IRIS² is poised to become a crucial element of success for states, enabling secure internet

[1] Amritha Jayanti, 'Starlink and the Russia-Ukraine War: A Case of Commercial Technology and Public Purpose?' (Belfer Center for Science and International Affairs, Harvard Kennedy School, 9 March 2023) <https://www.belfercenter.org/publication/starlink-and-russia-ukraine-war-case-commercial-technology-and-public-purpose>accessed 7 July 2023.

[2] Landry Signé and Hanna Dooley, 'How space exploration is fueling the Fourth Industrial Revolution' (Brookings Institution, 28 March 2023) <https://www.brookings.edu/blog/techtank/2023/03/28/how-space-exploration-is-fueling-the-fourth-industrial-revolution/> accessed 7 July 2023.

[3] PJ Blount, 'Satellites Are Just Things on the Internet of Things' (2017) 43 (3) Air and Space Law 273, 294.

[4] Commission, 'IRIS²: the new EU Secure Satellite Constellation Infrastructure for Resilience, Interconnectivity and Security by Satellite' <https://defence-industry-space.ec.europa.eu/eu-space-policy/eu-space-programme/iriss_en> accessed 7 July 2023.

connections and expanding global connectivity fighting the distance between the connected and the unconnected. However, as satellite constellations continue to expand, it is crucial for the international community and organisations like the European Union to prioritise the safety, security, and sustainability of outer space through effective regulations and collaboration.

3 The digital divide

Networks of satellites placed up in large satellite constellations can be a crucial element to bring broadband internet connection to every part of the European Union, strengthening the connectivity across the continent.

The ability to communicate is a fundamental human right in the United Nation Universal Declaration of Human Rights (UDHR). Every human should have the capability to access the internet to be able to communicate with comrades or business partners around the world.[5] This need has never been felt as nowadays. Nowadays, access equality is an essential humanitarian need. During the COVID-19 Pandemic, we became more dependent on Internet connectivity, not only for communication or browsing for information, but also for a wide range of important services ranging from fundamental personal and social activities to accessing government and health institutions. Despite this growing importance of connection, a large portion of the world's population remains disconnected or under-connected to Internet infrastructure.[6] According to the International Telecommunication Union (ITU), just 63% of the world's population was connected in 2021, and of the 2.9 billion of offline people 96% resides in developing countries.[7]

The gap between the connected – who can wholly benefit from the service offered by modern information and communication technologies– and the unconnected forms the Digital Divide.[8] In Europe the digital divide affects mainly rural and remote areas, where roughly just 34% of the population have at their disposal high-speed broadband connection.[9]

In Europe enhanced internet connectivity can play an essential role in preventing digital divide, isolation and depopulation by reducing the costs of delivery of both goods and services and partially compensating for remoteness. In addition, the quality of life

[5] United Nations, Universal Declaration of Human Rights, 10 December 1948, Article 19.
[6] Gunes Karabulut Kurt, Angeles Vazquez-Castro and Ejder Bastug, 'Guest Editorial: Low Earth Orbit Satellites to Enable Access Equality' (2022) 60(4) IEEE Communications Magazine 16, 17.
[7] ITU, *Measuring digital development Facts and Figures 2021* (ITU, 2021) <https://www.itu.int/en/ITU-D/Statistics/Documents/facts/FactsFigures2021.pdf> accessed 7 July 2023.
[8] Everett M Rogers 'The digital divide' (2001) 7(4) Convergence 96, 111.
[9] Victoria Masterson, '70% of homes in the EU have high-speed internet – but a digital divide persists' (World Economic forum, 7 September 2022) <https://www.weforum.org/agenda/2022/09/eu-high-speed-internet-digital-divide/> accessed 7 July 2023.

in rural areas would improve by allowing internet-based services such as online education, eHealth, and eGovernment. The effort would provide an opportunity for small businesses in distant locations to interact with suppliers and consumers, as well as build digital business models[10].

In addition, it is important to bear in mind that internet connectivity has become a crucial component of every country's critical infrastructure given the reliance of all aspects of economic activity, government, and social development on internet communications[11], therefore the capability of a state or organisations to provide ubiquitous connection can constitute a factor of influence in the international scenario. Moreover, the advent of the Internet of Things, with the need for all devices to be interconnected further emphasized the need for fast broadband internet connection which ensures that all people can benefit from new technologies regardless of where they are located.

3.1 The importance of satellite communication to fight the digital divide

Technological development achieved today by humans may be utilised to the benefit of humankind. The interplay of space and the deployment of new technologies detains the potential to reverse the paradigm of the impossibility to ensure fast connection to everyone. With intelligent satellites, we can now revolutionise the communication system and benefit from the increased data collection and processing that will result from the satellite communication (SATCOM) industry.

Today, the right to internet access cannot be adequately guaranteed since terrestrial technologies share a fundamental weakness: they fail to provide global connectivity. Terrestrial networks are also extremely vulnerable to natural catastrophes and terrorist threats. Instead, satellite access networks, particularly large-scale low-Earth orbit (LEO) satellite constellations, have demonstrated their potentiality to extend terrestrial networks to meet the aforementioned challenges.

Since the turn of the century, the relevance and necessity of internet democratisation have been generally recognised.[12] In particular, as critical responsibilities of the state are transferred as online services, it is commonly observed that the Internet becomes increasingly intertwined with democratic life; it unavoidably means that democratic citizenship relies on digital citizenship.[13] As a result, in today's interconnected world, a

[10] Commission, 'Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions Connectivity for a Competitive Digital Single Market - Towards a European Gigabit Society' COM/2016/0587 final.

[11] OECD, 'The Economic and Social Role of Internet Intermediaries' (2010) <https://www.oecd.org/digital/ieconomy/44949023.pdf> accesses 7 July 2023.

[12] Peter Ferdinand, *The Internet, Democracy and Democratization* (1st edn Routledge 2000).

[13] William H Dutton, *The Oxford handbook of internet studies* (OUP 2013).

person cut off from the internet loses the capacity to give his democratic contribution to society.

Today, space is used for a wide range of civic and military purposes, and it is a highly disputed and crowded political and scientific domain. Among the numerous applications, space can be deployed to improve communications in order to democratise the internet. In today's digital age, space-based connectivity will be a strategic asset for global resilience. Furthermore, the new type of connectivity will boost economic power, digital leadership, competitiveness, and societal advancement.[14]

The idea of space communications as a democratisation factor for access to the internet has been theorized several years ago, but it was not technically and technologically feasible.[15] Today with the level of technological development of the space industry and of AI the "old past dream" is reality. Indeed, there have been attempts to operate Communications satellites in low Earth orbit (LEO) since the early 2000s; however, previous large-scale plans were cancelled or reduced due to high costs and limited demand. With increased demand for broadband service and to overcome terrestrial geographic limitations, several companies are developing constellations of satellites in LEO to provide broadband service from space.[16]

LOE satcom may provide tangible benefits to society, playing a role in expanding broadband access, in particular in rural and remote areas; particularly, bridging the gaps, swiftly expanding network coverage, and enhancing existing infrastructure. Moreover, as demonstrated in Ukraine by Space-X deployment of hundreds of LEO satellites, it allowed Ukrainians and key infrastructure to maintain internet connectivity.[17] Moreover, the expanding Internet of Things has raised the need for such communications. Indeed, space-based constellations can provide continuous coverage, allowing these internet-enabled devices to connect from anywhere.[18]

As an example, offering broadband internet connection to rural areas would improve the quality of life by allowing internet-based services such as online education, eHealth,

[14] PWC, '*Main Trends & Challenges in the Space Sector* (July, 2022) 3rd edition <https://www.pwc.fr/en/industrie/secteur-spatial/pwc-space-team-public-reports-and-articles/main-trends-and-challenge-in-the-space-sector.html> accessed 12 July 2023.

[15] Daniel M Kohn, 'Providing global broadband internet access using low-earth-orbit satellites' (1997) 29(15) Computer networks and ISDN systems 1763, 1768.

[16] John Garrity and Arndt Husar, 'Digital Connectivity and Low Earth Orbit Satellite Constellations: Opportunities for Asia and the Pacific' (2021) Asian Development Bank (ADB) Sustainable Development Working Paper Series n. 76/2021 <https://www.adb.org/publications/digital-connectivity-low-earth-orbit-satellite-opportunities> accessed 12 July 2023.

[17] Michael Sheetz, 'Elon Musk's SpaceX sent thousands of Starlink satellite internet dishes to Ukraine, company's president says' (CNBC, 22 March 2022) <https://www.cnbc.com/2022/03/22/elon-musk-spacex-thousands-of-starlink-satellite-dishes-sent-to-ukraine.html> accessed 12 July 2023.

[18] Mariel Borowitz, 'The Military Use of Small Satellites in Orbit' (French Institute of International Relations - IFRI, 4 march 2022) *Briefings de l'Ifri* <https://www.ifri.org/sites/default/files/atoms/files/m._borowitz_military_use_small_satellites_in_orbit_03.2022.pdf> accessed 12 July 2023.

and eGovernment. In 2019, 86 percent of all EU households had access to at least 30 Mbps broadband, whereas just 59 percent of rural households had this sort of connection. The effort would provide an opportunity for small businesses in distant locations to interact with suppliers and consumers, as well as build digital business models.

In addition, as a spillover effect of the new communication system, the EU will be able to establish a new kind of internet governance reinforcing its position in cyberspace. The EU's new 'status' will enable the seamless operation of key infrastructure and the continuous cooperation of citizens and public agencies in the event of emergencies and disasters. Furthermore, it would serve as a backup infrastructure for terrestrial networks as well as a stable infrastructure for places that are currently disconnected but may need communication in the event of crises and catastrophes.[19]

Consequently, considering the different benefits given by satellite communications the European Union wants to fill the gap for rural households high-speed connectivity in Europe deploying a sovereign constellation of satellites in LEO, in order to be able to provide broadband internet connection, alongside safe communication. The former will be the focus of the paper, and the latter – safe and reliable communication – will not be specifically addressed here.

Therefore, satellite broadband is poised to become an even more crucial technology for tackling the growing digital divide and ensuring the functioning of a society that is daily more reliant on digital solutions given the spreading of the Internet of Things in every aspect of our life.

3.2 How satellite broadband works

When a space object is launched it will position itself in an orbit, which may be of different kinds depending on the service in question. There are three major types of orbit, including the geostationary earth orbit, also referred to as a geosynchronous equatorial orbit (GEO), medium earth orbit (MEO), and low earth orbit (LEO).

This classification depends mainly – as clearly understandable by their nomination – on their altitude in outer space. GEO is located roughly at 36 000km, LEO it is encompassed between 300 to 2000km, and MEO encompasses a large range of orbits anywhere between GEO and LEO.

Satellite broadband is, as the name indicates, the provision of broadband internet service from satellites either in GEO, MEO, or LEO. Satellites use specific segments or

[19] Giovanni Tricco, Giorgia Zaghi and Maria Makurat, 'Securing Communications: what to expect from IRISS (Infrastructure for Resilience Interconnectivity Security by Satellite)' (International Team for the Study of Security, 2 January 2023) <https://www.itssverona.it/securing-communications-what-to-expect-from-iriss-infrastructure-for-resilience-interconnectivity-security-by-satellite> accessed 12 July 2023.

"bands" of spectrum—radio frequencies used to transmit signals wirelessly from one facility or device to another. The use of radio frequencies is regulated to avoid interference between users.[20]

Therefore, frequencies and orbits are used to offer determined service depending on their altitude in outer space. Satellites in GEO are positioned to be constantly above a determined area of the earth, typical services are telecommunication or weather forecast. They cover a large part of the globe; with few satellites the full coverage of the earth is ensured. On the other side, satellites in LEO or MEO can be deployed for a wide range of services but given their 'proximity' to the Earth a large number of satellites are needed to ensure global coverage.

Initially, satellite communications relied mainly upon GEO spacecraft. Technical advancement has enabled the emergence of LEO satellites, which are gradually providing connectivity services with latency and bandwidth comparable to terrestrial infrastructures.[21]

Indeed, a satellite in GEO can deliver more capacity to a specific region than non-geostationary satellites in a mega constellation that has to serve the entire globe. On the other hand, satellite constellations closer to Earth have the potential to offer low-latency solutions that can connect with terrestrial infrastructure more effectively. This means, that data will flow faster from terminals on the ground to satellites in orbit and back.

Today, the LEO satellites sector is more vibrant than ever – owing to the efforts of the private sector – which has already launched more than 3000 satellites into space in the past few years. Moreover, it is expected a significant growth for the satellite connectivity market with a triplication of its value from $4.3 billion to $20.6 billion by 2030.[22]

Therefore, this new scenario will open up incredible opportunities; however, a set of legal, technical, and ethical challenges will follow. One of the main risks to be addressed is that space orbits will become too much congested to ensure their safeness, since the orbital size available for low-orbit satellite constellations is by nature limited. The volumes available in earth orbit increase accordingly their altitude; it means that lower orbits are more prone to congestion than geostationary ones.

[20] Colby Leigh Rachfal, 'Low Earth Orbit Satellites: Potential to Address the Broadband Digital Divide' (Congressional Research Service – CRS Report, 31st August 2021) <https://crsreports.congress.gov/product/pdf/R/R46896> accessed 7 July 2023.

[21] Commission, 'Commission Staff Working Document Impact Assessment Report Accompanying the Document Proposal for a Regulation of the European Parliament and of the Council Establishing the Union Secure Connectivity Programme for the Period 2022-2027' SWD/2022/30 final.

[22] Satellite Market Research, 'Euroconsult Release its Flagship Satellite Connectivity and Video Market Report' (1 November 2021) <https://satellitemarkets.com/market-trends/euroconsult-release-its-flagship-satellite-connectivity-and-video-market-report> accessed 7 July 2023.

Indeed, proper space debris mitigation plans and Space Traffic Management frameworks will be required to ensure that space congestion does not result in the Kessler effect, whereby a certain amount of space junk or debris in space would end up in an indefinite cycle of collision rendering earth orbit inoperable.[23] As a result, the prospects provided by space applications in LEO would be unrealisable, aside from not favouring the passage of space research missions via the low orbit, which constitutes the first 'circle' around the planet Earth.

Thankfully, the fact that technology and outer space have always gone hand in hand comes to our assistance. Today, new technology such as Artificial Intelligence (AI) can play a major role in the satellite constellation sector, allowing satellites to communicate with one another in order to share data and information in real-time to prevent collisions in increasingly congested outer space. Therefore, technological progress is creating the potential to provide a diverse collection of services while also allowing the area to become more 'populated'.[24]

In light of the combination of less expensive launch systems, smaller and mass-produced satellites, better and smaller ground antennas, and novel technologies large-scale deployment of LEO satellite systems for internet access is now possible. Indeed, the synergies between land-based and space-based internet access solutions have the potential to overcome the digital divide and connect many more people to the internet.[25]

3.3 The hegemony of private parties in the LEO satellite market

It follows that the new kind of services offered by these new constellations of satellites can play an important role in the future of humanity, not only in offering broadband internet connection but either to ensure the safeness of such communication and the collecting of images that can result crucial – as enlighten in the Ukrainian conflict – in a war scenario. However, at this point in history, the development of such systems is still in its early stages, and few private parties can afford to have fully operational satellites in LEO constellations.

The few private parties in the front-runner in the deployment of constellations of thousands of satellites are mainly made up by the emperors of the digital world that are developing their own projects, from Musk with Space-X to Bezos with its project Kuiper of Blue origin. Therefore, the more ambitious projects are driven by the 'aristocracy' of

[23] Donald J Kessler and Burton G Cour-Palais, 'Collision frequency of artificial satellites: The creation of a debris belt' (1978) 83 (A6) Journal of Geophysical Research: Space Physics 2637, 2646.

[24] Pietro Cassará, Alberto Gotta, Mario Marchese and Fabio Patrone, 'Orbital Edge Offloading on Mega-LEO Satellite Constellations for Equal Access to Computing' (2022) *60*(4) IEEE Communications Magazine 32, 36.

[25] Internet Society, *Perspectives on LEO Satellites Using Low Earth Orbit Satellites for Internet Access* (November 2022) <https://www.internetsociety.org/wp-content/uploads/2022/11/Perspectives-on-LEO-Satellites.pdf> accessed 12 July 2023.

digital capitalism which is planning to be the first to place this new layer of the internet in outer space.

These examples may indicate that the deployment of broadband LEO satellite constellations extends far beyond the 'simple' business model of providing internet in areas that are not reached by land networks. Indeed, taking into mind the American offering, each of them takes a global strategy in order to be able to integrate earth-based and space-based data, but also presents themselves as a possible 'unique' data system with their primary services on earth.[26]

Indeed, the approach developed by SpaceX and Amazon goes one important step further in the space industrial approach establishing vertically integrated processes where the connectivity solution is part of a vertically integrated market, such as autonomous driving or e-commerce.[27]

In particular, Space-X is already offering widely its connectivity services, from March 2023 its offering roaming service to provide internet connection almost wherever in the world in particular according to them in: "*locations where connectivity has been unreliable or completely unavailable*."[28] Indeed, Space-X already has placed in LEO around 2700 satellites and plans to deploy a total of 42 000 satellites to complete its constellation.

On the other hand, Blue Origin has not yet released the lunch of its satellites that will constitute the Project Kuiper constellation. However, it obtained the approval for 3236 satellites by the Federal Communications Commission (FCC), with commercial service beginning once 578 satellites will be located in orbit[29]. In addition, it has just released its Kuiper satellite internet dished,[30] showing its commitment to be soon active in offering broadband services.

Given by nature space orbits and spectrum frequencies are finite goods – eg, there will not be space for an undefined number of constellations – therefore the time is running out for large satellite constellations in LEO and the American providers are well in a head start. Consequently, European actors must follow the trend immediately.

[26] Jean-Pierre Darnis, 'Space as a Key Element of Europe's Digital Sovereignty' (French Institute of International Relations – IFRI, December 2020) noted de l'Ifri <https://www.ifri.org/sites/default/files/atoms/files/darnis_space_europe_digital_sovereignty_2020_.pdf> accessed 12 July 2023.

[27] European Space Policy Institute, 'Rising Opportunities in the Satellite Connectivity Market: Eutalsat and One web Combination' (ESPI Executive Brief No. 60, 20 December 2022)<https://www.espi.or.at/wp-content/uploads/2022/12/ESPI-Brief-NO-60-Eutelsat-OneWeb-Combination__Final.pdf> accessed 7 July 2023.

[28] Emma Roth and Richard Lawler, 'SpaceX Starlink rolls out $200 per month 'global' satellite internet package' (The Verge, 15 March 2023) <https://www.theverge.com/2023/3/15/23641944/spacex-starlink-global-satellite-internet-portable-mobile> accessed 9 July 2023.

[29] Eli Blumenthalm, 'Amazon's Project Kuper Gets FCC approval for Over 3,200 Internet Satellites' (CNET, 31 July 2020) <https://www.cnet.com/science/amazons-project-kuiper-gets-fcc-approval-for-over-3200-internet-satellites/> accessed 9 July 2023.

[30] Emma Roth, 'Amazon reveals its squared-off Project Kuiper satellite internet dishes' (The Verge, 14 March 2023) <https://www.theverge.com/2023/3/14/23639450/amazon-project-kuiper-satellite-dish-internet> accessed 9 July 2023.

Moving to Europe, we find more traditional space companies that are participating in the LEO sector. One Web one of the only two nearly functioning global broadband LEO at the moment – alongside Space-X – in March launched 40 more satellites bringing the number of its satellites in LEO up to 582.[31] One Web stance in the sector has been further strengthened with the merger with Eutelsat in the past year. Eutelsat, one of the most respectable satellite providers, plans to integrate its GEO services with One Web LEO services to provide a multiorbital constellation in the years ahead. However, given the stake of the UK government in One Web it results likely that will not be considered for European governmental services.

SES another important European player that was a typical GEO satellite operator started to invest to offer multiorbital services, first with the acquisition of O3B[32] a MEO satellite company. Indeed, SES – before the One Web-Eutelsat merge – was the only satellite company operating the world's only multi-orbit constellation of satellites with over 55 GEO satellites and 20 O3b MEO satellites in orbit.[33] At the moment, it is under course the development and deployment of its next generation of MEO satellites with the O3B mPower satellites, which are expected to enhance SES's fast broadband offerings.[34]

In addition, given the clear run for LEO constellations and the importance of the development of a European constellation SES invested in INIO Enterprise a joint venture that seeks to take part in the development of the European constellation[35]. If the joint venture will succeed, SES will be the only satellite company with offerings from all the different orbits worldwide.

Therefore, we can assist in the efforts of the biggest European companies to foster the LEO market sector, alongside a vibrant SME industry.

However, until this day on both sides of the Atlantic, the soft engagement of public participation in these new sectors of space markets was clear. The traditional space industry driven by governments is no longer the Passepartout for the success of space missions, at least in LEO. As a result, in the years ahead there might be the risk that LEO may be overtaken by initiatives fuelled only by private interest. Indeed, if companies are left to self-regulate their activities, the deployment of hundreds of satellites may

[31] Mike Wall, 'SpaceX launches 40 OneWeb internet satellites to orbit, lands rocket' (Space.com, 9 March 2023) <https://www.space.com/spacex-oneweb-17-mission-launch> accessed 9 July 2023.
[32] Caleb Henry, 'SES Raises $1 Billion to Buy All of O3b Networks' (Via Satellite, 27 May 2016) <https://www.satellitetoday.com/telecom/2016/05/27/ses-raises-1-billion-to-buy-all-of-o3b-networks/> accessed 9 July 2023.
[33] Aaron Raj, 'SES's O3b mPOWER satellite constellation to revolutionize network connectivity' (TECHWIRE, 14 December 2022) <https://techwireasia.com/2022/12/sess-o3b-mpower-satellite-constellation-to-revolutionize-network-connectivity/> accessed 9 July 2023.
[34] SES, 'O3b mPOWER Redefining Satellite Services - Connectivity is Power' <https://www.ses.com/o3b-mpower> accessed 9 July 2023.
[35] Chris Forrester, 'SES commits to new LEO consortium' (Advanced Television, 7 September 2022) <https://advanced-television.com/2022/09/07/ses-commits-to-new-leo-consortium/> accessed 9 July 2023.

not be followed by appropriate normative safeguards that ensure the sustainability and safety of low orbits in outer space.

On the other hand, it shows that the participation of private parties is crucial for the deployment of such sophisticated and technologically complicated projects. Public-Private-Partnerships (PPP) will be crucial in the attempt of the constitution of the wide public participated constellations.

In addition, with the proliferation of projects in LEO to offer broadband and safe communication, it may form a risk for the European Union and its Member States to be designed to rely on non-European space backbones without being able to control and play a part in the many facets of the projects.

Indeed, in Europe, the debate was heated among the major satellites company on the idea of a whole European-based constellation. In 2021 SES, Eutelsat and Hispasat said – in a jointly-issued position paper – that they are prepared to participate in an EU-wide LEO scheme:

"*Eutelsat, Hispasat and SES strongly believe a European satellite infrastructure would strengthen the strategic autonomy of the EU by providing it with the ability to compete with ambitious constellation projects being deployed or planned on other continents at an accelerated pace, often benefiting, directly or indirectly, from massive governmental support*".[36]

On these premises, the European Union started to invest in the development of its own large satellite constellation in order to offer equal access to the internet to its citizens and neighbourhood, while benefiting from the opportunities given by the new infrastructure. Indeed, in February 2022 the EU proposed a regulation to establish a secure connectivity satellite constellation [37], which was finally adopted by European Institution in February 2023.[38]

4 IRIS²: the upcoming European Constellation

As previously mentioned, in the wake of the Ukrainian conflict governments clearly grasped the significance that space communication and broadband service can play in the seamless functioning of the internet. As a result, the risk that the last resort for the proper functioning of the Internet - and the critical infrastructures connected to it -

[36] Eutelsat, Hispanic and SES, 'Joint Satcom Operators' Position Paper European Constellation' (2021). <https://www.eutelsat.com/files/PDF/Joint-Satcom-Operators-Position-Paper.pdf> accessed 9 July 2023.
[37] Euractiv, 'EU states agree on need to build own satellite constellation' (Euractiv, 17 February 2022) <https://www.euractiv.com/section/global-europe/news/eu-states-agree-on-need-to-build-own-satellite-constellation/> accessed 9 July 2023.
[38] Commission, 'Adoption by the European Parliament of IRIS², Europe's new Infrastructure for Resilience, Interconnection & Security by Satellites' (14 February 2023) News article <https://defence-industry-space.ec.europa.eu/adoption-european-parliament-iris2-europes-new-infrastructure-resilience-interconnection-security-2023-02-14_en> accessed 9 July 2023.

should be in the hands of a single private party advanced the debate on the need for the EU to put forward a project for its European constellation providing satellite broadband and safe communication.

The proposal for the regulation establishing the constellation was presented in February 2022, and the agreement between the European Parliament and the Council of the EU was reached with a record timing within just 9 months, in November 2022. The adoption was paved by the vote in the Parliament with a record vote of 603 in favour and just 6 against in February 2023, now the approval of the text by the council is scheduled soon.

The constellation will bridge the digital divide in Europe and its partners. Indeed, it would assist in the accomplishment of the connectivity targets set out in the 2030 Digital decade.[39]

Iris[2] would provide a ubiquitous and resilient communication system to assure the internet's seamless functioning. The new broadband connection will cover the farther rural part and the dead zones of the European territory, therefore bridging the digital divide and guaranteeing the right to equal access enshrined in the UN Charter of Human Rights.

The constellation will form the third space program of the EU alongside Galileo and Copernicus. For the first time, the EU is creating an operating program in the context of a well-established commercial market in which companies already are offering connectivity services. Neither for Galileo nor for Copernicus this was the case, therefore, the approach to the development of the new programme must take into consideration this scenario.

For this reason, it will be of crucial importance for the EU to partner with private parties for the success of the constellation. The success of the deployment of the constellation will pass via the capabilities of the European institutions to coordinate the work of private parties benefitting from the synergies from the different know-how in the industry. Indeed, according to the Proposal of the Commission, the constellation will be built on a PPP.[40] It will be crucial that the EU, ESA and the European Member States lay down an appropriate framework to unfold creative PPP in order to engage the private market appropriately.

According to the commission, the IRIS[2] infrastructure will be envisioned as a system of systems, comprising the required space and ground components to provide IRIS[2]

[39] Commission, 'Europe's Digital Decade: Commission sets the course towards a digitally empowered Europe by 2030' (March 2022) Press release <https://ec.europa.eu/commission/presscorner/detail/en/IP_21_983> accessed 9 July 2023.

[40] European Space Policy Institute, 'IRIS2: The new (material) girl on the block' (ESPI - Brief No°61, 2022)<https://www.espi.or.at/wp-content/uploads/2022/12/ESPI-Brief-NO-61-Secure-Connectivity_Final.pdf> accessed 9 July 2023.

Governmental and Commercial Services. It will be made up of a Governmental Infrastructure, a Shared Infrastructure, and a self-standing Commercial Infrastructure.[41]

The cost of the constellation considering its development and deployment is expected to be approximately €6 billion; the EU and ESA will contribute respectively €2.4 billion and €750 million. The private sector will provide about €2 billion, with the remaining millions covered by European Member States.

Consequently, in order to attract private investment to reach the full ambition of the program the constellation when operative should provide for commercial offerings alongside governmental ones. Indeed, as planned by the proposal the constellation will give this opportunity to private parties that took part in setting up the constellation. Indeed, article 3(B) of the proposal states that the program shall: "*Enable the provision of commercial services or services offered to governmental users based on commercial infrastructure by the private sector in accordance with Article 7(4), including services to further develop Union and worldwide high-speed broadband and seamless connectivity*".[42]

Therefore, given the structure envisioned for the development of the European project the EU correctly recognised the importance that European companies will retain in the deployment of its large satellite constellation. In particular, it is fundamental that the EU involves European actors to nurture the European satellite market, which can consolidate its know-how – already well established in the GEO sector market – even in large constellations. In addition, the European Commission aims to ensure that the private actors involved in the projects are based in Europe and not subject to the control of third countries to strengthen the strategic autonomy of the EU.[43]

Indeed, well established European space companies welcomed positively the EU initiative, SES which may be one of the most important actors among the European space enterprises in a statement, said: "*The IRIS² constellation that was disclosed is a pivotal milestone to help determine Europe's sovereign space strategy for the decades ahead. As a European company offering satellite-based content connectivity solutions since 1985,* […]".[44]

It follows that for the success of the proper deployment of the constellation, a coherent and safe approach to space must be given by the EU in the years ahead in order to ensure a coordinated front among its member states.

[41] EU Regulation 2023/588 of the European Parliament and of the Council establishing the Union Secure Connectivity Programme for the period 2023-2027 [2023] OJ L79/1.

[42] European Parliament, 'draft Report on the proposal for a regulation of the European Parliament and of the Council establishing the Union Secure Connectivity Programme for the period 2023- 2027' C9-0045/2022 October 2022.

[43] EU Regulation 2023/588 (n 41) Art 22.

[44] Chris Forrester, 'SES supports EU LEO scheme' (Advanced Television, 21 November 2022) <https://advanced-television.com/2022/11/21/ses-supports-eu-leo-scheme/> accessed 9 July 2023.

5 Legal challenges facing large satellite constellations

As extensively described, space operations and services are under an everlasting transformation thanks to the technological fast-paced environment typical of the industry. However, the advent of this modern 'Space Race' did not follow the proper creation of new laws governing the new complexities.

Instead, the opening of these new opportunities in space pushed for the commercialisation of space, where space actors compete to launch services which exploit space orbits and make space congested. Indeed, as shown in paragraph 3.3, private actors, such as Starlink, Blue Origin, or OneWeb, alongside vibrant SMEs are planning to send thousands of satellites in LEO without a properly defined legal framework or guidelines in place. According to Aschbacher, the Director General of the European Space Agency (ESA), space is going to be much more restrictive in terms of frequencies and orbital slots available and the fact that Musk owns half of the active satellites means that he can make the rules himself.[45] We can say that there is an urgent need for governance to catch up with reality.

In the present era, it is imperative to acknowledge that the domain of space law remains comprehensively governed by the Outer Space Treaty (OST), widely regarded as the paramount legislative framework for regulating activities pertaining to space.[46] The OST encompasses a multitude of essential principles that form the bedrock of space law. As stipulated in Article 1 of the OST, it establishes a legal foundation for all endeavours related to the "*exploration and utilization of outer space, including celestial bodies such as the Moon*." Nevertheless, the treaty does not directly target or regulate specific activities, particularly those that have recently gained greater prevalence.[47] Alas, the prospect of amending the treaty to effectively address the novel challenges confronting the space community appears rather remote, given the different perspective among different states which will make complicated to reach consensus in international fora such as the United Nations.[48]

Therefore, regardless of this shift from a state-centric approach to a far greater engagement of private initiatives in space, the international legal framework has not seen any new crucial statutory intervention, since the past century when the international community could agree on a set of fundamental treaties – alongside the

[45] Pelly Hollinger and Clive Cookson, 'Elon Musk being allowed to 'make the rules' in space, ESA chief warns' (Financial Times, 2021) <https://www.ft.com/content/7d561078-37c7-4902-a094-637b81a26241> accessed 9 July 2023.

[46] He Qizhi 'The outer space treaty in perspective' (1997) 25 J. Space L. 93.

[47] Paul G Dembling and Daniel M. Arons 'The evolution of the outer space treaty' (1967) 33 Journal of Air Law and Commerce 419, 456.

[48] Joan Johnson-Freese and David Burbach 'The outer space treaty and the weaponization of space' (2019) 75(4) Bulletin of the Atomic Scientists, 137, 141.

OST – that would set the rules for the space race during the cold war.[49] Therefore, the current framework may appear to become increasingly outdated, and governments are looking into ways to strengthen it.

As pointed out by Freeland: "*It seems that the advent of small satellite constellations is inevitable, at least from the perspective of industry, even in the absence of clear prohibiting regulation; thus, it is important to understand the major relevant legal issues related to this development to be faced in the years ahead.*"[50]

As a result, the international community is currently facing a number of legal challenges that require an appropriate response in order to guarantee the proper functioning of constellations in LEO while preserving the sustainability of outer space. The following are the most imminent legal challenges for satellite operations: licensing and registration of space objects, which are critical given the advent of thousands of satellites in order to be cognizant of the objects floating in orbits; frequency attribution, which must be properly addressed in order to avoid interference and ensure proper communication among satellites and dishes down to earth; and the need for proper space traffic management framework and space debris removal mitigation plan to ensure smooth and safe coordination of the thousands of satellites out there in earth orbit.

Indeed, over 2000 satellites have been launched in the last three years since 2017, accounting for more than a quarter of all items launched in the preceding 60 years. It is obvious that, in terms of keeping track of all space objects, ensuring the safety, security, and sustainability of space orbits it is required a prompt answer.[51]

Notwithstanding, it is acknowledged that just a small portion of space objects are registered in the UN registry of space objects.[52] Indeed, according to NASA human-created space objects – superior to 10 cm – out there in space are over 20000, but just 7949 objects are present in the UN registry.[53]

In the next years, it is crucial that states rigorously adhere to the registration process. States must keep pace with the numerous launches expected in the years

[49] Yun Zhao, 'Space Commercialization and the Development of Space Law' in Peter Read and others (eds), *Oxford Research Encyclopaedia of Planetary Science* (OUP 2017).

[50] Steven Freeland 'Legal Issues Related to the Future Advent of Small Satellite Constellations' in *Handbook of Small Satellites: Technology, Design, Manufacture, Applications, Economics and Regulation* (Springer International Publishing 2020) 1315, 1336.

[51] Henry R Hertzfeld, 'Unsolved issues of compliance with the registration convention' (2021) 8 (3) Journal of Space Safety Engineering 238, 244.

[52] The registration convention of 1976, alongside the Outer Space Treaty of 1967 set out a framework for the registration of space objects, in order to track the space object out there and provide clear data to the space community. In addition, the first U.N. General Assembly Resolution regarding registration was the 1961 U.N.G.A. Resolution 1721 B (XVI). It paved the way for the voluntary reporting of space objects to the UN, which today still remains crucial because of the relatively few nations that have ratified the Registration Convention.

[53] National Aeronautics and Space Administration 'Space debris and human spacecraft' <https://www.nasa.gov/mission_pages/station/news/orbital_debris.html> accessed 10 July 2023.

ahead. Therefore, ensuring an appropriate registration of space objects is fundamental to construct an appropriate governance framework for large constellation of satellites.

In practice, appropriate registration permits that objects in space are identified and tracked, alongside promoting transparency, fair responsibility, and accountability in space activities. Indeed, with information about space objects publicly available, the international community can better comprehend what is happening in space and collaborate to encourage responsible space behaviour. Otherwise, in case of failure on following the registration process in the event of a collision, the process to attribute liability would become extremely challenging. This would lead to complications in attributing responsibility and addressing damages, in particular given the inherently sophisticated nature of space activities.

Moreover, regarding frequency attribution, the International Telecommunication Union (ITU) establishes a framework for frequency coordination through the Radio Regulations. These regulations outline the procedures and criteria for allocating frequency bands and coordinating their use among different satellite systems and terrestrial services. Their objective is to promote efficient spectrum utilisation, minimise interference, and ensure equitable access to frequency resources.[54]

However, the increasing number of satellite constellations and the spectrum requirements they entail pose challenges to the ITU's frequency coordination process. The existing regulatory framework may face difficulties in accommodating the sheer scale and complexity of these constellations, leading to potential conflicts and competition for spectrum resources.[55]

Therefore, proper frequency attribution is even more essential to prevent interference and ensure seamless communication among satellites and between satellites and ground-based systems. Efficient frequency management mechanisms are required to allocate frequencies in a manner that avoids conflicts and optimises spectrum utilisation.[56] Clear guidelines and procedures should be established to address the increasing demand for frequency resources and prevent harmful interference among different satellite systems forming large constellations.[57]

Furthermore, as already mentioned, with the growing number of satellites in LEO challenges the risk of collisions and the proliferation of space debris have become

[54] Roscoe M Moore III 'Business-Driven Negotiations for Satellite System Coordination: Reforming the International Telecommunication Union to Increase Commercially Oriented Negotiations over Scarce Frequency Spectrum' (1999) 65 J. Air L. & Com. 51.
[55] Audrey L Allison 'Requirements for Obtaining Spectrum and of Orbital Approvals for Small Satellite Constellations' in *Handbook of Small Satellites: Technology, Design, Manufacture, Applications, Economics and Regulation (*Springer International Publishing 2020*)* 1263, 1285.
[56] Mahdasi Jalali, Flor G Ortiz-Gomez, Eva Lagunas, Steven Kisseleff, Luis Emiliani and Symeon Chatzinotas 'Radio Regulation Compliance of NGSO Constellations' Interference towards GSO Ground Stations' (2022) IEEE 33rd Annual International Symposium on Personal, Indoor and Mobile Radio Communications (PIMRC) 1425, 1430.
[57] Audrey L Allison (n 55).

significant concerns. A comprehensive space traffic management framework is necessary to regulate the movement and trajectories of satellites, ensuring safe coordination and avoiding congestion in critical orbits.[58]

In addition, space debris mitigation strategies will detain an important role in order to minimise the creation of space debris and actively remove existing ones to sustain the long-term sustainability of outer space.[59]

Governments, international organisations, and private stakeholders will have to face these legal challenges associated with large satellite constellations; they should work together to ensure the appropriate functioning and sustainability of space activities in the face of rapid technological advancements. It will be important to guarantee the success of these networks ensuring the safe deployment of infrastructures able to provide internet connection and safe communication worldwide, especially with IRIS² throughout all the European territory.

6 Facing the legal challenges of large constellations: between international cooperation and national laws

How should we approach all these legal challenges that are presented in front of us is a crucial step in the history of the space law-making process. Either the international community is able to answer the most imminent and compelling issues, otherwise the deployment of large constellations will put in danger the safety, security and sustainability of LEO and as a consequence of the whole outer space. While at the same time not allowing the unfolding of innovation given by space activities.

As a benchmark, the UN COPUOS[60] Guidelines for the Long-term Sustainability of Outer Space Activities might be seen as a good starting point to open the Pandora's box of the many legal questions regarding the need for a new space governance, and in particular for large satellite constellations.[61]

The resolution put forward 21 guidelines that actors involved in space activities should attain in order to ensure the sustainability of space. These include direction on governance framework for space activities, such as safety of space operations, equitable use of the radio frequency spectrum, registration, and mitigation of space debris. Moreover, they urge States and international organisations to voluntarily take action to

[58] Theodore J Muelhaupt and others 'Space traffic management in the new space era' (2019) 6.2 Journal of Space Safety Engineering 80, 87.
[59] Martha Mejía-Kaiser 'IADC space debris mitigation guidelines' in '*The Geostationary Ring: Practice and Law*' (Brill 2020) 381, 389.
[60] The United Nations General Assembly established the Committee on the Peaceful Uses of Outer Space in 1959 to govern space exploration and use of space for the benefit of all humanity: for peace, security, and development. The committee provides a unique forum for international cooperation in space law and policy.
[61] UNOOSA A/74/20, Guidelines for the Long-term Sustainability of Outer Space Activities of the Committee on the Peaceful Uses of Outer Space 2019, para 163 and Annex II.

ensure that these guidelines are implemented to the greatest degree possible. As a result, many of the 21 guidelines address several of the points of friction that the proliferation of large satellite constellations raises in relation to international space law.

Indeed, as pointed out by the Secure World Foundations sustainability in space is: "*ensuring that all humanity can continue to use outer space for peaceful purposes and socioeconomic benefit now and in the long term.*"[62] It seems clear that the commercialisation of space and – in particular – the development of large satellite constellation being one of the biggest challenges that the space community is facing that may end up in rendering earth orbit inoperable. It follows, that it would not be possible to benefit from all the services that well-established large constellations would provide for society, such as bridging the digital divide.

The Guidelines, as the result of a United Nations procedure, address States and multilateral organisations, which hold accountability for space activities performed by both individuals and organisations under their authority or control in the present international order. Sceptical views of the value of such international tools might argue that because the guidelines are optional and non-binding, private companies will disregard them unless they are incorporated into national legislation. In this regard, commercial space actors have a significant role to play in socializing the issue of space sustainability and leading by example to demonstrate their adherence to these guidelines as a minimum standard of responsible corporate behaviour in space.[63]

Therefore, in order to ensure the success in the functioning of a large constellation of satellites it is of critical importance to take into consideration the UN guidelines when considering how to approach space law-making efforts, both on behalf of governmental actors and non-governmental.

Notwithstanding, as well noticed at the moment the common stance is characterised by reluctance to conclude new international binding provisions of international space law. However, as pointed out by Israel the 'treaty statis' of space law-making in the international scenario does not imply that space-fearing actors are not involved in the creation of other kinds of regulation, such as guidelines or standards.[64] Indeed, guidelines and standards have proven to be a good option to face different challenges over the years.

However, the new complexities given by the advent of large constellations might need a more coherent and stronger regulatory approach in order to ensure their sustainable future.

[62] Secure World Foundation, 'Space Sustainability' <https://swfound.org/our-focus/space-sustainability/> accessed 11 July 2023.
[63] Peter Martinez, 'UN COPUOS Guidelines for the Long-Term Sustainability of Outer Space Activities' (2021) 8 (1) Journal of Space Safety Engineering 98, 107.
[64] Brian Israel, 'Treaty Stasis' (2014) 108 AJIL Unbound 63, 69.

As emphasised by Freeland, the current legal framework was not created with small satellite technology in mind. As a result, further regulation will most likely be required particularly at the national level. Bearing in mind that it will need a balance of sometimes conflicting interests between protecting the national or regional activities or fostering innovation, research and development.[65]

At the international level the Committee agreed to form a working group – under a five-year work plan – under its Scientific and Technical Subcommittee to continue the Long-Term Sustainability discussions in COPUOS, in order to foster their development and implementation.

However, COPUOS will have to deal with the challenge of preserving the consensus decision-making rule in a committee that is continuously growing in size. When the Committee started working on LTS in 2010 there were 70 member States. As of March 2023, COPUOS has 102 participants. As the Committee's membership grows, so does the variety of space powers, perspectives, and objectives represent by the member countries. These developments will make reaching an agreement in the Committee even more difficult.[66]

Indeed, at the time being it is not possible to avoid considering that with increasing countries joining the space club, international space legislation proves more difficult in view of diversified interests in space activities. As a result, the adoption of soft-law documents constitutes a favourable option given the impellent need for rules governing the new complexity presented by large constellations. As a second step, legislation at the national level stands out as a viable channel for the regulation of space activities; it can ensure the implementation of soft law via national laws. Indeed, COPUOS has identified space law capacity building as a main task in the new era of space governance.[67]

Therefore, the international community can adopt mainly two different directions. The international dialogue can be fostered by involving the wide members of COPOUS in the development of binding agreements or amendments of one of the 5 foundational treaties of space law.[68] However, this seems a remote option that would be accompanied by a lengthy procedure that would postpone the adoption of a much-needed governance approach to the development of large satellite constellations.

The other path would attain the modern undergoing approach with the development of soft law in the form of guidelines or standards, as well as strengthening existing ones such as the LST, by involving as many states and stakeholders as possible to ensure a common approach in the development of space standards for the governance of large

[65] Steven Freeland *(*n 50).
[66] Peter Martinez (n 63).
[67] See note 52.
[68] The treaties are: The Outer Space Treaties (1967); Rescue and Return Agreement (1968); Liability Convention (1972); Registration Convention (1975), Moon Agreement (1979).

constellations. Following the establishment of new standards, the international community should, over time, encourage their acceptance at the country level, making such rules enforceable on its national space operations.

Indeed, given the growing understanding of the importance of space operations for the future of human endeavours, the space community may remain hopeful that public and, in particular, commercial players will attain the aims of such non-binding agreements during this process. In particular, doing so would avoid leaving card blanche to private actors to self-regulate their activity during the deployment of their large satellite constellations.

In this moment, the latter option would allow the EU to play an important role in fostering this kind of international approach; the EU should ensure a coherent and common front with its Member States. Indeed, with the launch of its own large satellite constellation the EU can put out there its constellation alongside appropriate space behaviour and guidelines. Therefore, leading the adoption of a new safe, and sustainable approach in the deployment of large constellations of satellites, which for the time being have been led mainly just by private parties.

Indeed, as is customary in the formation of international consensus, fostering the discussion on certain arguments can be beneficial in bringing specific issues to the forefront in order to set the stage for the development of future normative approaches. Here it enters the role of the EU with its IRIS² constellation alongside a set of new space initiatives at the European level that will be presented in the next section. In particular, the debate in finding legal solutions at the international level might take into consideration the new approach that the EU is posing toward space matters.

7 A momentum for a new European approach to space law and policy

The scope of this section is not analysing the evolution of European space law and policy; rather, to consider the legal framework within the EU can take action today in order to understand where it might go in the future, given the importance of proper direction for the deployment of large satellite constellations while ensuring the safety, security, and sustainability of outer space.

Indeed, since the end of the last century, the EU has been committed to developing a European Space Policy, investing significant resources in promoting and carrying out European Space Programmes, as well as increasing the synergies of space-based applications in different EU policies. This action was bolstered further by the Lisbon Treaty with the introduction of Article 189 TFEU which includes a clear and particular competence on space titled “Research, technological development, and space.”[69] Since

[69] Consolidated version of the Treaty on European Union [2008] OJ C115/13.

the introduction of Article 189 the EU has taken a proactive approach to space matter increasingly day-by-day.

However, according to art.4(3) and art. 189 TFEU, the European Parliament, and the Council are yes entitled to adopt, on the basis of a proposal from the European Commission, regulations, directives, or decisions, provided that they are not aimed at harmonizing national legislation. It follows that harmonisation to obtain a more uniform European legal framework is not possible, even if such a framework would better promote private sector activities on the use of space, alongside enhancing competition intra-industries in Europe.[70] Therefore, Member states preferred to reserve the matter just for national law, fearing that otherwise, a de facto power transfer from the European Council to other institutions less subject to their control might occur.[71]

Indeed, respect other areas of law, where according to the principles of "subsidiarity" and "proportionality," member states would no longer be allowed to draft their own legislation if those competences had been transferred to the European level and such transfer was instrumental to ensure a harmonised regime, if necessary, by harmonising existing national regimes, here such harmonisation is not a followable path.[72]

Nevertheless, recently, the European Union has taken a strong stance in its space policy approach, the new proactive attitude is driven by several factors, including the increasing crystal-clear importance of space activities and the fierce competition raising among states and private parties to increase their space endeavours.

The announcement of the launch of its large satellite constellations, the publication of its Space Strategy for Security and Defense,[73] the publication of a Draft Opinion by the Council of the European Union on "Fair and Sustainable Use of Space", [74] and the publication of an EU approach to Space Traffic Management[75] clearly shows the importance that space bears for the Union.

The Council draft opinions are non-binding documents showing an overall political direction in order to foster the debate on specific matters. In the draft opinion on "Fair and Sustainable Use of Space" have been underlined an important point that can be considered for an attentive approach in the deployment of large satellite constellations.

[70] For a deep analysis of EU space law and policy see: Sergio Marchisio, *The Law of Outer Space Activities* (Edizioni Nuova Cultura 2022).
[71] Julién Beclard, 'With the Head in the Air and the Feet on the Ground: The EU's Actorness in International Space Governance' (2013) 19(3) Global Governance 463, 479.
[72] Frans G von der Dunk 'The EU Space Competence as per the Treaty of Lisbon: Sea Change or Empty Shell?' (2011) 66 Space, Cyber, and Telecommunications Law Program Faculty Publications 382.
[73] Commission, Joint Communication to the European Parliament and the Council European Union Space Strategy for Security and Defense JOIN (2023) 9 final.
[74] Council of the European Union, 'Draft Council conclusions on "Fair and Sustainable Use of Space' 8962/23, 5 May 2023.
[75] Commission, 'Joint Communication to the European Parliament and the Council An EU Approach for Space Traffic Management An EU contribution addressing a global challenge' JOIN(2022) 4.

First, the opinion acknowledges the fact that specific satellite orbits, especially LEO, are rapidly becoming hazardous areas due to space debris and non-manoeuvrable satellites orbiting at very high speeds. Then, it encourages the European Member States to continue the implementation of the 21 voluntary guidelines for the Long-term Sustainability of Outer Space Activities in order to achieve a European Long Term sustainable approach. It also calls for the creation of agreements regarding requirements to be fulfilled by all satellite service providers providing services for the EU and its citizens. Of particular interest, it calls to consider that:

"*The current requirement on a safe decommissioning of satellites 25 years after end-of-life might be too long; and INVITES the Commission to put forward suggestions for requirements to be discussed with Member States in order to achieve sustainability* […]".[76]

Therefore, the draft opinion includes requisites that if carried out would sustain action to ensure also safe and sustainable deployment of constellations in order to ensure the proper sustainability of orbits according to the COPUOS guidelines.

Moreover, the Space Strategy for Security and Defense is an important step for a common approach to space for matters related to international security, which is its main focus. In this regard, it lies down the basis for the creation of a future European space law. Indeed, it calls for the need: *"To enhance the level of security and resilience of space operations and services in the EU, as well as their safety and sustainability, the Commission will consider proposing an EU Space Law*". [77]

Therefore, the European Commission is considering the proposal for an EU space law. The legislative proposal should mainly address the resilience of space systems and services to ensure coordination between Member States and would be placed alongside other European cyber laws in order to be able to offer a comprehensive framework for space systems and services. In this regard, the law will focus mainly on the need for coordination to ensure the safety of space assets and their safeguard against cyber threats.

However, on the wave for a European space law – mainly focused on security and defense matters – in the future the EU might coordinate and approximate different national laws into law at the European level.

In particular, it can be said that the EU space law called in the Space Strategy for Security and Defense if enacted would circumvent the limit of Article 189 TFEU that does not permit the harmonisation of space law at the European level.

[76] Council of the European Union (n 75).

[77] European Agency Defence, 'European Union Space Strategy for Security and Defense' <https://eda.europa.eu/news-and-events/news/2023/03/10/eu-space-strategy-for-security-and-defence-to-ensure-a-stronger-and-more-resilient-eu> accessed 11 July 2023.

Indeed, as cited above according to Articles 4(3) and 189 of the TFEU the EU can adopt legislation in space matters. However, Article 189 specifically introduced a competence to create a European Space Policy which does not allow the harmonisation of Member States' laws and regulations. These constraints have been the subject of strong debates, with many claiming that the competence given to the Union was not shared, but rather a 'sui generis' parallel competence. The Space Strategy for Defence and Security does not design how the European Union would address the issue of legitimacy for the creation of such a law. Therefore, the EU institutions would have to rely on Member States' cooperation, the EU would have to convince its Member states that law at the European level would serve better the interest of the EU and its space companies.[78]

Therefore, it may follow that the EU will shift its approach to European space law-making. Indeed, if the proposal for an EU space law would succeed – as envisioned by the Space Strategy for Defense and Security – the EU may pave the way for the prospect of harmonisation in space law matters, where retained necessary closely collaborating with its Member states. As a result, it would be possible to guarantee more coordinated and coherent laws also in other facets of space law, such as coordination for matters of space traffic management, debris mitigation, registration, or spectrum frequencies. Consequently, it would be better ensured the safety, security, and sustainability of European space assets, such as satellites forming up IRIS².

For the time being – as noticed in Section 4 – given the development of IRIS² as PPP the EU should ensure to accompany the tenders for procurement with specific requirements that would ensure the safe and sustainable design, development, validation, deployment, and operativity of its constellation, such as Life Cycle Assessment,[79] appropriate spectrum frequency coordination and ensuring a coherent approach to space traffic management and debris mitigation.

As envisioned in its Joint communication on a European approach to Space Traffic Management: "*The EU should be pro-active at ensuring the development of international standards where feasible and needed and developing its own EU standards whenever appropriate.*"[80]

As a consequence, the EU in the launch of its constellation might be able to ensure the highest standards and guidelines in relation to the numerous legal challenges following the advent of large satellite constellations. The EU would act as a champion of

[78] Gilda Caso, 'The New European Union Space Strategy for Security and Defence: Perspectives and Opportunities' (2023) 22 (1) The Aviation and Space Journal 51.
[79] Thibaut Maury, Philippe Loubet, Sara Morales Serrano, Aurélie Gallice and Guido Sonnemann, 'Application of environmental life cycle assessment (LCA) within the space sector: A state of the art' (2020) 170 Acta Astronautica 122, 135.
[80] Commission, 'An EU approach to Space Traffic Management' <https://defence-industry-space.ec.europa.eu/eu-space-policy/eu-space-programme/eu-approach-space-traffic-management_en> accessed 11 July 2023.

responsible behaviour in LEO, advocating for the respect of international commitments and guidelines such as the COPOUS LST. It will be a concrete step for the EU to strengthen its position as a role model in the international scenario. In this regard, the EU if successful might leverage its capabilities in the safe deployment of the constellation leading the direction of international dialogue. It would constitute a first step in the direction of strengthening the role of the EU as a leader in the coordination of space law projects in the EU, and consequently in the international scenario.

Indeed, given the increased significance of space in the future, it will be critical for the EU to maintain a more consistent and coordinated posture in the international scenario.

It appears to be a very promising future scenario, but it is now time for new kinds of responses to ensure that the EU remains at the forefront of the development of legislative evolution in response to the emergence of new legal challenges to international space law posed by the arrival of thousands of small satellites and the technologies contained within them.

8 Conclusions

During the past years has come to the spotlight the importance that space communications detains for the functioning of society. Internet connectivity has become a crucial component of every country's critical infrastructure given the reliance of all aspects of economic activity and social development on Internet communications, the capability of a state or organisations to provide ubiquitous connection throughout their territory can constitute a factor of influence in the international scenario. Large satellite constellations come to our aid having the capability to provide broadband internet connection anywhere in the world, therefore ensuring that everyone can have equitable access to the same opportunities offered by the internet.

In that regard, this paper sought to show that the upcoming of IRIS² constellation provides an incredible opportunity for the European Union to bridge the digital divide and strengthen its role in the international scenario. The EU deploying a large constellation of satellites providing internet broadband connectivity can ensure equitable access to digital services for all its citizens - and close neighbours – and promote economic growth and technological innovation.

However, as shown in section 5, the success of the IRIS² project hinges upon a set of challenges, from legal and regulatory concerns to technical complexities, and the risk of collision followed by the formation of orbital debris. The EU, alongside its Member States and the International Community, must establish a robust and coherent legal framework, engage in international cooperation, and adopt innovative solutions in areas like space traffic management or space debris mitigation.

Section 6 underlines that the UNCOPUOS remain the principal and most important law-making body in space matter, however in the actual scenario it would not be capable to produce hard law in the time needed. Therefore, the best followable road is to foster the formation of soft law including the participation of different stakeholders as extensively as possible and then, encouraging the implementation of national legislation in the different states in order to make the guidelines enforceable by states over their national players acting in space. As an example, Adolfo Urso the Italian Secretary of State for industries, whose portfolio includes space, called for the need for a new Italian Space law to be adopted during the next year,[81] in order to govern the new complexity given by the proliferation of private initiatives in outer space; therefore, showing the awareness and commitments of states to act promptly in the near future.

In the last section the paper intended to underline that the IRIS² success also would offer the EU an opportunity to leverage its achievements in fostering a stronger stance in the international space community and in the law-making process, further promoting normative power in the space sector. As space activities continue to expand and evolve, the EU's leadership and promotion of international space law will have far-reaching consequences for the global space community. By successfully implementing IRIS², the EU can establish an example for responsible spacefaring nations in the deployment of large satellite constellations, paving the way for future generations to benefit from a more inclusive, sustainable, and well-regulated space environment.

[81] Antonella Salerno, 'Space Economy, Urso: "Italia protagonista, nuova legge in tempi rapidi"' (SpaceEconomy360, 11 April 2023) <https://www.spaceconomy360.it/politiche-spazio/space-economy-urso-italia-protagonista-nuova-legge-in-tempi-rapidi/> accessed 11 July 2023.