White Paper 9

outer space

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1.

state of the art:
current
space activities law

International space law is a relatively new branch of international law. Even though writings referring to an outer space law appeared as soon as 1910, it is only in the second half of the 20th century that its study and development became systemized. From the 1960s onwards, and under the instigation of the United States and the USSR, space law was formally developed within the United Nations Committee on the Peaceful Uses of Outer Space (hereafter "COPUOS") (Section 1). Afterwards, due to a progressive privatization of space activities, States adopted special national legislations based on the main principles defined in the international order, and in some instances even went beyond them. (Section 2).

Section 1
International Space Law

In 1958, barely a year after Sputnik, the first artificial satellite to orbit Earth, was launched by the USSR, the General Assembly of the United Nations created the COPUOS. This *ad hoc* Committee is tasked, among other, with studying legal problems arising in programs to explore outer space. A year later, the General Assembly Resolution 1472 (XIV), established the COPUOS as a permanent body, and its missions were extended to the examination of international cooperation and the study of practical and applicable measures to carry out programs relating to the peaceful uses of outer space that might usefully be undertaken under the auspices of the United Nations. In 2021, the COPUOS had 100 members.

In 1963, the COPUOS adopted the Declaration of Legal Principles governing the Activities of States in the Exploration and Uses of Outer Space, providing the foundations for this new field. The principles established then served as a guide for all negotiators of subsequent instruments, whether they are adopted under the auspices of the United Nations (A.), or by other governmental and non-governmental entities (B.)

A. General Space law

International Space Law has been shaped and based on general texts developed within the COPUOS. Initially, and until the 1980s, this was done based on binding international agreements (1). Following the lack of widespread adherence to the Moon Agreement, rejected by the spacefaring nations, this regulatory dynamic faltered. It led to the adoption of non-binding and more technical legal instruments (2).

1. Space Law Treaties

Today we count five space law treaties. The first one is the *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies* (hereinafter "Outer Space Treaty") of 1967, which is supported by four others, clarifying and implementing some of its principles:

- *The Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched into Outer Space*, of April 22, 1968 (hereinafter "Rescue Agreement"),
- *The Convention on International Liability for Damage Caused by Space Objects*, of March 29, 1972 (hereinafter "Liability Convention"),

Figure 1
Signature of the Outer Space Treaty (source: *UN Photo/x*)

- *The Convention on Registration of Objects Launched into Outer Space*, of January 14, 1975 (hereinafter "Registration Convention"),
- *The Agreement Governing the Activities of States on the Moon and Other Celestial Bodies*, of December 18, 1979 (hereinafter "Moon Agreement")

Compared to other branches of international law, the dynamics of space law negotiations were historically characterized by a proactive part played by the two space powers of the time: the United States and the USSR. This is still the case today, even if

to a lesser degree, as new States have joined the restricted group of space powers.

At the time of the race to the Moon it was essential to clarify with agreements the legal framework applicable to space and to celestial bodies. From 1966 onwards, negotiations accelerated, now that the USSR completed the first successful moon landing with the Luna 9 space probe.

It is in this context, that the United States, which had been unwilling to create an international space treaty, reopened negotiations with the USSR. For both States, the main objectives were to have a legally binding framework, in order to guarantee the principle of non-appropriation and the prohibition of any military activity on the Moon. In the end, it was decided that the negotiated treaty should not be limited to the activities on the Moon but should also be applicable to the rest of outer space. It was agreed that a more precise agreement on lunar activities would be discussed soon.

The Outer Space Treaty is relatively short and establishes only a limited number of principles. This is due to the intensions of the Parties to agree on as many questions as possible and to focus on the topical issues only. Therefore, the main principles enshrined in the Treaty are:

- The freedom of exploration, use and scientific investigation in outer space, on the Moon and other celestial bodies (article I),
- The non-national appropriation of outer space and celestial bodies (article II),
- The respect of international law, including the Charter of the United Nations, concerning activities in outer space (article III),
- The peaceful use of outer space and an exclusively peaceful use of celestial bodies (article IV),
- The protection of all astronauts considered as “envoys of mankind” (article V). This principle was completed afterwards by the Rescue Agreement of 1968,

- The direct and international responsibility of States for activities in outer space carried out by governmental entities, including private entities, as well as the obligation for States to authorize and survey activities carried out by non-governmental entities in outer space (article VI),
- The international liability of launching States for damages caused by space objects (article VII). The implementation of this principle is completed by the Liability Convention of 1972,
- The jurisdiction and control of the registration States over objects launched in outer space and over any personnel on board (article VIII). These principles will be further developed in the Registration Convention.
- The principle of non-contamination of the Moon and Earth (planetary protection) and the principle of *due regard* (article IX).

These principles, formulated at the end of the 1960s, at a time when space activities were not yet very developed, have never been amended. Until recently, their efficiency and effectiveness have never been questioned, even if some rules do not benefit from a uniform interpretation by all States, such as the principle of non-appropriation.

2. The development of soft law for outer space

The end of the 1970s marked a pause in the space race. The conquest of the Moon had been driven by national prestige. The Americans having achieved their goal, they abandoned the Apollo program. From the 1980s onwards, outer space started opening up to commercial activities. In this context, States considered that they must work on a framework concerning space applications and on the promotion of space cooperation rather than on developing new binding legal instruments. With this is mind, a set of resolutions including declarations and principles was adopted by the General Assembly of the United Nations in the 1980s and 1990s, on a more flexible basis and respecting the freedom of the space powers:

- *The Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting* of December 10, 1982,
- *The Principles Relating to Remote Sensing of the Earth from Outer Space* of December 3, 1986,
- *The Principles Relevant to the Use of Nuclear Power Sources in Outer Space* of December 14, 1992,

- *The Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries* of December 13, 1996.

Since the 2000s, the COPUOS has abandoned normative principles in favor of more technical texts as guidelines or recommendations based on State practices. These instruments were subsequently taken up by resolutions of the General Assembly of the United Nations. Among them:

- *Space Debris Mitigation Guidelines*, approved in 2007,
- *Safety Framework for Nuclear Power Source Applications in Outer Space,* adopted in 2009,
- *Guidelines for the long-term sustainability of Outer Space activities of the Committee on the Peaceful Uses of Outer Space* of June 19, 2019.

Even if they are not binding, these texts are generally applied by all the space powers. Some commentators argue that some of them have acquired the value of customary law, but this view is not unanimously shared.

B. Specific instruments concerning space activities

In addition to international Space law adopted under the auspices of the United Nations, other legal instruments have been adopted by both governmental and non-governmental entities and are intended to govern space activities directly. It's the case of the International Telecommunication Union Law (hereinafter "ITU') (1.), the legal corpus of the International Space Station (hereinafter "ISS") (2.), the Planetary Protection Policy developed by the Committee on Space Research (hereinafter "COSPAR") (3.), the Space Protocol of the International Institute for the Unification of Private Law (UNIDROIT) (4.) and the Artemis Accords (5.).

1. International Telecommunication Union law

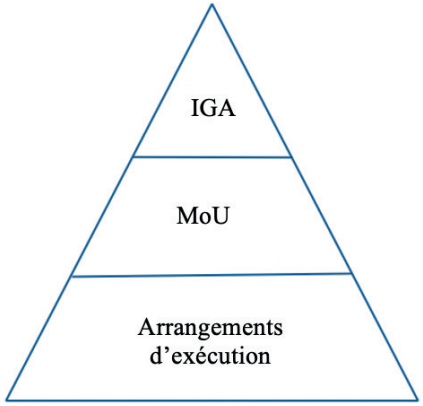
The space applications, whether civil or military, rely mainly on satellites used for communication, observation, meteorology, positioning/navigation, and electromagnetic listening. Space exploration also uses communication channels between Earth and Space. It is therefore understandable that space activities rely on the use of telecommunications resources: the radio spectrum and, if necessary, associated orbits. International cooperation concerning telecommunications falls under the

jurisdiction of the International Telecommunication Union. Seen from this perspective, space activities are governed by three instruments:

- The Constitution of the International Telecommunication Union of 1992,
- The Convention of the ITU of 1992,
- The Radio regulations, which have the value of a treaty and include technical norms that are periodically revised at world and regional radio conferences. The latest version is from 2020.

2. The International Space Station law

In 1984, during a G7 meeting, Ronald Reagan launched the idea of creating an international space station, an idea which was accepted by several states: Japan, Canada and the European Space Agency members. Russia was asked to join the project a few years later. After years of negotiations, a legal framework for the ISS was adopted in 1998. It took the form of a three-level pyramid.



At the top is the Intergovernmental agreement (referred to as "IGA") signed on January 29, 1998. This agreement, concluded between partner States, is the keystone of the ISS regime. All subsequent instruments refer to it and are subject to it. The purpose of this agreement is to establish a long-term international cooperative framework among the Partners, for the design, development, operation, and utilization of the ISS for peaceful purposes (Article I). It deals with many issues, partic-

ularly those related to the jurisdiction of the stations' modules, the liability between States involved, criminal jurisdiction, immigration and customs, and even intellectual property rights.

- At the second level of the pyramid, there are four Memorandums of Understanding (MoU), concluded between NASA and every partner agency: the Canadian Space Agency (CSA), the European Space Agency (ESA), the Russian Federal Space Agency (Roscosmos) and the Japan Aerospace Agency (JAXA). These memorandums described the role and the operational responsibilities of the agency in the design, development, operation, and utilization of the station.
- Finally, at the lower level, there are more detailed implementation arrangements which national agencies conclude to implement the MOUs.

3. The Planetary protection policies of the Committee on Space Research

The Committee on Space Research (hereinafter "COSPAR") is a non-governmental international organization created in 1958 during the International geophysical year by the International Science Council. This committee, whose headquarters are in Paris, aims to "promote on an international level scientific research in space, with emphasis on the exchange of results, information and opinions, and to provide a forum open to all scientists, for the discussion of problems that may affect scientific space research".

The Planetary Protection Policy, adopted for the first time in 2002, represents the implementation of article IX of the Space Treaty, relating to the principle of non-contamination, since it has the double aim of ensuring that scientific research on celestial bodies will not be compromised by human contamination and of protecting the Earth from possible contamination by an extra-terrestrial organism. Thus, depending on the aim of the research, the celestial body studied, and the trajectory (contact or not with a celestial body, return to Earth, etc.), appropriate precautionary measures must be respected (sterilization, decontamination, quarantine...). Even though it is not binding, this document is widely respected by national space agencies.

4. The Space Protocol of UNIDROIT

The Convention on International Interests in Mobile Equipment (known as the "Cape Town Convention"), adopted in 2001 under the UNIDROIT, intends to standardize and harmonize transactions involving movable property. Four protocols were subse-

quently adopted to facilitate the implementation of this text in certain sectors: aircraft equipment (signed in 2001), railway rolling stock (signed in 2007), space assets (signed in 2012), and mining, agricultural and construction equipment (signed in 2019). Only the Aircraft Protocol entered into force.

The protocol concerning specific matters on Space Assets was adopted to facilitate the acquisition and financing of space assets, that is, all or part of space vehicles and payloads. It provides a stable legal framework and an appropriate environment for the transactions involving space assets. The text harmonizes and modernizes the law on secured debt and leasing operations, facilitating theoretically the arrival of new actors in this expensive and risky field. However, in 2022, this protocol has only been accepted by 4 of the 10 states necessary for its entry into force. This text has been highly contested by the main satellite actors (companies and professional associations) as they consider it potentially harmful, particularly for manufacturers and small satellite operators. It was argued that the Protocol only adds complexity and limits access to a sector that is already functioning very well.

5. Artemis Accords

The Principles for Cooperation in the Civil Exploration and Use of the Moon, Mars, Comets and Asteroids for Peaceful Purposes or the "Artemis Accords" are a series of accords that aim to establish a set of principles to guide the future space exploration and cooperation, notably in the frame of the Artemis program, aiming to send back human on the Moon. They were developed by the United States in 2020 and represent a major initiative in space law despite there are not considered as "law", either hard or soft, by all. Indeed, in addition of providing a new interpretation of the 1967 treaty, they open the door for legal developments in an area that has been frozen for several decades. To this date, 20 States have become signatory to the Accords, confirming their interest in the Artemis program and their consistent interpretation of the Space treaty with the United States. These adherences progressively create a shared vision of space cooperation and exploration.

Among the principles enshrined by the Artemis Accords, some of them are new and not contested, others are new and disputed, and others expressly repeat the provisions of the Space Treaty.

- New and undisputed principles, subject to the modalities of their implementation: the principle of protection of the lunar cultural heritage and the right to create safety zones.
- New and disputed principles: the Artemis Accords provide, in section 11, that the extraction of space resources does not constitute national appropriation under Article II of the Outer Space Treaty of 1967. This principle takes place in an already fierce debate within the space law community. Although it was initially widely contested, it is noticeable that, over time, the criticism has faded. However, no international consensus seems to have been found on this issue, except regarding the scientific use of space resources.
- Principles already set out: the principle of exclusively peaceful use of celestial bodies, the principle of transparency through the propagation of scientific information and space policy elements, assistance in case of distress in space, registration of space objects, prevention of activities detrimental to other States and non-proliferation of space debris.

Section 2
The development of a national Space law

International Space Law was at first developed, based on international law, by the implementation of principles set out by UN treaties (top-down approach). Today, the dynamic tends to be reversed, and international space law tends to rely on national practices and norms adopted by States (bottom-up approach).

Initially, States that have a national legal framework for their spatial activities center their legislation around three principles resulting from the Outer Space Treaty of 1967 and subsequent treaties: the principle of authorization and continuing supervision of activities conducted by non-governmental entities, liability for damages caused by space objects and the obligation of registration. These legislations are generally focused on three activities: the launching of a space object, the return of a space object and orbital maneuvers. A law concerning Space Operations has thus been adopted in the following countries: Australia (1998), Austria (2011), Belgium (2005), Denmark (2017), Finland (2018), France (2008), Greece (2017), Honk Kong, China (1997), Japan (2016), Kazakhstan (2012), the Netherlands (2006), New

Zealand (2017), Norway (1969), Russia (1993), South Africa (1995), Sweden (1982), Ukraine (1996), the United Kingdom (1986), the United States (1984)... Other States have adopted regulations or laws for some activities, such as Spain or Argentina on registration, or Canada and Germany that have specific legislation on the Earth Remote sensing. Furthermore, because of the commercialization of space activities, we notice in some States, from the 1980s onwards, the development of a private space law which has adapted to the legal constraints imposed by international space law. It is based on space contract law, space insurance law, and liability and dispute settlement mechanisms.

Until recently, the content of these national legislations did not cause any difficulty, as they only used, sometimes by different mechanisms, stable and commonly accepted principles of international law. Recently, some States, the United States in the lead, have adopted legislations that, for some, go beyond what is written in space treaties to encourage private entrepreneurship. These initiatives are sometimes welcomed, like the regulation of suborbital flight, or disputed when it comes to authorizing the exploitation of celestial bodies' resources. Four States have adopted legislation concerning this field: the United States (2015), Luxembourg (2017), the United Arab Emirates (2019) and Japan (2021). Although the first laws, the American and Luxembourgish ones, were criticized by a part of the doctrine and by some delegations at COPUOS, it would seem that, in the foreseeable future, they have led to a new interpretation of article II of the Outer Space Treaty relating to the principle of non-appropriation. This gradually shifts international law to the point of making it evolve. In 2020, the United States promoted the "Artemis Accords", enshrining the possibility of extraction and use of resources from celestial bodies for other purposes than scientific research. These "Accords" are open to all States wishing to participate in NASA's Artemis program, which aims at sending the first woman and the first person of color to the lunar surface. In June 2022, 20 States signed the Accords, thereby confirming their agreement with the U.S. interpretation of the space treaty and with one another. For its part, the COPUOS has struggled to set up a working group on the issue. It should submit its conclusions in 2027, but the aim is now to offer some clues as to the regime of the exploitation of celestial bodies' resources instead of wondering about the international legality of such an activity.

2.

the challenges

While Space activities developed in the context of the race to the Moon, during the Cold war, and with an aim that was more symbolic than development, they have evolved considerably since then. Historically, space activities were first undertaken by governmental entities before the private sphere became interested in them. This dynamic is on the rise over the last two decades, marking the beginning of the famous "new space": new actors, new measures and new aims, all of them breaking with the space traditions known until then. This tumult effervescence has deeply affected the space sector, to the point where we now speak of a "democratization of space". The miniaturization of equipment, for example small satellites, is encouraging new private actors to get into the space adventure. However, a key point is that the drastic reduction of launching costs, thanks to an increase in competition, and the existence of more efficient techniques and technologies make the access to Space much easier for a growing number of actors. In the 1960s and up to the 1990s, the price of the launch was stable and averaging around $20,000 per kilogram launched. With the arrival of Space X's Falcon 9 launcher in 2010, the price was divided by 10 and dropped to $2,000/kg. Its heavier version, known as Falcon Heavy, can send payloads into space for $1,600/kg. Finally, it is estimated that Starship, Space X's future super-heavy launcher, will offer prices at $200/kg.

In addition to increasing the number of objects sent into Earth's orbit, the democratization of space is proportionally increasing our dependence on satellite' applications, which form the pattern of our daily lives, whether for Earth observation, geolocation/navigation, telecommunications and connectivity, or television and video. It is now known that, on average, a citizen uses space services almost 40 times a day. Without satellites, we would be deprived of a large part of our communications, we would no longer be able to control energy management, and we would only be able to forecast the weather 2 days before. It would also be impossible to follow the impacts of climate change. Beyond the comfort that space offers to us, it is also one of the main backbones of the world economy. Indeed, thanks to satellites, stock markets and cash machines can be synchronized on a universal time and therefore function. The armed forces, for their part, are largely dependent on space data which has become necessary for territorial defense and for external operations.

These evolutions stimulate our curiosity and dreams, but also give rise to fears and invite some to rethink the place of the Human on Earth, and even its legitimacy in the universe: how far will we go? From a more pragmatic point of view, they raise many challenges for the space sector. Some of them are related

to the overexploitation of our orbits (Section 1.), others to the new space economy (Section 2.) and finally to the military use of space (Section 3.).

Section 1
The Increasing Number of Space Objects

The first thing that comes to mind when we think about space, or when we look at it, is its infinite and horizonless expanse. However, the reality of space activities seems to run counter to this idea, and many of the challenges they face today can be linked to paradoxical observation: the first problem of outer space, is the lack of space. The increase in the number of objects sent has highlighted the orbits' congestion: 130 objects launched into space in 1970, 121 in 2000, 456 in 2017, 1807 in 2021. The surge in space objects will considerably increase due to the parallel development of several satellite constellations and mega constellations. However, despite the rise in space activities, they are still confined to a limited space. 99% of objects launched since the beginning of the space age are located at less than 36 000 km (limit of the geostationary orbit), of which more than ¾ at less than 2000 km, in low orbit. Thus, Earth's orbits are now reaching saturation. This situation threatens the safe and sustainable exploitation of outer space and raises several challenges: prevention of space debris (A.), use of frequencies without harmful interferences (C.), and more recently, space traffic management (B.).

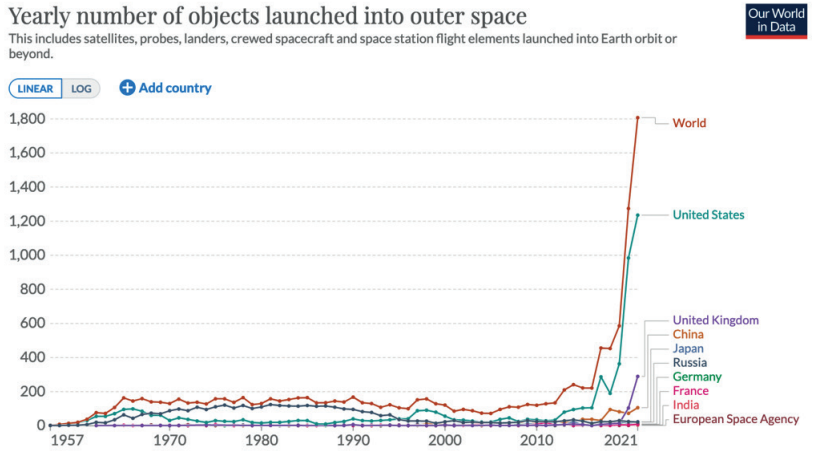


Figure 2 - Number of objects launched into space per year (Source *"Out world in data"*, based on Online Index of *Objects launched into Space* of the UN office for Outer Space Affairs).

A. Prevention of Space debris

Space waste (also known as space debris) is a phenomenon as old as space use. When the first artificial satellite, Sputnik 1, was launched to orbit Earth on October 4, 1957, there was already more debris than operational objects. The small spacecraft weighed only 87 kg while the central stage of the launcher, also on orbit, weighed 6,500 kg. Moreover, the satellite was operational for only 21 days out of the 91 spent in space. Today, it is difficult to quantify the amount of space debris, as its size and origin are hard to determine. The European Space Agency, while indicating that not all the objects are tracked and recorded, counts 36,500 space debris objects greater than 10 cm in size, 1,000,000 space debris objects from 1 cm to 10 cm and 130,000,000 space debris objects smaller than 1 cm.

The origins of this debris are various and can be natural or artificial:

- Fragmentation debris. This includes debris resulting from the internal exploding of objects, due, for example, to battery failure, presence of propellant, exploding tanks, etc.
- Collisions between spacecraft and/or space debris. This event is rare but is the source of a large amount of debris. This occurred in 1996, 2009, 2013 and 2021.
- Objects having reached the end of their operational lives. This includes objects that are no longer needed in space, such as launch vehicle stages and non-functional satellites.
- Voluntary destruction of satellites. It is a part of the testing of anti-satellite missiles (known as "ASAT" for "Anti-SATellite"). To this date, only four powers have shown to have this type of technology: the United States, China, India and Russia. Each State has generated clouds of debris of varying size.
- Objects lost by humans during extravehicular missions. These debris are anecdotal.
- Kessler Effect: growth of the debris population through regeneration when debris collide with each other.

Most of these debris are in low Earth orbit and will fall back naturally on Earth due to the combined effects of gravity and the remaining atmosphere found there. However, this process may take several years, decades or centuries, depending on the altitude of the debris. During this period, they represent a major risk for space activities. Indeed, in addition to the risk linked to the growth of activities previously mentioned, debris are not maneuverable and therefore can't avoid the other objects they will come across. Moreover, based on NASA's Don Kessler's calculations, the pace of debris regeneration is higher

than their disappearance. This vicious circle threatens all space activities. Over time, humans could become prisoners of their own planet.

B. Space traffic management

To avoid collisions and other interferences between space objects, a new approach has been developed: Space Traffic Management (STM). It is based on two pillars, one capability-based, and the other regulatory, and it aims to promote the safety of access, space activities and the return from outer space, without interference.

Within this approach, there are several unrelated sub-categories:

- Space Situational Awareness (SSA) and Space Surveillance and Tracking (SST)
- Space debris mitigation and removal
- Management of orbit and frequency
- Life cycle of space objects from launch to deorbit
- Re-entry of spacecraft into the airspace

Today, and despite the unanimous recognition by the international society of the importance of these matters, initiatives to counter this phenomenon remain limited both geographically and materially. From a regulatory point of view, the United States is the only country to have adopted the directive concerning the Space Traffic Management in 2018, while in 2022, the European Union decided to strengthen its capacities related to the surveillance of space, notably by coordinating regulatory and standardization activities. For the EU, as for other countries, space traffic management capacities need to be strengthened. To this date, only the United States and Russia have SSA and SST technologies and only a Japanese company, Astroscale, has demonstrated the feasibility to remove space debris from orbit.

C. The prevention of harmful interference

The access to the "spectrum-orbit" resource is a crucial asset for the conduct of space operations around the Earth. The ITU has a key role in supporting international cooperation in the use of this scarce and shared resource. In the absence of clearly established procedures, states would face harmful interferences that would severely disrupt the functioning of space objects. Since the beginning of the space conquest, the "first come, first served" rule has been imposed. States that register

at the ITU space and orbit frequencies and associated orbital position, obtain international protection against interferences. By doing this, States undertake to stop interferences affecting registered frequencies. The ITU looking at applications in order of arrival, the first to file are the first to be served. The international protection covers the duration of use of the resource. This normally is equivalent to the satellite's operational life, but operators generally replace it to extend the validity of the international guarantee against interferences. In the 1970s and the 1980s, in response to the needs of developing countries, which feared being deprived of access to space due to a lack of spectrum resources, the ITU enshrined in its constitution the principle of equitable access to space resources and planned the use of certain frequencies' bands by guaranteeing each State access rights, independently of their actual use. Today, the ITU's model is being threatened by the multiplication of launches and the diversification of space systems. In 2019, the ITU simplified the regulatory framework applicable to small satellites, whose number has increased significantly. The same year, it adapted its procedures to the orbit placement of satellite constellations. However, the deployment of mega-constellations represents an unprecedented challenge for the ITU. Never before have humans launched so many objects into space. With its 12,000 planned satellites, the Starlink project, will multiply by 3 the number of satellites in orbit, and the number of operational satellites by 5. The procedures implemented by the ITU at the beginning of the space era to prevent harmful interferences, could turn out to be ineffective. In 2012, operators welcomed the establishment of an international emission control system that allows the identification of the source of interference, but, facing the multiplication of interferences, the ITU has to redesign its dispute settlement mechanism and strengthen its monitoring and sanctioning powers.

Section 2
The New Space Economy

Initially, and until recently, space activities were limited to just a few activities: exploration, scientific research, satellite applications (Earth observation, meteorology, telecommunications, television, positioning, etc.) to which transport services can be added. The vast majority of these activities offer services provided from space to Earth. The emergence of the *New Space* has been marked by the appearance of programs and concepts, some of which could until then only be found in science fiction.

Many will never take shape. Others are being developed. They pose new challenges for the space sector and lead lawyers to adapt the existing international framework.

A. Space tourism

This leisure activity in space, while not new, has begun to extend. In 2021, three companies managed to send people into space or to the edge of the atmosphere for the first time, marking the beginning of their tourism activities: Virgin Galactic (July 11, 2021), Blue Origin (July 20, 2021), and Space X (September 15, 2021).

The first space tourist, Dennis Tito, was sent for 8 days on the International Space Station in 2001, for the handsome sum of 20 million dollars. Between 2002 and 2021, 7 other people fulfilled this adventure, with prices ranging from 20 million to 35 million dollars. Since the successive achievements of the three aforementioned companies in 2021, 39 people have been able to reach space for different amounts of money:

- For Space X: the company sends tourists in low orbit and towards the International Space Station. For flights to the ISS, the trip costs 55 million dollars and lasts about 2 weeks. The price is not known for their low orbit stays.
- For Blue Origin: the company sends tourists to an altitude of 100 km (Karman line). This is called a “sub-orbital flight”. Passengers stay 10 minutes in microgravity. The price is not yet known, and the company is currently only conducting private sales.
- For Virgin Galactic: the company also offers sub-orbital flights lasting 10 minutes at a price of 450,000 dollars.

On top of simple trips to space, other entities are thinking about and/or are developing even more advanced private programs:

- Creation of orbital hotels. In 2022, for example, Axiom Space's Ax-1 mission enabled a private crew to stay for ten days on board of the ISS. Eventually, Axiom Space plans to build its own space station, at first as a component of the ISS; at the end of its lifetime, it plans to detach it from the ISS and make it autonomous so it can become the first private hotel in space.
- Spacewalk for tourists outside the ISS. This idea was confirmed by Russia in 2020. Since then, due to the crisis in Ukraine

and the sanctions imposed to Russia, the country has announced its future withdrawal from the ISS program. It is therefore unlikely that this project will be carried out, but others may have similar ambitions.

- Film production in space. Following the Russian fiction film "The Challenge", filmed in October 2021 partly on board the ISS, Hollywood has announced that the a future film starring actor Tom Cruise will include footage filmed on board a private film studio docked to the ISS.
- Moon tourism, on the surface and/or in orbit. This is for example the case of Space Adventures and Space X. Billionaire Yūsaku Maezawa offered to fund sending several artists into orbit around the Moon by 2023.

Some argue that the development of space tourism does not really pose any major challenges. On the contrary, Space X and Blue Origin representatives justify these activities by arguing that they serve to finance innovation and the development of both terrestrial and space activities. However, despite this praiseworthy ambition, a part of civil society rejects this type of activity on environmental grounds. Indeed, even if space tourism does not generate waste in space, it is a new link in the chain of CO2-emitting activities which is difficult to justify.

While some of the public is seduced by these new conquerors, the panorama offered by these billionaires who spend colossal amounts of money to divert themselves in space introduces for the first time a negative image of the space conquest, an image that seems to be at odds with the aspirations of a youth in search of more noble values. Yet these private flights are preparing our civilization for a much more important challenge: the expansion of mankind into the universe, the colonization of the Moon and Mars being the first step.

B. In-orbit service

Despite the development of space activities, one important issue remains, a keystone of any infrastructure market: maintenance and repair. Any intervention in space in the event of a satellite failure is an extremely costly and technically complex operation. As a result, once a satellite fails, it is left to rot. Projects for in-orbit services are being developed to provide new and multiple services to give space objects a second life or to extend their lifespan. The range of services offered is diverse:

- Inspection,
- Refueling,

- Modification of the orbit or inclination of a satellite,
- Repair or maintenance,
- Adding and removing components,
- Building infrastructure in space by assembling various elements,
- De-orbiting and cleaning of space

Figure 3
An astronaut performing a maintenance run on the *Hubble* telescope
(Source: *NASA*)

This activity is not new but due to the drastic decrease in launch costs and new technological capabilities, it is becoming more accessible to a wide range of space actors. It was previously limited to certain very expensive programs and involved human intervention. The first operation of this type was in 1984 to repair the Solar Maximum Mission scientific satellite. The famous Hubble telescope was repaired five times by astronauts between 1993 and 2009. The International Space Station also frequently needs maintenance from its occupants. It was in 2019 that a company, Northrop Grumman, performed for the first time a fully robotic in-orbit service mission. One of its satellites, designed by Space Logistics, reached a graveyard orbit slightly beyond the geostationary orbit (an altitude of about 36,000 km) to refuel an Intelsat satellite before returning it to its original operating orbit. In 2021, the same company successfully refueled another Intelsat satellite, this time directly on its service orbit.

C. The permanent return of humans to the Moon and beyond

Since the end of the American Apollo program in 1972, which sent 24 astronauts around the Moon, including 12 to its surface, no human has returned near our natural satellite. This program, whose total cost is estimated at more than 25 billion dollars, was terminated prematurely because of the financial abyss it represented in relation to the domestic (economic crisis, development of social programs) and external (such as the war in Vietnam) factors the United States was facing. No other state has been able to send humans to the Moon because of the technical complexity and cost of such a feat. However, other states have succeeded in putting objects there, for scientific purposes, in the context of scientific programs, often with considerations of national prestige: the USSR and then Russia, India, the European Space Agency, and China.

In recent years, there has been a renewed interest for manned space missions to the Moon, both from public and private actors:

- In 2007, Russia announced that it wanted to create a lunar orbital base as one of the two components of a future Russian program on the surface of the Moon.
- In 2015, the European Space Agency announced its intention to create a permanent lunar base. The project, which has been called "Moon Village", seems to be more of a discussion center for the development of new approaches to exploration and exploitation of the Moon.
- In 2017, the United States announced the Lunar Gateway project, which aims to place a station in lunar orbit, in order to conduct manned space flights to the Moon and cislunar space. In 2020, the US signed three MOUs to implement the program: one with the ESA, one with Canada, and the other with Japan.
- In 2017, China said it wanted to send taikonauts to the Moon by 2030.
- In 2017, the United States initiated the Artemis program to return to the Moon permanently by 2024. However, this deadline has been extended several times and is now set for 2026. Any state that is interested can join the Artemis program and sign the Artemis Agreement on Principles for

Cooperation in the Exploration and Civilian Use of the Moon, Mars, Comets and Asteroids for Peaceful Purposes.

- In 2021, China and Russia signed an agreement to develop an inhabited lunar base. This project is an international project where any interested state can join.

The objectives of having people return to the Moon are multiple, and it is not possible to classify them in order of priority, as they are so interdependent in a common goal: to go further, towards Mars. Indeed, even if the Moon is 'close', it poses the same difficulties concerning access as interplanetary missions (choice of trajectory, orbit insertion, lunar landing, radiation, etc.).

- National prestige objective: any manned mission to the Moon, and even more so to another celestial body, represents the ultimate symbol of power that a State can achieve.
- Scientific and technical objectives: the establishment of people on the Moon aims to increase knowledge about our natural satellite, but above all to prepare future interplanetary travel. The new missions will thus help to better understand the technical difficulties posed by distant travel and to develop solutions to deal with them, for example in terms of energy production, communications, in situ mobility, consumption, etc. They will also be valuable in understanding human adaptability in space.

The return of humans to the Moon is thus part of a larger design: traveling to Mars. However, we can legitimately ask the question of what the objectives of such a journey are. Would it be to go even further? To colonize space in the event that humans cannot live on Earth anymore? To keep the sector and the space dream alive?

D. The appropriation and exploitation of resources from the Moon and other celestial bodies

Several scientific missions, particularly the Apollo missions, have made it possible to recover resources from celestial bodies for scientific purposes, most recently by China in December 2020. Until the early 2000s, there was little interest in the resources of celestial bodies other than for scientific purposes. Initially, scams flourished and some entities tried, from Earth, to sell titles to all or part of different celestial bodies. As a result of one such purchase, an individual even sent a $20 parking bill to NASA for landing one of its probes on "his" asteroid (Eros), a

claim that was later dismissed by a U.S. Federal Court as having no legal basis. Since then, more serious resource exploitation projects have emerged. They can be grouped into two categories:

- The use of resources to support activities on celestial bodies, including manned missions, such as the use of lunar regolith to build habitats and structures useful to astronauts or the use of water present in the form of ice in lunar craters for the crew's consumption or for the creation of fuel.
- The commercial exploitation of resources from celestial bodies for processing in space or on Earth. Many projects have emerged since the 2010s, but none has seen the light of day yet. While the theoretical resource reserves might be worth billions or even hundreds of billions of dollars, no project is for now financially convincing enough. As a result, Deep Space Industries, Planetary Resources and Asteroid Mining Corporation Ltd, pioneers in this market, have all brought their activities to a stop.

Section 3
The Militarization of Space

The 1967 Space Treaty is based on the peaceful use of space, but Article IV, which implements this principle, prohibits the placement of weapons of mass destruction in orbit around the Earth. Only the celestial bodies are completely protected. No military activity can take place there. The international legality of the use of space for military purposes seems to have been since then established, including the placement of non-nuclear weapons in orbit and their use. There are three reasons for this permissive legal framework: the similarity between military and space technologies; the strategic dimension of space; and the support given by the military to the space industry. The militarization of space was openly highlighted in a famous televised speech by President Reagan on March 23, 1983 in which he presented to the world his Strategic Defense Initiative, whose aim was to provide the United States with an anti-nuclear shield using, among other things, defensive weapons placed in orbit around the Earth. Today, the militarization of space takes two forms. The first is the development or use of space applications to serve military institutions on Earth, including telecommunications, remote sensing, missile warning, positioning, tracking

and electromagnetic intelligence. This is referred to as the passive militarization of space. The second is the deployment and use of weapons in space. This is known as the weaponization of space. This includes the capacities to destroy or neutralize enemy satellites, either from space with anti-satellite weapons or from Earth with missiles. The exercises conducted by China (2007), the United States (2008), India (2019) and Russia (2021), aimed at destroying one of their own satellites with a missile launch, reflect the ongoing process of space weaponization. The military ambitions of states in space are now being asserted in the open. In this regard, it is worth noting that in April 2022, the U.S. became the first country to ban the use of kinetic, anti-satellite weapons testing. Canada followed one month later. In 2019, the United States and France announced the creation of a branch of the armed forces to conduct operations in outer space. Iran (2020) and Australia (2022) have made such initiatives public.

3.

questionings

In less than a hundred years, space has gone from being a *terra nullius* to becoming a privileged play-field for scientists, a battlefield for the military and a promise of prosperity for private entities. Humanity has been able to use what they found on Earth to get away from it and master the hostile environment of space. Nothing seems to stop them now, although this process simultaneously and proportionally increases their dependency on space operations and the inherent risks their use poses.

In front of these challenges, international space law seems to have frozen, as powerless before the scale and speed of space activities' evolution. Actually, it has remained little changed since its birth. The main guiding principles are still there, unchanged, but the context in which they were adopted is no longer the norm. This acknowledgment raises numerous questions that are, or eventually will, be asked by all parties involved, who also need to be named at some point: are existing rules adapted to all the challenges posed by the space sector's dynamism? Is this the right time to remodel international space law and, if so, on what basis should it be? In addition to these general questions, we will also focus on questions more specific to certain challenges raised today by the space sector.

Questioning n°1:
Are existing rules adapted to all the challenges the dynamism of the space sector imposes?

At the time the Treaty on Outer Space was thought of, negotiators willfully chose to adopt a relatively short instrument that provided only essential principles guaranteeing the security of space operations. Some fifty years later, when time and the evolution of space activities could well have eroded them, these principles are still enforced and demonstrate their adaptability. They seem to have proven their efficiency, since the use of outer space today, is still a perfectly logical extension of these rules: exploration and use of space are still unrestrained and carried out in a pacific manner (exclusively pacific manner for celestial bodies), no space zone has ever been appropriated by a nation and cooperation is respected. Moreover, no international litigation has been officially started. Some assert that the unclear terms of the 1967 Treaty's dispositions is a strength as it allows a flexible interpretation of the text and for rules to be easily bent according to the needs and the evolution of space activities. Besides, this enables national legislation to develop in order to regulate a large range of activities while observing most of the Treaty's spirit and letter. However, others claim that there are no specific rules for all activities: the status of space

tourists, the use of celestial bodies' resources, the frontier between airspace and outer space, the use of anti-satellite weapons, etc. For them, because of this absence of rules, States can act as they please in these areas. In this respect, some call for a more precise regulation in order to avoid too flexible interpretations, which lead to too much complacency in the way space activities are conducted.

The question of knowing whether existing rules are adapted to all challenges raised by the dynamics of the space sector deserves a two-stage answer. On the one hand, a first answer would be "yes" as, despite those challenges, the space sector manages to develop in a continuous manner, without ever being the cause of litigation or serious legal issues. Indeed, and even though there are no specific rules for every single question, we find that space law actually establishes a very liberal framework for space activities, either through the principles set out or thanks to their flexibility. It is therefore obvious that the dynamism of the space sector is nothing but the result of the principle of liberty in space. Thus, the existing rules largely allow for the development of all space activities, provided that they respect the broad framework set out by the treaties. However, some point out the fact that the principles set out in the treaties are now under pressure and that there is still a need to clarify the legal regime applicable to certain activities or issues.

Beyond this answer, others are possible, but they call to answer beforehand an underlying question: what outer space do we want? This counter-question helps us not to think of the rules as adapted or not to the challenges raised by the evolution of the space sector, but rather as their being the cause of these challenges. If, as is the case today, we want an outer space that can be freely used and exploited, without any condition of nationality, but only of capacity, then yes, the rules seem adapted. This model is interesting as it enables all space actors, public as well as private, to thrive, while at same time providing a framework for competition, which promotes innovation. However, this it has two limitations. On the one hand, it is confronted with one natural limit, namely the maximum capacity of terrestrial orbits. Once it is reached, it will no longer be possible to send new objects into space. On the other hand, there is no order of priority in activities. Therefore, a private company is just as legitimate to send a billboard or the ashes of wealthy people into space, as a team of scientists to send a probe to deepen our knowledge of the universe or the impacts of climate change. Thus, with this model, the first to arrive will be the first

to be served, at the expense of the last to arrive, regardless of the type of activity undertaken and the benefits and spin-offs for humanity.

But is this the space we wish for? If we want a space that makes room for more reasoned and moderate uses, then "no", space law is not adapted to the challenges raised by the dynamics of the space sector. The law only contributes to this dynamic. Then what other systems would be conceivable in order for space to be used in a more moderate manner, for the real "*benefit and in the interests of all countries, irrespective of their degree of economic or scientific development*"[1]?

Questioning n°2:
Should we complete space law or rather rethink it?

As laid out, space law tends today to be the center of several challenges and critics. To address these issues, therefore, two solutions may be considered: completing existing space law (option n°1) or rethink it (option °2)

Note 1 Article I of the Outer Space Treaty of 1967

Option n°1 : Completing the existing space law

In spite of the unwavering efficiency of space law's governing principles, some assert that they are now strained by the numerous challenges of space law and that new rules are now needed. Some States have already started to adopt new regulations on certain specific challenges on a national or limited multilateral scale. However, since outer space is a common good, shared by all States, this kind of initiative seems rather unsatisfactory. They do not make it possible to encompass all players concerned, and in fact even contribute to a future fragmentation of space law. How could identical activities and companies in the same environment, and with similar technical and financial means, be regulated by different rules without leading in the end to legal inconsistency? What would happen if a dispute broke out between two entities that are not governed by the same rules?

Ideally, the additional regulations needed to compensate the deficiencies in space law should be adopted on an extended multilateral basis in order to involve as many players as possible.

What are the areas where space law could be more precise?

- The delimitation between airspace and outer space. This issue was raised early on and regularly appears in the dis-

cussions of the COPUOS ever since it was created. Until recently, this issue raised no practical difficulties, however, the advent of sub-orbital spaceflights urges to present a more precise legal framework, notably for responsibility and liability purposes. Are these spaceflights subject to air or space law, or do they require *sui generis* rules?

- The regulation of anti-satellite weapons. Many States have reacted to Russia's last test on November 15, 2021. This is a high-risk operation for space activities as it jeopardizes the security of orbital activities. Beyond the expressed protests, the United States, on April 18, 2022, voluntarily decided on a moratorium that prevents the country from performing this type of test. A UN General Assembly work group on the reduction of space threats was established in December 2021 to examine these issues.

- The status of space tourists. The issue of space tourism raises various challenges, the first one being the status of individuals embarking on a trip towards the outer fringes of the atmosphere. Are they to be treated in the same way as astronauts, that is to say as *envoys of mankind*, as space law puts it? Do we owe them the same duty of help and assistance if they are in danger?

- The use of space resources. It is the most divisive issue of the return of humans on the Moon. Can we use space resources of celestial bodies, and, if so, to what purpose(s)? If it is legal to use them for scientific ends, and as a support to perform missions, what about their commercial use? May we take away resources to sell them? Many interpretations exist. Should we accept this practice and, if we do, under what legitimacy and operating model?

- The use of mega-constellations. Although of recent, and for the moment, limited use, mega-constellations of satellites are being developed. Let's name the projects of Space X (Starlink, with 12,000 satellites), Amazon (3,286 satellites) and One Web (648 satellites), to which can be added a Chinese constellation (13,000 satellites) and one led by the European Union. All share the same ambition: guarantee a quick and cheap access to the internet, all over the world. Their deployment could disrupt cooperation mechanisms put into place by the ITU. This Organization, which has already adapted its procedures, may be forced to put into place a stricter framework in order to guarantee access to space for all. The constellations are also the cause of a luminous and radioelectric pollution that disturbs the astronauts and radio astronomers' activities. Therefore, it is necessary to

reflect on the ways to protect the starlit sky from these interferences.

As we see, aside from the question of the delimitation between air and outer space, the areas of law in need of new regulations are quite recent. Do they all really need the adoption of new international rules? Do we have the necessary hindsight to correctly regulate them? This begs the question of whether space law should intervene downstream, on the basis of experienced problems, or upstream, when they have not yet emerged. In other words, is space law destined to build on an existing fixed basis (mainly the 1967 Treaty), with occasional amendments when it shows signs of weakness, or should this basis be replaced in order not to become out-of-date?

Option n°2: Rethinking space law

The Outer Space Treaty was established in a particular context, the Moon race, with the Cold War as a backdrop. Its main objective is to guarantee that outer space remains a zone of cooperation dedicated to pacific operations that are conducted in all the States' interest. Nowadays, the race to the Moon exists no longer, and the entire space sector has changed. The "Old Space" was mainly led and financed by governmental players to conduct public programs. The arrival of private entities has toppled this organization over, and has marked the beginning of the "New Space" area, which is characterized by a new entrepreneurial approach. Almost all current space issues arise from this dynamic, which reveals a rupture between yesterday's fears and today's expectations. The principle of the free use of space, intended to guarantee equal access to outer space to all States, seems to be responsible for the saturation of our orbits. This tension heavily weights on current and future activities, and many fear that the breaking point is drawing near, and that soon an object will be sent and break the existing balance. That would be the last straw. It would put an end to human activities in space for decades.

The context in which the Outer Space Treaty was adopted and today's context appear diametrically opposed. One can therefore legitimately raise the question whether the legal framework set down by yesterday's space pioneers is still relevant in light of today's players' expectations. Is it not time to rethink space law to cope with and embrace these new challenges? This question raises other sub-questions: on what ground(s) do we need to rethink space law? What priority(ies) and guiding stars are to direct future negotiators in quest of new regulations? Is it the right time to conduct such a reform?

Sub-question 1: How to rethink space law?

If international space law, as some assert, is under pressure just like our orbits, it might be because the model of the Outer Space Treaty is no longer adapted. Therefore, it helps to consider the other possible models. Several questions are underpinning. First of all, what are the possible options for new models? Then, what players should be included in this reform of space law?)

A. What models for what space?

Initially, space law developed on the basis of existing models. At first, high-seas and air space regimes inspired the discussions. Following the "admiralty" approach, space has to be of free use for everyone and cannot be the object of national appropriation. Conversely, according the "aerial" conception, state jurisdiction must extend beyond air space, and outer space becomes a fragmented zone split between States. In the end, the first approach prevailed in practice, when Sputnik flew over the territories of numerous States in 1957, without provoking any other reaction than admiration. Later, during the negotiations on the first legal instruments on outer space, the status of the Antarctic served as a model on various aspects: principle of pacific use and demilitarization, principle of international cooperation, place of science, etc. NASA officials had in fact been to the Antarctic before the Treaty was signed in 1967.

From then on, the regimes of international zones have regularly come up, in the study of space law: the question of space resources is often studied in light of the Antarctic regime or the regime of the Zone for the deep seabed, the legal status of space debris is sometimes considered according to shipwreck law, etc. Should we continue to think about space law on the basis of these comparisons or do we need to find new basis that are only applicable for it?

The use of analogies is reassuring. It enables to rely on the success of those who came before us. However, using analogies too often may be a source of difficulties. On the one hand, the risk of a dependence of space law on other models exists. When Luxembourg justifies the appropriation of space resources arguing that they are just like "fish and shells" in law of the sea[2], we may wonder how far these analogies may go. Will space law continue to be developed and interpreted in the light of admi-

Note 2 Bill on the exploration and use of space resources, 2016

ralty law or the law of the Antarctic, or will it be included in the emerging branch of international digital law when we know that 80% of the space economy comes from the connectivity and data trade? Satellites are communicating infrastructures placed in space. Is their use subject to the rules of international and regional law applicable to telecommunications? Data production and distribution from space is fully covered by the new international data law. The dynamic of the New Space also tends to make of space law a subcategory of digital law. Space law could, on the other hand, take on its independence and become a fully autonomous branch of international law, especially since it is often recognized that the environment has a determining impact on a legal system. This is the more coherent that it is often established that the environment has an impact on the making of a legal system. Space is a unique environment, so does it not deserve its own regulations?

Space law should develop its own model so that all rules perfectly fit today's specific challenges of the space sector. Several scenarios, which can be combined, are possible to achieve a more sustainable and responsible use of space:

- A space entirely subject to international law. According to this model, we could imagine the establishment of an international organization, which would be competent to attribute launching licenses. Hence, this organization would oversee objects sent to space, their number and objectives, and would make sure space is managed for humanity's greater good.
- More integrated activities. We could imagine a better dialogue and coordination between all parties involved in the space sector. Rather than having hundreds of telecommunication or Earth observation operators that use their own machines, we could have a generalized sharing of satellite infrastructures (up to the limit of their capacity). This would have environmental (avoidance of orbit overpopulation) and economical virtues (drastic reduction of costs for both operators and users). In another area, providers of private spaceflight services for leisure purposes could be compelled or encouraged to support scientific research by hosting one or two scientific astronauts, whose missions would be funded in whole or in part by tourism revenues. Some individuals' pleasure would therefore be of use for the development of everyone's knowledge.
- Implementation of space quotas. According to this approach, access to space would not be based on the principle of States' liberty, but would rather follow a quota regime set in accordance with the type of space activity. A maximum rate of use per orbit could be fixed and then divided into

quotas: 30% for telecommunications, 20% for earth observation and/or meteorology, 10% for navigation, 15% for scientific research, 20% for defense and 5% for other uses (amateurs, manned flights, etc.)... These quotas are then equitably distributed between States, who may then resale their parts for the more or less long term. The funds may then be used, for example, to finance the development of the space sector in a given country.

- A space revolving around human needs. According to this approach, it would only be possible to launch objects into space if they bring direct benefits (in terms of usefulness, technological and scientific spin-offs, etc.) to a large part of the population. Access to space operations (such as telecommunications or meteorology) could be monetized, but should not generate profits that would exceed the cost for managing the programs. The aim would be to make of space and the way we use it a kind of international public service.

Ideas to reach a more responsible use of space are numerous, but all call for a revision of the fundamental principle of liberty that was recognized during the first space flight and codified in the Outer Space Treaty. Other solutions are possible, and the final one will depend on the issue of long and difficult negotiations, and, more specifically, on the players that would participate.

B. Who would be the thinkers of tomorrow's international space law?

Rethinking space law also requires paying attention to the players engaged in its future reformation. What place are we to give to space powers? What will be the role of States not capable to access space and/or to launch space programs? How can the private sector be integrated into the discussions? Should representatives of civil society also be fully involved? If space was once the privilege of a few entities and the benefits driven from its exploration were limited, now it is within everyone's reach, and we all benefit from satellite operations. Therefore, should we not conduct discussions with all involved parties, as had been done for the World Summit on the Information Society? And if this were the case, what place should be given to each of the parties?

The question here is to reflect more globally upon the creation process of international law. In light of certain international organizations, such as the International Maritime Organization, the COPUOS welcomes a series of governmental and non-governmental organizations: ESA, the International Law Association (ILA/ADI), the International Space University (ISU), the European Center for Space Law (ECSL), For all Moonkind, UNIDROIT, the European Organization for Astronomical Research in the

Southern Hemisphere (ESO), the International Astronautical Federation, etc. Is this really enough to balance the purely state-based negotiations? Can these entities really influence the course of the discussions?

Beyond the issues raised by the part played by non-state actors in the space sector, the main question remains that of the effective participation of all state actors, who are supposed to be at the heart of the negotiations. To this day, the development of space law has been the initiative of the space powers. The other States take part in the debates but cannot impose their approach, as had been the case for the question of the sovereignty of the equatorial States over the geostationary orbit claimed in the Bogota Declaration of 1978. Likewise, the 1979 Moon Agreement, which established the concept of the common heritage of mankind, was not supported by the space powers. While space can be seen as a common good, how can we ensure that the voices of non-spacefaring nations will weight in the debates and that they will not be confined to the role of follower?

Sub-question 2:
Is this the right time to rethink space law?

Negotiations for a new outer space treaty would naturally take place on a completely different basis from the 1967 Treaty. The latter was mainly, but not exclusively, negotiated between the two space powers of the time: the United States and the USSR. Today, other States have access to space, but what is more important is that the presence of private actors will likely be felt at the negotiating tables. In some countries, such as the United States and France, these players have an essential role in the space industry. In addition to providing huge benefits in terms of employment, prestige, and economic spin-offs, they guarantee permanent access to outer space, which is essential in the context of national sovereignty prerogatives. States with a strong space industry will defend their interests at all costs. Thus, if a new treaty is negotiated, the questions at stake will no longer focus solely on States' functions, but will also include economic aspects.

This turning point recalls the failure of the Moon Agreement. As a matter of fact, institutional actors, who had an idealistic vision of space exploration, negotiated the latter. When the United States discussed its ratification, however, the agreement was widely criticized by economic actors and even the whole

space community. The text was considered restrictive for the development of space activities. The sharing mechanism was perceived just as a tax that would benefit States taking no economic risk. After the Apollo program was concluded, the American space industry needed new objectives to be maintained and to renew itself, and the exploitation of the Moon for commercial purposes was one of the most promising. The Agreement was eventually not ratified by the United States, which led many other States to reject it as well. What was the point of adhering to an agreement to which the only actor concerned was not a party?

Since then, many States have consulted their industries before the negotiations, in order to define their needs and guidelines. Therefore, rethinking space law today seems unrealistic. How can we review the principle of freedom of use of space in order to make its use more responsible without proportionally limiting the economic ambitions of its actors? Will States accept to restrict their own economic actors? As a matter of fact, a new treaty is likely to reinforce the economic use of space, and would in practice support an unreasonable use of this environment. Is a catastrophe necessary to make the international community realize that they are in a dead end and compel them to reach an agreement, as is often the case in international and domestic policies?

Questioning n°3:
The return of human beings on the Moon and beyond

In addition to the general questionings, others arise more specifically for each of the space sector's challenges and encourage to think about the place of humans in space. As previously mentioned, more and more varied missions are being undertaken beyond our atmosphere. No area of our solar system seems to have been spared by our meticulous scientists. Over and over again, humans have sent probes beyond it, and they are still drifting in interstellar space... Yet, many questions remain without an answer, and the more answers we find, the greater we find our ignorance to be. When it comes to scientific matters, the access to knowledge and understanding of the world seems to be enough in itself to justify these journeys. However, the permanent settlement of human beings on the Moon is already raising questions within civil society, a part of which does not realize either the interest or the benefit/risk for itself, and, more generally, for our planet. These questions are legitimate, and their appearance reveals a break with the past century. Is space no longer a dream like before? Have we integrated it too much into our consciousness, so it is no longer a place of exception, adventure, and mystery, making whole generations dream? Or,

have our dreams evolved? Was Cooper (main character in Christopher Nolan's 2014 film *Interstellar*) right when he declared that *"we used to look up at the sky and wonder at our place in the stars. Now we just look down and worry about our place in the dirt"*?

Among the questions that we can sometimes hear in the press and on social networks, there are two main ones that can be generally found:

- The first are ethical: Are human beings really entitled to colonize space? How far will they go? If the Moon is the first step while waiting for Mars, what will be the next ones? Are there not more important concerns to deal with first: global warming, hunger, poverty, health, etc.?
- The second are environmental: Have we not polluted Earth enough to go and also pollute the Moon? Why accentuate global warming on Earth by going to the Moon where there is no more interest since the Apollo missions? These are some of the never-ending questions of the balance between the social utility of an activity and the environmental impacts it generates.

Would a dialogue between those who are in favor of an unrestrained space conquest and those who are in favor of a sober and environmentally respectful space exploitation not be necessary before their opinions become too polarized? Space would then also be caught in the movement of mistrust towards technologies. Could we one day see space flights forbidden or space exploitation projects canceled under pressure from public opinion? Space law must certainly answer the concerns raised by technological progress by proposing a responsible approach of the exploration and exploitation of the cosmos.

annex 01

acknowledgment and persons interviewed

Acknowledgment

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List of personalities interviewed

- David Bertolotti, Head of institutional and international affairs, Eutelsat, France
- Tanja Masson-Zwann, Leiden University, Netherlands

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