INHABITING CELESTIAL BODIES

A proposed legal framework

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« *There's so many different worlds,*

So many different suns and we have just one world,

But we live in different ones »

Dire Straits, *Brothers in arms*

« *Norm is a paved road, it makes for an easy walk but there are no flowers.* »

Van Gogh

GENERAL INTRODUCTION

1/ Humanizing the cosmos means establishing a permanent, self-sufficient human settlement in outer space. The aim is to offer mankind the opportunity to be born, live, work and die in outer space.

The ISS was the first great cooperative intergovernmental initiative aiming at perpetuating human presence in outer space. The station made it possible to carry out numerous experiments in micro-gravity while ultimately providing a potential staging post for future Moon or Mars missions.

The US-initiated ARTEMIS human spacecraft programme has one ambition: to return mankind to the surface of the moon by 2024. ARTEMIS is a federative programme bringing into close association both the private sector, particularly in the area of spacecraft development, and NASA's partner nations by way of cooperation agreements for the funding and supply of certain equipment.

ARTEMIS is also an essentially political and ideological initiative as it paves the way for human settlements in outer space. Let us work together so this project should not aim to "begin the world over again" [1] by allowing US law to prevail in space. We share a common history and the old continent carries with it the wisdom of experience.

Experience is what we shall need to decide together how celestial bodies, as international areas which are for the whole of mankind to share, should be settled. Wisdom is what we shall want to channel the zeal of the new private stakeholders for whom inhabiting outer space heralds the emergence of new economically profitable markets -such as Deep Space Industries and Planetary Resources Incorporated which are developing asteroid-mining technologies- and represents an opportunity to impose a new libertarian and

1 As Thomas Paine famously wrote in 1776

transhuman cosmic order -as called for by the promoters of the Asgardia project who are currently working towards the establishment of the first Space Nation[2].

2/ While a few tech billionaires like Elon Musk aim at colonizing Mars, states are setting their sights on a more realistic aim and are working towards a return of mankind to the Moon in the decade.

One must understand that the two space colonization ambitions have quite different legal implications. Mars is not the Moon and the respective distance between the two celestial bodies and Earth is directly proportional to the degree of autonomy enjoyed by the colony. Now, where an autonomous colony will have to govern itself according to its own norms, a community established in a circum-terrestrial area will come under the jurisdiction of a terrestrial legal system.

3/ There is thus ground for distinguishing between the area corresponding to Earth's gravitational well, known as Greater Earth, and the remainder of extra-atmospheric space.

From a physics point of view, the Greater Earth area corresponds to a spherical region of space with Earth at its centre earth, where the gravitational influence of our planet dominates the movements of any given object. The area corresponds to Earth's gravitational field and, as noted by Woods & Bernasconi (1995), "extends 1.495.000 kilometres from its centre where it meets the gravitational influence of the Sun. This sphere has 13 million times the volume of the physical Earth and [within it] are enormous amounts of other resources, including the Moon and occasional passing asteroids" [3]. Space operations do not require overly significant amounts of energy, nor do they face the risk of losing contact (whether in terms of communications or operations monitoring) with the Earth-based authorities. Radio wave propagation time does not exceed 3 to 4 seconds, which means that communication exchanges with Earth can be both cooperative and continuous. The time required for a manned spacecraft to return to Earth is comparable to that of the moon missions, while being more economical in terms of propulsion[4]. Thus, a colony established within the Greater Earth area would stay in constant touch with Earth-based authorities in terms of supply, communication and crisis management.

From a legal point of view, Greater Earth is an internationalized area in that no state nor any governmental or non-governmental entity may stake a territorial claim or appropriate any part of outer space, including the Moon or any celestial body[5]. The area represents the natural perimeter of Earth. It is the seat of Earth's legal system and therefore determines the scope of international space law.

It follows, on the one hand, that the establishment of a base within this area must be subject to authorization and continuous monitoring by a State[6] and, on the other hand, that any colony on board a space object located within this area will be subject to the power of jurisdiction and control of the State of Registration of the said object[7].

What would happen to a colony venturing beyond Earth's gravitational field? Settling mars involves sending human beings more than 55 million kilometres from Earth on an eight-to-nine month, potentially one-way mission. The duration of a communication

2 P. DELVILLE-BARTHOMEUF "Bienvenue à Asgardia", *RFDAS,* vol. 282*,* 2017, II. p.147.
3 http://www.ours.ch/greater-earth.php
4 J. ARNOULD, « Nouvelles frontières de l'Espace », *Études,* vol. t. 406, no. 3, 2007, pp. 347-357, p.354
5 Art. II of the Outer Space Treaty of 1967
6 Art. VI of the Outer Space Treaty of 1967
7 Art. of the Outer Space Treaty of 1967

between Mars and Earth is estimated at 6.5 minutes when the two planets are at opposition and more than 44 minutes when they are in superior conjunction with each other. Breakdowns in communication will be frequent.

A colony established in deep space will live in complete independence from terrestrial life support systems and will have to ensure its subsistence and protection on its own thanks to in situ means of production. No control or continuous monitoring of the crew can be carried out from Earth.

Article VIII of the Space Treaty, which requires the State of Registration to retain jurisdiction and control over the space object and all personnel on board, becomes de facto ineffective.

The survival of the colony will depend on its ability to act on its own, to make the right decisions at the right time and to adopt its own code of conduct[8]. It will have to organize itself as an autonomous community with its own political and legal organization, including of course the capacity to enact rules and enforce them.

St. Paul wrote: "for when Gentiles, who do not have the law, by nature do the things in the law, these, although not having the law, are a law to themselves, who show the work of the law written in their hearts, their conscience also bearing witness […]."

Thus, although it is premature to lay the foundations of what might be the future space legal system, let us simply agree, as Saint Paul did, that it will flow from natural law. Perhaps it will be a "new kind of bio-techno-natural Law"[9], as G.S. ROBINSON predicted under the pretext of a flexibility of natural law, unless the colonists consider natural law in its immutable and universal dimension as the "participation of the eternal law *in the rational* creature"[10].

From this distinction between the flexibility of natural law and the immutability of natural law will flow our representation of the "human family"[11]. It would be regrettable for the colonization of space to stumble over a division of mankind between spacekind and earthkind, or worse, a classification of mankind in terms of homo sapiens sapiens, homo spatialis[12], homo alterios spatialis... where each taxon would set itself up as an autonomous and sovereign community interacting with Earth's States as equals.

Let us keep in mind that "there is no evolutionary future to be expected for man outside of his association with all other men"[13]. The humanization of space must allow man to embody mankind in its most accomplished form, in perfect unity, free from all divisions.

The hypothesis of a colonization of deep space will not be considered in this study, in so far as it entails highly prospective questioning, which is contrary to a positivist study of space settlement. For the purpose of this study, we shall only consider the status of lunar habitats within the Greater Earth area.

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8 From Greek *autos*: self and *nomos*: law

9 G. S. ROBINSON, "Space law for humankind, transhumans, and post humans: is there a need for a unique theory of natural law principles?", Annals of Air and Spacelaw, McGill, vol. XXXIII, 2008, p. 287 à 323, p. 316.

10 L. CHARETTE, "Droit naturel et droit positif chez saint Thomas d'Aquin". *Philosophiques*, 1981, 8 (1), 113–130.

11 The Universal Declaration of Human Rights of 10 December 1948, in particular, refers to the "the inherent dignity of all members of the human family"

12 G. S. ROBINSON, « Space law for Humankind, Transhumans, and Post Humans: is there a need for a unique theory of natural law principles? "Annals of air and space Law, Mc Gill, Vol. XXXIII, 2008, p. 289-29

13 P. TEILHARD DE CHARDIN, *Le phénomène Humain,* éd. Points, coll. Points Sagesses, n° 222, 2007.

5/ To inhabit means to live in a place. Inhabiting space entails the construction of space habitats. A space habitat can be defined as an installation consisting of an orbital station or a base established with a life support system on a celestial body and intended to accommodate people on a permanent basis. In this sense, a space habitat differs from orbital relays or spacecraft that are meant to transport goods or ferry passengers.

The life support system is a critical component of the space habitat in that it must ensure a viable environment with air, water, food of sufficient quality and quantity, maintenance of acceptable temperature and pressure, sufficient protection against radiation and micrometeorites, and waste management and recycling.

If artificial orbital megastructures, largely inspired by SF works such as O'Neill's cylinders, Bernal's spheres or Stanford's torus have influenced the beginnings of space colonization, they never got beyond the stage of theoretical study. Such orbital installations have major disadvantages: prohibitive construction costs, pollution of circumterrestrial orbits, necessary importation of raw materials, artificial environments, psychological confinement.

Though they have not been definitively abandoned, these orbital habitat projects are gradually giving way to a plan for settling humans on celestial bodies. ESA is thus contemplating the possibility of a "moon village", a more ambitious undertaking in terms of knowledge, habitability, exploitation of in situ resources and human achievement. The lunar habitat would consist of an inflatable structure sheltered by a 3D-printed shell made from locally available raw materials. The shell would serve to protect the base from micrometeorites and cosmic radiation[14].

From a legal point of view, hypothesizing the establishment of inhabited stations on a celestial body makes it possible to widen the topic of space colonization to consider, beyond the legal nature of the space habitat itself, the conditions under which celestial bodies may be settled.

Occupying the space domain is an unarguably topical issue with regard to the legislative evolution relating to the exploitation of mining resources and planetary protection. It is also a core issue in terms of space settlement in that it conditions the establishment of installations, the use of in situ resources, the potential staking of claims on the ground or the implementation of environmental easements.

7/ The prospect of inhabiting space raises several issues: what is the legal framework for the occupation of the space domain? What are the duties and obligations of the operators involved in the construction of a base on the surface of a celestial body? What is the legal nature of a space habitat and what rights apply to space settlements?

We shall try to provide answers regarding human settlements on the Moon and within the Greater Earth area more specifically, looking first at the main principles and concepts involved (Part I), before outlining ideas and concrete proposals for the foundation and safety of both private activities and settlements (Part II).

PART I-NATURE OF THE MAIN PRINCIPLES AND CONCEPTS UNDERLYING THE REFLECTION ON THE OCCUPATION OF THE SPACE DOMAIN

14 https://www.challenges.fr/entreprise/aeronautique/un-village-sur-la-lune-l-incroyable-projet-de-l-agence-spatiale-europeenne_25483

We shall first outline the major founding principles of space activities arising from the Outer Space Treaty of 1967 (I), then set out our position regarding the status of celestial bodies in light of the common heritage of mankind principle under the 1979 Moon Treaty (II),

I/ THE MAIN PRINCIPLES OF THE OUTER SPACE TREATY (1967)

Among all the principles established in the Outer Space Treaty of 1967, three appear to us as being of major significance for any reflection on the occupation of the Moon and the Greater Earth area by man.

A- States' freedom to occupy the space domain

Freedom to explore, use and occupy celestial bodies is regulated by international space law.
Under Article I §2, States may, without any discrimination, under conditions of equality and in accordance with international law, freely explore and use all the regions of the celestial bodies that are meant to be freely accessible. Article IV of the Outer Space Treaty specifies that the use of any equipment or installation necessary for the peaceful exploration of the Moon and other celestial bodies is not prohibited.

State Parties may conduct their exploration and use of the Moon anywhere on or under the surface. To this end, State Parties may, inter alia, place their space objects on the Moon[15].
As a result, the freedom to explore and use celestial bodies includes the freedom to occupy the celestial bodies by establishing a settlement.

This freedom cannot be interpreted as a blank cheque given to States. It is a freedom that is regulated by the principle of non-appropriation and the commitment to protect the outer space environment.

B- The principle of non-appropriation of celestial bodies

Freedom to explore, use and occupy a part of a celestial body cannot lead to appropriation of the said parcel and must provide free access to this area for any entity that requests it.

The principle of non-appropriation, as codified in article II of the Outer Space Treaty of 1967, prohibits any appropriation of celestial bodies by anyone and of any kind whatsoever: "outer space, including the Moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means". This means that no state or governmental or non-governmental organization or private entity can claim exclusive rights over the surface of celestial bodies.

15 Art. VIII §1 and 2 and art. IX of the Moon Agreement.

States are prohibited from claiming title to territory over any part of celestial bodies. The objective is to avoid, at all costs, territorialization and a reproduction in outer space of Earth's divisions between States.

Outer space is thus emerging as a common area for the benefit of the whole of humanity: as no entity may appropriate a part of a celestial body, all entities are free to have access to and explore it freely. This means that the occupation of a part of a celestial body should not deprive another entity of access to it (art. I §2 of the 1967 Treaty).

The Treaty makes clear that the principle of non-appropriation does not apply to resources extracted from celestial bodies. Indeed, the Moon Agreement, although ratified by few, expressly authorizes the exploitation of the natural resources of celestial bodies.

Article 11 §3 of the Moon Agreement provides that "Neither the surface nor the subsurface of the moon, nor any part thereof or natural resources in place, shall become property of any State, international intergovernmental or non- governmental organization, national organization or non-governmental entity or of any natural person".

It can be inferred from this that the Moon Agreement prohibits the appropriation of resources by appropriation of land: only the "natural resources in place" are not subject to appropriation. On the other hand, once extracted, they become perfectly appropriable. Finally, the Space Act of 2015 closed the debate on the appropriability of resources by recognizing the right of every American citizen to claim ownership of the mining resources extracted from asteroids, this without eliciting any opposition from the international community.

The use of space by States could thus be defined as an occupation of the space domain without territorial title. Such an occupation, in the legal sense of the term, will condition the rights of private entities wishing to build a habitat on the Moon.

C- The principle of protection of the celestial environment

Prohibition of the contamination of celestial bodies.

States shall ensure that the settlement of outer space, including the Moon and other celestial bodies, is organized in such a way as to avoid the detrimental effects of their contamination and, if necessary, shall take appropriate measures to this end, in accordance with Article IX of the Space Treaty and Article VII §1 of the Moon Agreement.

On this basis, COSPAR has come up with a number of recommendations to prevent the contamination of celestial bodies.

The question of the contamination of celestial bodies arose recently following the crash on the Moon of the Beresheet probe with hundreds of tardigrades onboard[16]. The question that arose was to know whether these microorganisms had survived and if so, what could the consequences of the introduction of such organisms in terms of contamination of the lunar environment be. NASA took the problem very seriously and reiterated the need to update the planetary protection policy in relation to the most modern technologies, so that they be adapted to our scientific knowledge.

16 Microorganisms with ultra-resistance to extreme environments.

We believe that the international community must go beyond this and consider the adoption of binding environmental standards, so that in the event of their non-compliance with these environmental standards, States will be held internationally liable, in accordance with Article VI of the Outer Space Treaty. The aim is to anticipate environmental issues so as not to reproduce the mistakes made on Earth.

Particular attention will be paid to the question of the biospherization of celestial bodies with a view to establishing settlements and dealing with their environmental impact.

In this respect, States will have to pursue sustainable development goals and take care in particular to ensure:
- the protection of sensitive areas on celestial bodies,
- an economical use of areas
- the non-contamination of celestial bodies and the preservation of ecosystems

Protection of historical sites

Going beyond the protection of the outer space environment itself, NASA has issued recommendations to protect historical sites where no new construction or modification can be carried out without authorization[17]. The aim is to protect lunar artifacts including, among others, Apollo lunar surface landing and roving hardware, unmanned lunar surface landing sites (e.g., Surveyor sites), impact sites (e.g., Ranger, S-IVB, LCROSS, lunar module [LM] ascent stage), USG experiments left on the lunar surface, tools, equipment, miscellaneous EVA hardware and specific indicators of U.S. human, human-robotic lunar presence, including footprints, rover tracks.

Celestial bodies are the common heritage of mankind. Each State is a caretaker and a guardian of this heritage for the benefit of mankind.

II/ APPLYING THE COMMON HERITAGE OF MANKIND PRINCIPLE TO CELESTIAL BODIES

We shall use the common heritage of mankind principle as a starting point to defend the idea that, on the one hand, celestial bodies have been the common heritage of mankind since the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies of 1979 (A) and that, on the other hand, each State is the administrator and guardian of this heritage in the interest of mankind (B).

A- Celestial bodies of the common heritage of mankind

17 NASA's Recommendations to Space-Faring Entities: How to Protect and Preserve the Historic and Scientific Value of U.S. Government Lunar Artifacts, July, 20, 2011.

Celestial bodies are the common heritage of mankind[18]. The notion of common heritage of mankind is generally described as a manifestation of the transpatial and transtemporal character of mankind in that areas are reserved for the benefit of mankind (transpatial character) with a view to transmitting this heritage to future generations (transtemporal character).

The common heritage of mankind must be understood as the "materialization of the common interest of mankind in specific areas, goods and living beings"[19]. It is characterized by the non-appropriation and the rational and peaceful use of the protected asset, as well as the equitable sharing of the fruits of this heritage[20].

The notion of the common heritage of mankind is often described as a vague notion with little legal significance, the scope of which is often restricted by commercial interests.

Still, we argue that this is a central notion of space law in that it means that celestial bodies are not subject to appropriation by nations and men but are a place to which they belong.

The distinction was specifically clarified in domestic law by Article L. 110-1 of the French town planning code, which provides that: "the French territory is the common heritage of the nation. Every public authority is its caretaker and guardian within the limits of its powers".

The same idea can be found in Article I of the Outer Space Treaty: "The exploration and use of outer space, including the moon and other celestial bodies […] shall be the province of all mankind.

In English, the term "province" may be understood as meaning "a political division within larger entity which [...] is never considered the property of who governs it and must be administered for the benefit of all its inhabitants as well as in the interest of the nation as a whole"[21].

As a result, in a homothetic perspective, we shall defend the idea that celestial bodies and, more broadly, the Greater Earth area, constitute the common heritage of mankind. Each State is the caretaker and the guardian of this heritage within the limits of its powers.

The scope of the notion of common heritage under domestic law is particularly interesting since it describes the manner in which this territory must be administered by those who live there. Thus, while local authorities manage the nation's common heritage in the interest of and for the benefit of the nation, States, for their part, in a homothetic perspective, administer celestial bodies in the interest of mankind as a whole.

18 Art. 1 and 11 of the Moon Agreement

19 A. Ch. KISS, "La notion de patrimoine commun de l'humanité", *RCADI*, 1982, II, vol. 175, p.102 à 252, p. 243.

20 Voy. A. KISS, *ibid*, p.135.

21 C. LE BRIS, *L'humanité saisie par le droit international public*, LGDJ, Bibliothèque de droit international et communautaire, 2012, 668 pp. 336.

B-Administering celestial bodies in the interest of mankind

The common heritage must be administered in the interest of all mankind, this is in line with Article I of the 1967 Treaty, which states that "The exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind".

From the utopia of a centralized administration of international areas to the dystopia of a unilateral administration predicated on the "first come, first served" rule.

The aim is to consider a legal model for the occupation and administration of celestial bodies that is both efficient and implemented in the interest of mankind. Such a model must avoid the pitfalls of a centralized administration along the lines of the 1982 Montego Bay Convention on the exploitation of the seabed and move away from a unilateral approach by States predicated on the "first come, first served" rule as can be found in the Space Act of 2015.

The legal system resulting from the 1982 United Nations Convention on the Law of the Sea institutionalizes mankind through a High Authority responsible for organizing the exploration and exploitation of celestial bodies on behalf of and in the interest of all mankind [22]. In concrete terms, such a centralized method of administration implies that States go through an International Authority with sole competence to deliver, subject to conditions, licenses to exploit and control operations conducted in situ. In other words, States may not exploit resources unilaterally.

Such an institutional and legal system rarely wins approval from industrialized countries owing to cumbersome institutional procedures and the legitimate fear of States regarding mechanisms of centralized administration and a priori redistribution of resources in the absence of any fully guaranteed return on investment[23].

That is why the United States has refused to ratify the Moon Agreement and the Convention on the Law of the Sea. Their strategy is to bypass these Agreements and Conventions by refusing to ratify them while at the same time exercising external influence by applying their own domestic legislation[24]. The Space Act of 2015 is a perfect illustration of this approach. The United States have unilaterally passed national legislation authorizing any American citizen to exploit resources extracted from asteroids, while reasserting that they do not claim any sovereignty, exclusive rights or ownership over celestial bodies. Again, such a system predicated on the "first come, first served" rule is, by nature, set up for the benefit of a minority and not in the interest of mankind.

We must therefore reflect on the implementation of a mixed legal regime predicated on a unilateral administration by States of the space domain in the interest of all mankind.

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22 M. BEDJAOUI, *Le nouvel ordre économique international*, UNESCO, 1978, p. 234.

23 This is why the United States have refused to ratify the Convention, considering the Authority to be excessive, costly, and endowed with questionable powers. More specifically, they oppose the payment of taxes when applying for a permit.

24 On 28th June 1980, President Carter signed the Deep Seabed Hard Mineral Resources Act, establishing a legal framework allowing North American consortia to undertake the exploitation of polymetallic nodules located in the Area. See: M. A. Bekkouche, « La récupération d concept de patrimoine commun de l'humanité par les pays industriels », *RBDI*, 1987, I, p. 134.

PART 2 -

A PROPOSED LEGAL FRAMEWORK FOR SPACE AND GLOBAL HABITATS

In order to reconcile developments in the occupation of the Greater Earth area and the Moon with the above-mentioned principles and concepts, we propose to reflect on the possible legal foundations for the establishment of, specifically, private operators (I). With this in mind, we moved on to devise the legal building blocks of what we refer to as "space habitat" (II).

I/ PROPOSALS FOR THE LEGAL FOUNDATION OF SPACE SETTLEMENTS

We believe that the trust mechanism as applied to the space domain would provide for efficient management of the space domain without jeopardizing its legal status as common heritage of mankind (A). We also are of the opinion that the issues raised by privately-built settlements could be resolved in part by applying the modalities set out thereafter (B).

A - Trusts as a guarantee of efficient administration of the space domain for the benefit of mankind.

The trust mechanism (1), as applied to the space domain (2), would make it possible to administer the space domain efficiently without distorting its legal characterization as a common heritage of mankind.

1- Trust essentials

A trust implies a triangular relationship. The trustee is entrusted by the settlor with the legal ownership of certain trust-held assets which he has a duty to administer either for the benefit of a third person, known as the beneficiary, who has an equitable interest in the trusted assets or for certain purposes permitted by law.

A trust is not a contract, but results from a unilateral act by the settlor.
Public trusts are widely used in order to ensure the protection of certain natural resources[25].. They involve entrusting certain governmental authorities (trustees) with the mission of administering these resources to ensure their harnessing or even their restoration for the use and benefit of mankind (including present and future generations). "The general public, including future generations, is the "beneficiary" of this

25 E. CORNU-THENARD, « Éléments sur l'apport de la doctrine américaine du public trust à la représentation de l'environnement devant le juge », VertigO - la revue électronique en sciences de l'environnement [En ligne], Hors-série 22 | septembre 2015, mis en ligne le 10 septembre 2015, consulté le 28 janvier 2019. URL: http://journals.openedition.org/vertigo/16259 ; DOI : 10.4000/vertigo.16259

trust and can, as such, hold the trustees liable for the degradation of the trusted resources before a court of law".

2- Space trusts

Here, the trust fund is not made up of the celestial bodies themselves but of the fees paid in consideration for occupancy of the celestial bodies and the use of the resources in situ. In other words, the trust fund is funded by the fees paid by private operators in return for the right to occupy the celestial bodies and use the resources in situ.

At the moment, it is no longer conceivable that private stakeholders from the tech sector whose market capitalization exceeds some States' GDP be allowed to occupy and exploit the space domain without paying financial compensation. This situation would be particularly unacceptable in a context of terrestrial resource depletion.

Indeed, if the natural aim of a private enterprise, whatever its nature, is to make profits, wealth redistribution is, on the other hand, the responsibility of States.

States have a central part to play in the administration of space resources, which must be strengthened in the interest of all mankind.

The amount of the occupancy fees must compensate:
- any possible damage to the environment,
- the loss of opportunity for another operator (possibly originating from another State) to use the same resources
- the limitations imposed in terms of physical access to these resources

The calculation of the fees must also guarantee an equitable sharing of the benefits resulting from the exploitation of resources which are part of the common heritage of mankind.

The distribution of roles may be envisaged as follows:

Settlor: the entity that establishes a space trust is naturally the State for two reasons:
-on the one hand, because it has sole competence to issue exploitation licenses to private operators;
- on the other hand, because it has international responsibility for national activities conducted in space by private entities (Art. VI of the Outer Space Treaty)

In fact, the State, having sole competence to issue an exploitation licence to a private entity, enjoys in return the privilege to charge fees resulting for this exploitation in so far as it will be held liable by the international community for the exploitation activities that it has duly authorized. The settlor State transfers the total amount of fees to the trustee.

Trustee: as a central party to the trust, the trustee has the duty to administer the exploitation rights or the resources themselves in the interest of mankind. It seems wise to entrust a public authority with this mission, perhaps in the form of a committee bringing all space agencies together, for example.

The trustee will be in charge of collecting the fees, managing them to the best of his abilities and redistributing them to the beneficiaries. The fees thus collected could be used, among other things, to facilitate access to space for developing countries by funding programs and/or to fund space clean-up initiatives, etc.

Beneficiary: The beneficiary is none other than the whole of mankind and the end pursued is none other than the best interest of mankind

Such a mechanism guarantees in a flexible and efficient manner the administration of the space domain in the interest of all.

B- Private operators' right to build

States, in their capacity as administrators of the common heritage of mankind, have the possibility of enhancing the value of the space domain by providing access to private operators for the realization of certain activities, in the form of a temporary occupation permit (1). Subsequently, private operators will be able to obtain a permit to build a structure within the land and time limits of the occupation permit (2).

1-Temporary occupation permit

The use of the common heritage may be either collective or private. Private use will require the granting of an occupation permit issued by the administering State. This permit will confer an exclusive right on its holder. Any authorization to occupy[26] a celestial body should be delivered on a precarious and revocable basis, allowing the private user to occupy the site allotted to him until either expiration or revocation. Finally, private occupation will be subject to payment of a fee as consideration for the special advantages granted to the occupant. The fees will be paid into a fund set up for the benefit of mankind as a whole and administered on the trust model. The occupation of celestial bodies could thus be organized around the following principles:

No one may, without authorization, occupy an outer space territory belonging to the common heritage of mankind or use it within limits that exceed the right of use that belongs to all.
- The occupation or use of the public domain may only be temporary (the occupation permit must always be issued for a fixed period of time and is generally not tacitly renewed).
- The duration of occupation permits depends on the nature and the extent of the works being carried out.
- States must register the said objects thus built on the space domain.
- The temporary occupation permit determines the extent of the land occupation and the characteristics of the environment.
- The permit issued by an administering State is precarious and revocable (the occupation permit may be revoked where it may harm the interest of mankind, the cosmic environment, the rights of other States in space, etc.), regardless of the duration of occupation that was initially decided, without the managing States being required to pay compensation to the licensee).

26 Based on the temporary occupation permit model under Art. L. 2122-1 to L 2122-4 and L.2125-1 of the general Code on public property (CGPP)

- Occupation permits are issued on a strictly personal basis and are not assignable to third parties.
- Occupation permits must provide for the conditions of access, extraction and rational use of in-situ resources.
- The occupation gives rise to the payment of a fee. Occupation of the celestial body may exceptionally be authorized free of charge where it contributes directly to the preservation of the environment itself. This financial compensation stems from a concern for sound administration of mankind's heritage, but also from the fact that this occupation affects the right of access of other States which are potential users of the space domain. The methods of calculation of the fee amounts will have to take into account the interest and the surface of the occupied site. States will have competence to collect the fees. These will be paid into a trust fund based on the model developed above.

Temporary occupation permits shall be made available for consultation by other States in accordance with Article IX of the Treaty[27].

a- Planning permission

The planning permission is a compulsory administrative authorization that allows any natural or legal person to erect a structure. The aim is to make sure that the construction complies with the requirements set out in the temporary occupation permit. Planning permission shall of course be required for new constructions but also for alteration or restoration works carried out on existing constructions.

Any natural individual or legal entity, whether an operator or not, shall have to apply for planning permission with the State of which it is a national or under which jurisdiction its actual registered office falls.

Planning applications shall include a technical and an administrative part.

The technical part must verify the requirements set out by the government and provide a detailed description of the building operation. It is also necessary to identify potential hazards in order to provide a risk analysis for each of them. Depending on their severity, the operator shall have to propose measures to reduce the relevant risks either by modifying the design to limit their occurrence or by reducing their consequences.

The applicant shall have to supplement his application with an environmental impact assessment.

As for the administrative part, its objective is to allow the government to ensure that the operator provides sufficient moral, financial and professional guarantees. (no bankruptcy

27 Art. IX of the 1967 Treaty states that " If a State Party to the Treaty has reason to believe that an activity or experiment planned by it or its nationals in outer space, including the moon and other celestial bodies, would cause potentially harmful interference with activities of other States Parties in the peaceful exploration and use of outer space, including the moon and other celestial bodies, it shall undertake appropriate international consultations before proceeding with any such activity or experiment. A State Party to the Treaty which has reason to believe that an activity or experiment planned by another State Party in outer space, including the moon and other celestial bodies, would cause potentially harmful interference with activities in the peaceful exploration and use of outer space, including the moon and other celestial bodies, may request consultation concerning the activity or experiment".

record, sound management, implementation of a quality system, insurance policies, training and qualification).

In accordance with the safeguard clause to be found in nearly all national legislation, building activities cannot be authorized by a state when likely to "compromise the interests of national defence or compliance with its international commitments"[28].

Upon completion of the work, the operator shall be required to submit a statement of completion and compliance to the State that issued the planning permission. This document will be a condition for the validity of subsequent disposal of or changes to the construction.

b-Licence to exploit in-situ resources

A space operator wishing to build a space habitat from on-site resources must be duly authorized by his State and apply with the said State for an exploration permit (specifying the perimeter of the surveyed area, the substances one is looking for, etc.) as well as a license to exploit resources. Authorization shall be subject to a certain number of requirements with which the applicant operator must comply. These may include a technical certification of the extraction operation supplemented by an environmental impact assessment.

II/ A PROPOSED STATUS FOR SPACE HABITATS

A space habitat established on a celestial body is a complex asset created to carry on an industrial and commercial space activity which may consist of asteroid drilling, material recovery, energy production or even a hotel and leisure activity.

This purely technical definition requires a legal definition. This in turn raises the question of the legal nature of space habitats. Should it be regarded as real estate owing to its location on lunar soil? Is it a movable asset to be registered in the same way as spacecraft? Coming up with a legal classification for space housing is a crucial issue (A) in so far as it conditions the legal status of the said asset and in particular the conditions of its exploitation (B).

A-legal classification of space habitats

The idea is to consider all the elements inherent in the concept of space habitat (1) in order to offer a relevant legal classification (2).

1- Elements inherent in the concept of space habitat

A space habitat established on a celestial body consists of both the habitable structure itself, which may consist of a sort of radiation-protective outer shell made from substances extracted in situ and an inflatable modular part designed to accommodate the settlers.

The habitat also includes a life support system, i.e all the technologies involved in allowing the survival of humans in space, including intangible property such as patents.

By extension, we can legitimately consider that *rovers* and other vehicles, as movable property, represent accessory and necessary elements of the space habitat.

28 Loi n°2008-518 sur les opérations spatiales, 3 juin 2008.

Finally, the various authorizations issued for the construction and temporary occupation of the space domain constitute, in our opinion, an essential element of the space habitat.

Moreover, a space habitat is a patchwork of various elements:

- tangible elements such as the outer shell of the installation and the habitable modules established on the ground, rovers and other vehicles used for moving the inhabitants round the site.

- Intangible elements including all intellectual property assets (patents, software) and administrative authorizations that have been obtained (temporary permit to occupy the space domain, planning permission, licence to use natural in-situ resources, etc.).

The upshot is that a space habitat cannot be classified as mere real property by virtue of its being located on the surface of a celestial body. Likewise, we believe classification as registered movable property, in the manner of space objects, to be a very narrow approach in so far as a habitat is not an object that moves through space but a place for humans to live and work in.

2-De facto universal property as a relevant classification

The purpose is to come up with a legal classification for mixed and complex property such as a space habitat, which cannot be considered as real estate (a). De facto universality emerges as the most relevant concept.

Space habitats are not real property

Although established on solid ground, a space habitat cannot be regarded as real property. The reason for this is that only something that can be appropriated can be regarded as property. Establishment on solid ground is the test for identifying real property. There is no real property without a right of ownership to the ground on which said property is established. No one, however, may claim ownership rights over the surface of celestial bodies. Consequently, a base, although established on the surface on a celestial body, cannot be regarded as real property.

Moreover, space habitats are more akin to space objects that are resting on the ground and not really incorporated into the ground. For this reason, space objects, even when established on a celestial body, are generally classified as registered movable property.

Space habitats as de facto universal property

A space habitat can be considered as de facto universal property. The idea is to use aggregates to understand a composite entity[29]. The term "universal property" [French: universalité] dates back to JUSTINIAN, who used the term "universitas" [30].

Universal property is made up of assets that remain autonomous but are brought together in such a way that the whole retains an identity that remains separate from its constituent parts[31].

29 N. KATAYAMA, "L'immatériel et l'universalité : vers la théorie de la valeur", https://www.redactionjuridique.chaire.ulaval.ca/sites/redactionjuridique.chaire.ulaval.ca/files/8-_limmateriel_et_luniversalite_n._katayama.pdf
Going to court a fundamental strategy in (French) property law

30 A. S. FERMANEL DE WINTER. Universalité de fait et universalité de droit [Première partie]. In: Revue juridique de l'Ouest, 2008-4. pp. 409-455;

31 F. ZENATI, RTD Civ. avril - juin 1999, p. 424 "This realization that universal property is autonomous is underpinned by the discovery of the mechanism that allows the whole to fare differently from the constituent parts that make it up without being materially merged with it.

Universal property does not arise by itself: it is created, either naturally or artificially. Its constituent elements must display a certain degree of consistency based on the identity of the property holder and the pursuit of one common goal. A business activity, a rural fund or a marketable securities portfolio are all examples of de facto universal property.

By analogy, a space habitat could be considered as universal property composed of a number of mixed assets including tangible moveable property (installations, rovers, equipment) and intangible assets (patent, software, administrative authorizations), the purpose of which would be to act as an instrument of space activity.

De facto universal property, like a business activity, shall be classified as intangible personal property. This represents a small disadvantage and an interesting advantage where space habitats are concerned.

- The disadvantage lies in the fact that space property, as a de facto universal property, cannot include real property. Therefore, classifying a space habitat as de facto universal property implies as a prerequisite to consider the base established on the celestial body as a registered movable asset and not real estate. This is no insurmountable obstacle owing to the weak incorporation of the installations into the ground.

- The advantage of opting for classification as facto universal property is that it makes it possible to consider a space habitat as a "space fund" made up not only of tangible assets but also of intangible assets such as licenses and authorizations.

We argue that a space habitat, in that it represents a mixed whole, could be legally classified as de facto universal property. Such classification entails legal consequences.

B. The scope of classification as de facto universal property

Classifying space habitats as de facto universal property is interesting both in terms of achieving an economy of legal means (1) and establishing a single connection to a State’s jurisdiction (2).

1- The interest of a single legal status for space habitats

De facto universal property has a legal interest for two reasons.

Firstly, universal property, considered as a single item of property, is subject to its own single legal status. As a result, exercising rights over universal property means acting on the whole.

Universal property thus implies an economy of legal means in so far as deeds of conveyance (i.e., deeds of disposal, partition deeds, security deeds) or deeds making property available for somebody's use will deal with de facto universal property, considered as such. Thus, instead of using each constituent element of the habitat that makes up the universal property as collateral, it will be possible to use the universal property itself, ie the space habitat itself, as collateral.

When a constituent part is disposed of, the whole is unaffected and its durability is guaranteed by substituting the disposed part for its disposal price; the same is true when the disposed part is a sum of money (the acquired good is substituted for that sum of money): injudicis universalibus res succedit in locum pretii et pretium in locum rei. Real subrogation was born and, above all, with it came the realization that when one owns part of a universal property, one does not own the whole property.”

Similarly, disposing of "space property" shall entail the transfer of certain rights such as relevant insurance policies, which are transferred with the insured items, or compulsory licences. These rights, in so far as they are attached to the space property, cannot be transferred independently from it.

Secondly, de facto universal property implies that when one element is replaced by another, universal property is unaffected. Thus, removing a module cannot undermine de facto universal property, which remains whole.

2- Single registration of space habitats

Considering a space habitat as de facto universal property implies treating it as a single asset which, de facto, will be subject to single and global registration[32].

The purpose of this registration is to see that a space habitat, including personnel on board, is subject to one single legal system, namely the jurisdiction of the State of registration[33].

Therefore, a single law shall apply within the space habitat considered as universal property. Such a system makes it possible to neutralize conflicts of law and ensures uniformity of treatment of factual and legal situations arising on board the lunar base.

This avoids the pitfall of ending up with an assembly of various modules, each being registered by the supply partner, as happened in the case of the International Space Station. A person is subject to the law of the State of registration of the module in which he or she happens to be.

In concrete terms, the owner or operator of the "space property" shall apply for registration of the space habitat with their own State. In this respect, it would be helpful, in the interest of consistency and good management of the space domain, if the State that issues the temporary occupation permit and planning permission were also the State that registers the space habitat.

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Such could be the foundations of the future regime for the occupation of celestial bodies. It now remains to be seen whether the international community can be persuaded of the interest and urgency of initiating a reflection on the modes of occupation of the space domain.

32 Article II of the 1975 Convention states: "When a space object is launched into earth orbit or beyond, the launching State shall register the space object by means of an entry in an appropriate registry which it shall maintain. Each launching State shall inform the Secretary-General of the United Nations of the establishment of such a registry".

33 Article VIII of the Outer Space Treaty: « A State Party to the Treaty on whose registry an object launched into outer space is carried shall retain jurisdiction and control over such object, and over any personnel thereof, while in outer space or on a celestial body".