Use Versus Appropriation of Outer Space: The Case for Long-Term Occupancy Rights

Brendan Cohen[*]

Abstract

Article I of the Outer Space Treaty guarantees free exploration and use of outer space and grants free access to all areas of celestial bodies. Article II, however, limits unfettered use by preventing appropriation. This paper explores the issue of whether, and to what extent, a State may maintain long-term ownership and control over a space object without violating the ban on appropriation. After defining appropriation as the ability to exercise the full complement of exclusive rights in property, it considers how such rights may be limited so that States may beneficially use outer space without harmfully impairing the rights of others. It draws on current and historical uses of the geosynchronous orbit as an analogy to think specifically about the scope of rights on the surface of the moon and other celestial bodies. The paper concludes that a functional limitationon a State's rights confined to the period and extent of active use is appropriateboth with respect to the temporal limits on use and on the spatial perimeter of such State's jurisdiction and control

I. Introduction

Though science fiction authors have dreamed of permanent space colonies for decades, humans have not walked the surface of another celestial body since Apollo 17 left the moon in December, 1972. Today, however, the possibility of leaving Earth's orbit for long duration missions is looking brighter. With newcomers like China and India, established spacefarers like the United States and Russia, and a host of private corporations contemplating establishing habitats on the moon or Mars,[1] it is important to consider the extent to which such celestial bodies may be used. In this paper, I examine

[*] The opinions and views expressed herein are solely those of the author and do not necessarily represent those of Cleary Gottlieb Steen & Hamilton LLP or any of its clients.

[1] Miriam Kramer, *Mars Missions Could Make Humanity a Multi-Planet Species, NASA Chief Says*, SPACE.COM (April 23, 2014 6:41am ET), http://www.space.com/25594-nasa-mars-missions-multi-planet-species.html.

the fine line between long-term use of outer space and appropriation. First, I consider the concept of "appropriation" as it has been interpreted by scholars and commentators. Second, I argue that the geosynchronous orbit ("GSO") provides an analogy for thinking about permissible occupancy and use of man-made structures on the surface of the moon or other celestial bodies, both with respect to the custom that has developed over the use of orbital slots and as a possible regulatory scheme for allocating real property in outer space. Third, I apply this analogy of the GSO to delimit the extent of allowed uses of such areas, both temporally and spatially.

II. The Meaning of Appropriation and Property Rights

Under the terms of Article I of the Outer Space Treaty,[2] outer space, including the Moon and other celestial bodies is free for exploration and use by all States. Because outer space is free for use, there is a presumption that States may not restrict the freedom of other States; any restriction must come from international law.[3] One of these restrictions is found in Article II of the Treaty, which prohibits "national appropriation" of outer space, including the moonand other celestial bodies, "by claim of sovereignty, by means of use or occupation, or by any other means."The words"national appropriation" are not defined in the Treaty, nor is thisa term traditionally used in public international law.[4] Black's Law Dictionary defines the relevant sense of "appropriation" as the "exercise of control over property; a taking of possession."[5]Consideringthis ordinary meaning in the context of the interplay of Articles I and II,[6] as used in the Outer Space Treaty, "appropriation" cannot entirely prohibit "control over property" or else Article I would be meaningless.[7]

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2 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, *opened for signature* Jan. 27, 1967, 18 U.S.T. 2410, T.I.A.S. 6347, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty].

3 Karl-Heinz Böckstiegel, Paul Michael Krämer& Isabel Polley, *Patent Protection for the Operation of Telecommunication Satellite Systems in Outer Space? (Part I)*, 47 ZEITSCHRIFT FÜR LUFT- UND WELTRAUMRECHT[hereinafter ZLW] 3, 7 (1998).

4 Karl-Heinz Böckstiegel, Paul Michael Krämer& Isabel Polley, *Patent Protection for the Operation of Telecommunication Satellite Systems in Outer Space? (Part II)*, 47 ZLW 166, 171 (1998).

5 BLACK'S LAW DICTIONARY 117 (9th ed. 2009).

6 *See* Vienna Convention on the Law of Treaties, art. 31(1), May 23 1969, 1155 U.N.T.S. 331, 8 I.L.M. 679("A treaty shall be interpreted in good faith in accordance with the ordinary meaning to be given to the terms of the treaty in their context and in the light of its object and purpose.").

7 *Cf.*CARL CHRISTOL, THE MODERN INTERNATIONAL LAW OF OUTER SPACE 47-48 (1982) (stating that "the prohibition against national appropriation must be read in connection with the provision of Article I, Paragraph 1, of the [Outer Space] Treaty where it is ordained that equal and non-discriminatory exploration and use shall

While there were debates around the time of the Outer Space Treaty's adoption as to whether any individual nation's use of outer space amounted to *de facto* appropriation and was not allowed,[8]the drafters of the Outer Space Treaty apparently contemplated the establishment and placement of installations on the surface of the moon and other celestial bodies by States Parties, sinceArticle XII explicitly provides for visitation rights to such installations.As some manner of State authority is essential in order to provide necessary safety and security, States must be able to legitimately exercise "some form of tenure," other than ownership, over these stations, butwhich is not "sovereignty to its full extent."[9]Thus, if such tenure is established that amounts to less than a plenum of exercisable property rights, such use should be permissible.

Property rightsare not singular and unitary, but can be seen as an agglomeration of certain fundamental means of engaging with the property, including the right to use (or not use), exclude, exhaust, and transfer. In common law jurisdictions, these rights are often thought of as a "bundle of sticks," which may be individually separated and dispersed among different holders. Although civil law systems today usually view property rights as

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prevail. These provisions must also be related to the major provisions of Article I, par. 2, namely, that such exploration and use are to be carried out for the benefit and in the interests of countries and all mankind.").

8 *See*CARL CHRISTOL, SATELLITE POWER SYSTEM (SPS) INTERNATIONAL AGREEMENTS 84 (U.S. Department of Energy, Office of Energy Research 1978) (citing U.N. Doc. A/AC.105/62 (June 1969) at 3-4) (The French Delegate to the Working Group on Direct Broadcast Satellites wrote that "the very use of geostationary satellites can be regarded as an 'appropriation' of the equatorial orbit." The U.S. delegate responded, saying that "using a favorable orbit for a legitimate activity cannot reasonably be classified as a prohibited national appropriation . . . using a favorable geostationary orbit is no more an 'appropriation' or '*de facto* occupation' than using a particularly favorable area of the lunar surface."). The view that mere occupation constitutes appropriation is held by some scholars today. *See, e.g.*, Leslie I. Tennen, *Towards a New Regime for Exploitation of Outer Space Mineral Resources*, 88 NEB. L. REV. 794, 811 (2010) (summarizing the views of several scholars on this point).

9 *See* Space Law Comm., Int'l L. Ass'n, *Some Legal Problems Arising from the Utilization of Outer Space*,54 INT'L L. ASS'N REP. CONF. 405, 428-29 (1970) [hereinafter ILA REPORT]; *cf.* D. Goedhuis, *Legal Aspects of the Utilization of Outer Space*, 17 NETHERLANDS INT'L L. REV. 25, 36 (1970) (explaining that just because States may not possess *absolute* title, this does not prohibit such States from exercising *any* rights over these areas).*But see* René Mankiewicz, *Interventions with Respect to Permanent Stations on the Moon*, 11 PROC. COLLOQ. L. OUTER SPACE, 163, 163 (1968) (permanent stations for the exclusive use of a State constitutes occupation and appropriation of the land on which it is built, which is unlawful); N.M. MATTE, AEROSPACE LAW 313 (1969) (attaching objects to the surface of a celestial body impermissibly grants rights to the "soil" of the celestial body, and thus "we arrive at an ownership, in truth a sovereignty, by technical and industrial occupation, without giving it a name").

more of an exclusive and indivisible right, albeit subject to varying degrees of restriction, depending on the circumstances,[10]the Roman Law origins of civil law systems recognized that the rights and entitlements of an owner could be parceled out.[11]Appropriation, then, may be viewed as the far end of this property rights spectrum in which a State claims all exclusive rights to a piece of property, that is the entire bundle of sticks or the full complement fundamental rights. If appropriation only occurs when the rightsholder has the ability to freely exercise all of its fundamental rights in the property,[12]then by consequence a country may use outer space so long as its rights are not absolute and are curtailed in some meaningful way.[13] As I argue belowby analogy to the custom that has arisen with respect to the GSO, a use-based functional limitation to a State's occupancy rights on the surface of a celestial body provides therequired meaningful restriction (namely that non-use leads to forfeiture of rights) that distinguishes permissible occupation from absolute title.

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10 *See, e.g.*, THEO R.G. BANNING, THE HUMAN RIGHT TO PROPERTY 19-20 (2001) (explaining that the right to use or dispose of property may be limited for reasons of public interest (*e.g.*,environmental protection, protection of cultural heritage) and the right to exclude may be curtailed by the rights of another party (*e.g.*, non-discrimination based on race)).

11 Anna di Robilant, *Property: A Bundle of Sticks or a Tree?*, 66 VAND. L. REV. 869, 904 (2013) (describing the rights of the owner, *dominus*, as the *iusutendi*– the right to make use of something to the exclusion of others, *iusfruendi*– the right to reap all the benefits capable of being legitimately derived from the thing, and *iusabutendi*– the right of consumption, destruction, and the right to freely dispose of the thing). *See also*BANNING, *supra* note 10, at 18-19.

12 *Cf.* MANFREDLACHS, THE LAW OF OUTER SPACE: AN EXPERIENCE IN CONTEMPORARY LAW-MAKING 42 (Tanja L. Masson-Zwaan& Stephan Hobe eds., 2nd ed. 2010) (explaining that States are barred from "establishing proprietary links" with regard to outer space, since property, "the legal expression of a basic form of 'appropriation,' . . . confers the right to use or dispose of an object and exclude all others from doing so"); Böckstiegel, Krämer&Polley, *supra* note 4, at 173 (describing appropriation as "the establishment of territorial sovereignties within the meaning of the public international law right of disposal over extraterrestrial territory," the prevention of "titles to property in private law," and the "establishment of exclusive rights over certain uses of particular segments of space") (citations omitted); *see also* Ram Jakhu, *Legal Issues Relating to the Global Public Interest in Outer Space* 15-16 (2005), available at http://www.cissm.umd.edu/papers/files/jakhu.pdf (summarizing the views of delegates to COPUOS with respect to appropriation).

13 LACHS, *supra* note 12, at 45 (noting that a nation's right to free use of outer space includes the right to establish stations and installations and to make use of a celestial body, so long as these rights are "exercised only to an extent compatible with due regard for the corresponding rights and interests of the other States"); *cf.* CHRISTOL, *supra* note 7, at 47-48 ("Exclusive rights may not exist even though the practical capabilities of some explorers, users, and exploiters may be greater than others.").

III. GSO Slots Provide an Analogy for the Use of Celestial Bodies

One instance in which nations have found a workable balance between the conflicting rights and obligations of Articles I and II of the Outer Space Treaty is in the use of the geosynchronous orbit. GSO is a special region of space at a distance of roughly 36,000 kilometers above the Earth's equator. A satellite launched into this particular orbit is synchronized with the Earth, that is, it makes one revolution about the Earth in exactly the same period as the Earth itself rotates and therefore appears to remain motionless from the perspective of a viewer on the ground. For this reason, such orbits are particularly important for communications satellites. Slots are quite limited, however, because satellites must be located some distance from one another due to the risk of collisions and electromagnetic interference. [14] The International Telecommunications Union ("ITU"), a U.N. specialized agency for information and communication technologies, has been tasked with allocating orbital slots and the associated frequencies with which they communicate. Prior to the 1988 World Administrative Radio Conference ("WARC"), the ITU used an *a posteriori* system, by which it merely acted as a coordinating body through which earlier users could register frequencies to gain priority over others. Later users had to coordinate with earlier users so as to prevent radio interference. As slots began to fill, developing countries without satellites realized they needed a means of ensuring they would have access to the GSO when they developed the technical capability. Eventually, the ITU adopted an *a priori* allocation system that attempted to equitably distribute these slots in such a way as to protect developing nations' future needs.[15]

Despite the fact that there is an international regulatory framework that governs the use of the GSO, the utilization by a satellite of a spatially-defined orbital slot bears many similarities to the physical occupation of a piece of real property on the surface of the moon or other celestial bodies and provides an analogy for thinking about the legal limits of occupation onsuch surface.[16]Nations have been placing satellites in GSO since 1963, and thus

[14] Satellites do not remain in perfect orbits, but rather drift slightly due to perturbations caused by the gravity of other bodies in the solar system. Additionally, satellites transmit to and from the ground using electromagnetic waves, which can interfere with one another when similar frequencies are broadcast too close together. *See* FABIO TRONCHETTI, THE EXPLOITATION OF NATURAL RESOURCES OF THE MOON AND OTHER CELESTIAL BODIES: A PROPOSAL FOR A LEGAL REGIME 166 (2009) (explaining that there are roughly 1,800 orbital slots in geosynchronous orbit, each 0.2° in longitude, though these are not equally attractive based on the Earth's uneven distribution of land masses).

[15] *See, e.g.*, *id.*at 182.

[16] *But see* Kurt Baca, *Property Rights in Outer Space*, 58 J. AIR L. & COM. 1041, 1071 (1993) (arguing that the analogy is not applicable in part because the characteristics of the uses of orbits is not close enough to the uses of facilities on the lunar surface to

over fifty years of custom has developed with regard to its use.[17]If the non-appropriation principle applies equally to orbits as to physical territory, then any long-term use that has been accepted with respect to satellite orbits can apply to physical property.Such an analogy is apt for three reasons: (1) State practice following the Bogotá Declaration demonstrates the belief in the applicability of the Outer Space Treaty, including Article II, to the GSO; (2) even though orbits are considered natural resources (the permissible appropriation of which is debated),they are simultaneously regions of physical space that would fall within the proscription of Article II; and (3) like physical property on the surface of a celestial body, orbits are non-exhaustible and return to their natural state following the occupation at issue.

A. The GSO is Subject to the Rights and Obligations of the Outer Space Treaty

In 1975, Colombia made a claim to the GSO above its territory. The following year, eight equatorial countries met in Bogotá to draft a cohesive argument for the equatorial nations' ownership of the GSO. In what is known as the Bogotá Declaration, they proclaimed "the existence oftheir sovereignty over this natural resource,"[18]and demanded countries wishing to place satellites into GSO receive authorization from the subjacent equatorial State.[19]They argued that orbitsare physical phenomena generated by the Earth itself, so orbits are not part of outer space, but rather are limited natural resources that "are an integral part of the territory over which the equatorial States exercise their national sovereignty."[20]Finally, they argued that because space had not (and still has not) been delimited, there "is no definition of outer space that is valid and satisfactory for the international community such as might be cited to support the argument that the geostationary orbit is included in outer space."[21]

In response, a number of countries opposed the claims of the equatorial States in sessions of the U.N. Committee on the Peaceful Uses of Outer Space ("COPUOS"). These refutations pointed out logical flaws in the Bogotá

be relevant); Philip de Man, *Rights Over Areas vs Resources in Outer Space: What's the Use of Orbital Slots*, 38 J. SPACE L. 39, 58 (2102) (noting the immense physical differences between the GSO and the lunar surface (*e.g.*, orbits do not possess a material manifestation) prevent the use of GSO as precedent).

17 *But see* Baca, *supra* note 16, at 1082 (stating that sufficient consistent State practice has not yet developed to show custom).

18 Declaration of the First Meeting of Equatorial Countries, art. 1, Dec. 3, 1976, *reprinted in* 2 MANUAL ON SPACE LAW 383 (NandasiriJasentuliyana& Roy S.K. Lee eds., 1979) [hereinafter Bogotá Declaration].

19 *Id.* at art. 3(d).

20 *Id.* at art. 1.

21 *Id.* at art. 4.

Declaration's position. [22] Airplane overflights require permission of the subjacent country,[23] but satellite overflights had been permitted for years, demonstrating a general consensus that satellites orbit beyond the regime of air law.[24] The delegate from the United Kingdom explained that the GSO was subject to the legal regime of the Outer Space Treaty,and therefore, as the U.S. delegate noted, the claims of the equatorial States were tantamount to impermissible national appropriation of these orbits.[25]This dominant view was summarized in the Report of UNISPACE 82[26] and has been endorsed by the Scientific and Technical Subcommittee of COPUOS, which stated that the "geostationary orbit, characterized by its special properties, is part of outer space."[27] That orbital slots are subject to the terms of the Outer Space Treaty has thus been recognized in the past and has even been reconfirmed in recent years.[28]

B. Orbits Are Simultaneously Natural Resources and Areas of Outer Space

Even if we accept that orbits are part of outer space, some scholars dispute the applicability of Article II, taking the position that natural resources are

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22 TRONCHETTI, *supra* note 14, at177.

23 *See, e.g.*, Convention on International Civil Aviation, art. 6, Dec. 7, 1944, 61 Stat. 1180, 15 U.N.T.S. 295 ("No scheduled international air service may be operated over or into the territory of a contracting State, except with the special permission or other authorization of that State, and in accordance with the terms of such permission or authorization.").

24 Stephen Gorove, *Major Legal Issues Arising from the Use of the Geostationary Orbit*, 5 MICH. YBI LEGAL. STUD. 3, 4 (1984).

25 *See* Stephen Gorove, *The Geostationary Orbit: Issues of Law and Policy*, 73 AM. J. INT'L L. 444, 452 (1979) (summarizing the viewpoints of a number of countries rejecting the Bogotá Declaration); Jannat C. Thompson, *Space for Rent: The International Telecommunications Union, Space Law, and Orbit/Spectrum Leasing*, 62 J. AIR L. & COM. 279, 308 (1996) (noting that the "overwhelming rejection of the view espoused" in the Bogotá Declaration validated the application of Article II to the GSO and electromagnetic spectrum).

26 Gorove, *supra* note 24, at 5 (citing Report of the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space, U.N. Doc. A/Conf.101/PC/L.20, at 70 (1982)) ("[I]t is accepted by most nations that GSO is a part of outer space and, as such, it is available for use by all States, in accordance with the Outer Space Treaty of 1967.").

27 Comm. on the Peaceful Uses of Outer Space, Rep. on its 56th Sess., ¶ 126, June 6-15, 2001, U.N. Doc.A/56/20 (2001), *available at* http://www.oosa.unvienna.org/pdf/gadocs/A_56_20E.pdf.

28 *See, e.g.*,Comm. Peaceful Uses of Outer Space, Legal Subcomm., 842nd meeting, March 20, 2012 at 7 (statement of the U.S. delegate to the Legal Subcommittee: "a party to the Outer Space Treaty cannot appropriate a position in outer space, such as an orbital location in the GSO, either by claim of sovereignty or by means of use or even by repeated use of such an orbital position.").

not subject to the proscription against appropriation.[29]The ITU considers "radio frequencies and any associated orbits, including the geostationary-satellite orbit, [to be] limited natural resources" that must be "used rationally, efficiently and economically. . . ." [30] Because there is no fundamental legal difference made between natural resources on the surface of a celestial body and those in outer space,[31] they argue that orbits are exempt from the non-appropriation principle. It is important, however, to distinguish between the resource and the area of outer space *per se*.[32]That the GSO is also a limited natural resource or a physical phenomenon that occurs at a particular point in space is irrelevant to the status of the physical segments of territory in which an object can remain in orbit.Even if the Earth's gravitational force did not cause a special circumstance at certain spatial coordinates, the space itself would exist and would be governed by Article II.[33] Thus, regardless of the nature of the orbit as a resource,the physicalterritory is part of the *res communisomnium*and thus not subject to national appropriation.[34]

It has been argued that the qualification of a particular component of space as an area or a natural resource should rest functionally on the activities undertaken there.[35]If one could claim strategically important areas merely by designating them limited resources and then exploiting them, however, such a gambit would provide an end run aroundthe non-appropriation principle, rendering it meaningless.A particular mare on the moon could be retained for exclusive use because it is in the best location to build a radio telescope. A flat-topped mountain could be commandeered because it served as the best launching point for further exploration of the solar system. Or a mineral rich crater could be claimed exclusively because of the resources located there. While this paper argues that there should be some right to use such locations on the surfaces of celestial bodies, it is important to recognize that, like prime orbital locations, they must be used and enjoyed within the limits set by the Outer Space Treaty.

Furthermore, even if one subscribes to the view that appropriation of orbits as natural resources is not prohibited by Article II, the regime set up by the

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29 *See* de Man,*supra* note 16, at 62, n.65 (citing a number of authors on this point).

30 Constitution of the International Telecommunications Union, art.44, Dec. 22, 1992, *available at* http://www.itu.int/net/about/basic-texts/constitution/chaptervii.aspx [hereinafter ITU Constitution].

31 de Man, *supra* note 16, at 62-63.

32 *Cf.* ILA REPORT, *supra* note 9, at 427 ("[A] distinction should be made between (1) the appropriation of areas of outer space which is prohibited by the Treaty, and (2) the appropriation of resources on which the Treaty is silent.").

33 Zachos A. Paliouras, *The Non-Appropriation Principle: The* Grundnorm *of International Space Law*, 27 LEIDEN J. INT'L L. 37, 53-54 (2014).

34 *Id.* at 51, n.93.

35 de Man, *supra* note 16, at 56-69, 132-33.

ITU ensures that while countries may make certain uses of the GSO, frequency assignments "should not provide any permanent priority for any individual country or groups of countries and should not create an obstacle to the establishment of space systems by other countries."[36]The ITU's Radio Regulations provide highly technical rules governing the use of GSO and set forth the means by which States may equitably use (but not appropriate) these orbital slots.[37] Thus, regardless of the applicability of Article II to the GSO directly, because the ITU does not permit appropriation, the analogy between customary uses of the GSO and areas on the surface of a celestial body remains apt.

C. Orbits Resemble Real Property

Finally, orbits serve as a means of thinking about the limits of physical occupation of extraterrestrial property because, while orbits are arcs rather than immovable points on a globe, they nonetheless possess many similar characteristics. Like extraterrestrial property, each can be precisely delimited with a series of coordinates, only a limited number of objects may be placed there, and they are inexhaustible resources in that once such objectsare removed, the area reverts to its prior state, unharmed and available for the next user.[38]

IV. Delimiting the Scope of Rights

Now that the analogy between GSO and celestial property has been established, it is possible to look at the customs that have developed with respect to the use of orbits to begin to delimit the bounds of permissible physical occupation of celestial bodies, specifically with regard to the temporal scope and physical extent to which a nation may exercise certain rights and extend its jurisdiction and control.Even though use of the GSO is regulated by the ITU, which is a technical body, rather than a legislative one,

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[36] Resolution 2: *Relating to the equitable use, by all countries, with equal rights, of the geostationary-satellite orbit and of frequency bands for space radiocommunicationservices* (Rev. WRC-03), *in*FINAL ACTS OF THE WORLD RADIOCOMMUNICATION CONFERENCE 383, *available at*http://www.itu.int/dms_pub/itu-s/oth/02/01/S02010000394002PDFE.pdf [hereinafter FINAL ACTS].

[37] COLOGNE COMMENTARY ON SPACE LAW, VOLUME 1: OUTER SPACE TREATY 61 (Stephan Hobe, Bernhard Schmidt-Tedd, & Kai-UweSchrogl eds., 2009).

[38] *Cf.* GLENN H. REYNOLDS & ROBERT P. MERGES, OUTER SPACE: PROBLEMS OF LAW AND POLICY 43 (2d ed. 1996) (noting that like ships crossing an area of ocean, "satellites do not 'use up' outer space by passing through it"). *But see*Baca,*supra* note 16, at 1082 (explaining that while use of an orbit cannot result in a change or physical improvement to the orbital position itself, use of the surface may result in certain site modifications).

the rules and norms that have developed there may serve to outline the current minimum boundary of acceptable uses of outer space.[39]

A. Space Objects Should be Used for their Functional Lifespans

1. Orbital Allocations Under the ITU

As discussed briefly above, the ITU uses two means of allocating portions of the GSO and associated frequencies, so as to prevent harmful radio interference: an *a posteriori* coordination regime and an *a priori* allotment mechanism. For those slots subject to the coordination regime, the ITU has resolved that frequency assignments shall not be considered perpetual, but will instead last either until the registrant notifies the ITU that it is no longer using the slot, or until theoperator-defined life expectancy, that is, the period for which the satellite network was designed, has expired.[40] The country requesting the frequency assignment determines the period of operation based on the intent of the use and may extend the period if such country plans to replace it with a new spacecraft using the same frequency, but different technical characteristics.[41]

For satellites governed by the allotment mechanism, which guarantees all States some access to the GSO when they are capable of using it, the ITU has made clear that while certain arcs are reserved for countries, there will be no "permanent priority" to the allocation, though there is no prohibition on the amount of time a nation can occupy a given slot (so long as it is not permanent).[42]Countries have a right to use, but not own, such slots,[43] as evidenced by the critical international response following Tonga's 1991 attempt to warehouse and rent orbital slots it was assigned through the ITU's *a priori* allotment system. Although most agree that Tonga's auctioning and leasingof several slots to others was not technically a breach of ITU rules, many considered such speculation in orbits a spiritual violation of the fundamental principles of equity and efficiency espoused by the ITU[44] and of the Outer Space Treaty's obligation touse outer space for the benefit of all

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39 *Cf.*Gennady M. Danilenko, *Outer Space and the Multilateral Treaty-Making Process*, 4 BERKELEY TECH. L.J. 217, 237-39 (1990) (explaining the influence specialized institutions like the ITU have over the negotiations and rulemaking at COPUOS).

40 Lawrence D. Roberts, *ALost Connection: Geostationary Satellite Networks and the International Telecommunication Union*, 15 BERK. TECH. L.J. 1095, 1113 (2000).

41 FINAL ACTS, *supra* note 36, at 384 (Resolution 4: *Period of validity of frequency assignments to space stations using the geostationary-satellite and other satellite orbits*).

42 Don Riddick, *Why Does Tonga Own Outer Space?*, 19 AIR & SPACE L. 15, 18 (1994) (citing WARC Conference Document (Rev. 1), 3.2.3(b), Sept. 15, 1985, at 324).

43 *SeeEvents of Interest: Developments in the International Law of Telecommunications*, 17 J. SPACE L. 47, 53 (1989) [hereinafter *Events of Interest*].

44 ITU Constitution, *supra* note 30, at art. 44.

nations.[45]Additionally, if States had complete freedom to sell slots they were allocated, such use would liecloser to a prohibited complete property right in an orbit.[46]

Under both ITU regimes, long-term use of orbits has been customarily allowed, but there are limits on the rights of operators such that the use does not constitute the full panoply of rights that make up appropriation. States may acquire orbital slots and may retaintheir orbital allotment based on their use thereof, but when a satellite operator stops actually maintaining a functioning satellite in an orbitalslot, it has no further rights to this position.

2. Allocations of Celestial Property

Applying this functional limitation to the long-term occupation of celestial property provides States with certain freedom to use such real estate, but ensures that theoccupation is not permanent and thus does not constitute appropriation.[47]So long as the site is in active use consistent with its original purpose, a State should be able to continue to occupy a particular location.

Like the ITU registrations and allotments in which an operator maintains its non-permanent right to an orbital slot so long as it complies with the terms of the ITU Convention and Regulations, a station-owner on the lunar surface must comply with the relevant space law treaties. For example, a State under whose jurisdiction the particular structure is registered must grant reciprocal rights of visitation, subject to consultation.[48] If the State meets this and other requirements, including, for example, not using the site for military purposes,[49] occupation for the term of use, whatever that may be, is a rational interpretation of the law of outer space.[50]

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45 TRONCHETTI, *supra* note 14, at184-186.

46 *See, e.g.*, Riddick, *supra* note 42, at 22-23 (pointing out this consequence of market forces creating functional property rights and recommending that States be allotted only those orbits they can actually use).

47 Former U.S. Attorney General Nicholas Katzenbach explained that the rights that would vest in States' structures are not sovereign rights, but rather the recognition of the "primary rights of a nation in a localized facility created by its own efforts," independent of real property ownershipthat exist by virtue of the activity ongoing in the facility. Nicholas Katzenbach, *The Law in Outer Space*, *in* SPACE: ITS IMPACT ON MAN AND SOCIETY 69, 78 (Lillian Levy ed., 1965) (quoted in THOMAS GANGALE, THE DEVELOPMENT OF OUTER SPACE: SOVEREIGNTY AND PROPERTY RIGHTS IN INTERNATIONAL SPACE LAW 47 (2009)).

48 Outer Space Treaty, *supra* note 2, at art. XII.

49 *Id.* at art.IV.

50 Patricia Sterns & Leslie Tennen, *Utilization of Extraterrestrial Resources: Law, Science, and Policy*, 35 PROC. COLLOQ. L. OUTER SPACE 499, 502 (1992) (writing that because States have an obligation to allow visitation by other States this requirement "militate[s] against the assertion that the occupation of the celestial location is exclusive and violative of the non-appropriation doctrine").

As discussed above with regard to satellites, the international community moved from a pure "first in time, first in right" model, where the ITU served merely as a means of registry, to a regime in which the intergovernmental organization actively apportions the orbital slots to take into account the needs of developing countries. This shift occurred as the orbital slots began to be filled and less developed countries realized they needed to act to secure their future in space.[51]Starting with a first-user system to encourage efficient and economic use of the moon, once the prime lunar locations begin to be used in earnest, then, if necessary, the United Nations can create a new regime resembling the ITU's allocation system that takes into particular account the needs of developing countries. The knowledge that one will not lose rights in one's installation prematurely provides the certainty to develop long-term usage plans, which would encourage early investment and risk-taking on ventures to celestial bodies but would not prejudice the future rights ofcurrently non-spacefaring nations.

At least at the present, a new international organization is not necessary for such a system. Articles II-IV of the Registration Convention already contemplate the registration of objects launched into outer space on national registries and with the Secretary-General of the United Nations.[52] Moreover, States Parties to the Outer Space Treaty agree to inform the public and Secretary-General, "to the extent feasible and practicable, of the nature, conduct, location, and results" of their activities in outer space.[53]Although not binding on many States, the Moon Agreement obliges its States Parties to inform the Secretary-General of the United Nations of the location and purpose of any lunar station, updated annually.[54]If countries providethe location on a celestial bodyand theexpected duration and intended use thereof, the current registration system should be sufficient to coordinatethe occupation and utilization of celestial bodies.

3. A Wrinkle in Time

In this paper, I propose that there must be a meaningful restriction on the period of long-term use of celestial bodies, but these durations need not necessarily be short. This is important because neither satellites nor structures are immune to the potential for otherwise unconstrained or near-unlimited use. The functional limitation I have suggested requires operators to actively

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51 TRONCHETTI, *supra* note 14, at164.

52 Convention on Registration of Objects Launched into Outer Space, *opened for signature* Jan. 14, 1975, 28 U.S.T. 695, T.I.A.S. 8480, 1023 U.N.T.S 15.

53 Outer Space Treaty, *supra* note 2, at art. XI.

54 Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, art. 9(1), *opened for signature* Dec. 18, 1979, 1363 U.N.T.S. 3, 18 I.L.M. 1434 [hereinafter Moon Agreement].

use and maintain their installations themselves, thus restricting such operators' rights by preventing non-use or free disposition thereof.

While satellites in GSO currently have relatively limited lifetimesof 15-20 years,[55]due in large part to deterioration of the electronics and the depletion of the satellite's fuel (used for station-keeping, the minor adjustments to a satellite's orbit), it has been observed that because operators are granted time for replacement before they lose their priority for a given orbital slot, in the event that a single satellite in a multi-satellite constellation fails, wealthy operators who can afford to relaunch satellites when necessary can potentially secure near-perpetual occupation of specific orbits.[56]A related problem concerns the on-orbit servicing ("OOS") of dead satellites to repair damaged components or refuel the satellite while it remains in orbit. The United States and Germany are both working on experimental programs, that, if successful, put pressure on the concept of a functional limitation by unexpectedly extending the natural life of the original satellite.[57] Today, there may be an effective time limit based on the life of a particular form of technology, but if OOS methods improve dramatically, fundamental parts and components may be regularly replaced as they wear out or become obsolete, thereby extending the useful lifetime of the satellite far beyond its originally expected period.

Fixed structures have their own complications that push on the framework I have laid out in this paper. Compared to satellites, it is probably easier to maintain or renovate a space installation, thereby artificially extending its useful life well beyond what may have originally been intended. Furthermore,

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55 Owen D. Kurtin, *Satellite Life Extension: Reaching for the Holy Grail*, VIA SATELLITE (March 1, 2013), http://www.satellitetoday.com/publications/2013/03/01/satellite-life-extension-reaching-for-the-holy-grail/.

56 *See, e.g.* Francis Lyall, *Paralysis by Phantom: Problems of the ITU Filing Procedures*, 39 PROC. COLLOQ. L. OUTER SPACE 187, 189 (1996) (recognizing the problem of substitution of satellites); *Events of Interest*, *supra* note 43, at 52 (noting the same, but explaining that in practice, this may not be an issue because new satellites are likely to be much more advanced than their earlier incarnations, so they likely will have to reenter the regulatory regime from scratch); Arthur M. Dula, *Regulation of Private Commercial Space Activities*, 23 JURIMETRICS J. 156, 172 (1983) (explaining that with developing technology, "simple preemption" can become "absolute preclusion" and it is necessary to look to the intent of the launching authority to determine if the placement is intended to be permanent).

57 *E.g.Phoenix*, DARPA, http://www.darpa.mil/Our_Work/TTO/Programs/Phoenix.aspx (last visited August 5, 2014) (describing DARPA's Project Phoenix, which intends to harvest and then re-use valuable components from retired or non-working satellites in geosynchronous orbit); *Robotics and Mechatronics Center*, DLR, http://www.dlr.de/rm/en/desktopdefault.aspx/tabid-3825/5963_read-8759/ (last visited August 5, 2014) (explaining DLR's DEOS, which will service non-communicative satellites and deorbit them if necessary).

while satellites are constantly sending and receiving broadcasts or collecting data, space installations are not always inhabited, making the question of what constitutes active use more difficult for a station. Even should OOS of satellites become more widespread, satellites stillgenerally have a predetermined purpose for which they were launched and have a fixed frequency on which they transmit, while stations may be more readily re-purposed. A building that is placed on the moon as the crew quarters for a scientific research station today could easily be turned into a hotel for space tourists in ten years, a change that arguably has not altered the fundamental purpose for which the station was built, that is, for human habitation in outer space. Such a system relies on the intent of the operator (*e.g.*, that the use is not intended to be permanent),[58] which raises the questions of whose intent matters and at what time. Some of these questions can be resolved through the registration requirements discussed above, but others may require a certain amount of trust among the parties involved.

I recognize that my proposed analogy is not perfect and does not necessarily solve all issues before they arise. What it does, however, is provide a framework based on custom for thinking about how to incentivize use of celestial bodies by providing a facility operator the assurance it will not suddenly lose rights and forfeit its investment, while simultaneously protecting less developed countries byguaranteeingthat celestial bodies will not be carved up among the first to establish stations.Ultimately, the issues raised in this section are not insurmountable and, to a large degree, must rely on the principle of good faith in international law,[59] applied to outer space through Article III of the Outer Space Treaty. In addition to conducting their activities in good faith, there is an obligation that activities in outer space "be carried out for the benefit and in the interests of all countries."[60]There will still be

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[58] Stephen Gorove, *Interpreting Article II of the Outer Space Treaty*, 37 FORDHAM L. REV. 349, 352 (1969) (considering appropriation to be exclusive use undertaken with a "sense of permanence"). While beyond the scope of the present paper, this raises the question of how we measure indicia of permanence, whose intentions matter (*e.g.*, the commander of a space colony, the head of the entity sponsoring the mission, or some official in the country of registry), and when we ask the question. If the trip begins as a short-term voyage, but the inhabitants decide to stay, does that transform an otherwise legal mission into a violation of Article II? *Cf.*Horst Bittlinger, *"Keep-out Zones" and the Non-Appropriation Principle of International Space Law*, 31 PROC. COLLOQ. L. OUTER SPACE 6, 8 (1988) (recognizing that a mental state test is not practicable in international law and that "an intent to appropriate could easily and uncontestably be denied, even if de-facto-occupation is obvious").

[59] *See, e.g.*, Vienna Convention, *supra* note 6, at preamble (noting the principles of "good faith and the *pactasuntservanda* rule are universally recognized"); U.N. Charter, art.2, para. 2 (demanding States "fulfill in good faith the obligations assumed by them").

[60] Outer Space Treaty, *supra* note 2, at art. I, para. 1.

instances in which diplomatic negotiations or ultimately judicial intervention is necessary, but having a clear set of guidelines is an important first step.

B. Zone of Non-Interference

While the previous section examined the durational limit for a structure on the surface of a celestial body, this section considers the physical extent of permissible occupation, that is, whether it is confined to the four walls of the structure or if there is some regionover which the State's jurisdiction and control extends. As discussed, the ITU system is in place in order to provide a buffer around satellites to prevent collisions and radio-interference.[61] Although these specific risksare not really ofconcern for installations, States still may require a buffer zone for safety and security and to protect their operations.
The Outer Space Treaty requires States Parties to conduct their activities with "due regard" for the interests of other States Parties and has a procedure to prevent harmful interference, which includes engaging in consultation with potentially affected countries.[62] One means of preventing such interference is to allow a zone of protection or exclusion around an installation.[63]ImreCsabafi has proposed what he terms "functional jurisdiction," a form of jurisdiction that "is limited according to its purpose,"[64] as a means of thinking about the

[61] Radio interference is prohibited under the ITU Constitution. *See*ITU Constitution,*supra* note 30, at art. 44(1) ("All stations, whatever their purpose, must be established and operated in such a manner as not to cause harmful interference to the radio services or communications of other Member States or of recognized operating agencies, or of other duly authorized operating agencies which carry on a radio service, and which operate in accordance with the provisions of the Radio Regulations.").

[62] Outer Space Treaty, *supra* note 2, at art. IX; *see also* Moon Agreement,*supra* note 54, at art. 8(3), which contains stronger a non-interference proscription.

[63] *See, e.g.*,Sterns &Tennen, *supra* note 50, at 501-02 (asserting that the authority to extend control for a limited distance beyond the perimeter of a space structure is allowed if the operator acts in compliance with the other provisions of the space treaties);JoAnne Clayton Townsend, *Property Rights and Future Space Commercialization*, 42 PROC. COLLOQ. L. OUTER SPACE 159, 167 (1999) (listing some of the important problems in space law that might be discussed in the near future, including the question of whether "facility operators have a right to a safety zone surrounding their facility"). *See generally* Bittlinger, *supra* note 58, at 7-10 (summarizing the opinions of various legal scholars, including the view that there is an absolute prohibition on *any* use beyond the object itself, the position that any *exclusive* use violates Article II, even if it does not fall into the category of sovereignty, and a proposal to use a rule of reasonableness to determine whether a keep-out zone is permissible); F. Kenneth Schwetje, *Protecting Space Assets: A Legal Analysis of "Keep-Out Zones,"* 15 J. SPACE L. 131, 132-142 (1987) (providing a synopsis of many authors' views on the legality of keep-out zones in outer space).

[64] IMRECSABAFI, THE CONCEPT OF STATE JURISDICTION IN INTERNATIONAL SPACE LAW 64 (1971); *see also id.* at 131 ("*[F]unctional jurisdiction* means the right of a state in international law to regulate rights of persons, to affect property, things, events and

permissible use of outer space around an installation. Csabafi discusses several instances of States exerting jurisdiction over international areas on Earth, including coastal states' establishment of jurisdiction over foreign vessels when sovereignty or security is at stake and the creation of air defense identification zones over international waters in which airplanes must submit their coordinates regularly or risk being shot down.[65]Similarly, underthe Third U.N. Convention on the Law of the Sea, nations may create Exclusive Economic Zones extending up to 200 nautical miles from the territorial sea, in which the coastal State has certain sovereign rights andjurisdiction, but must allow all other States the freedom of navigation, overflights and laying of cables andpipelines.[66]

Using some of these terrestrial precedents for State jurisdiction in international areas, Csabafisuggests that States may exercise control in a similar manner over regions of outer space or on celestial bodies, so long as "the establishment of the area is reasonable and instrumental to the lawful exercise of the freedoms of outer space."[67] Importantly, functional jurisdiction in outer space is not derived from sovereignty, territoriality, or occupation; rather, it is "justified by the need to render protection for the safe and orderly carrying out of an activity."[68] As it is tied to the specific use of the area, it requires a genuine link to such region and is limited in time to the period of the activity.[69]Language of Article 9 of the Moon Agreement echoes this functional delimitation, providing that a "State Party establishing a station shall use only that area which is

occurrences in designated zones in outer space or areas on celestial bodies, whether by legislative, executive or judicial measure to the extent and for the period of time that is necessary to safeguard and secure its right to explore and exploit outer space including celestial bodies.").

65 *Id.*at 61-66.

66 Third U.N. Convention on the Law of the Sea, arts. 56-58, *opened for signature* Dec. 10, 1982, 1833 U.N.T.S. 397. *See* Rosanna Sattler, *Transporting a Legal System for Property Rights: From the Earth to the Stars*, 6 CHI. J. INT'L L. 23, 41-44 (2005).

67 CSABAFI, *supra* note 64, at 63; *see also*Schwetje, *supra* note 63, at 141 ("For the detailed appraisal of the lawfulness of particular claims to exercise occasional exclusive competence in outer space, the most appropriate test would appear to be the traditional one of reasonableness.") (quotingMYRES S. MCDOUGAL, HAROLD LASSWELL& IVAN VLASIC, LAW AND PUBLIC ORDER IN SPACE 293 (1963)).

68 CSABAFI, *supra* note 64, at 131; *see also*Schwetje, *supra* note 63, at 134 ("Just as the establishment of such zones cannot be interpreted as appropriation of territory, so the establishment of safety zones around space objects cannot be seen as a sovereignty claim to the territory or space occupied by these zones.") (quotingZHUKOV &KOLOSOV, INTERNATIONAL SPACE LAW 64 (1984)); Carl Christol, *The Natural Resources of the Moon: The Management Issue*, 41 PROC. COLLOQ. L. OUTER SPACE 3, 5 (1998) (explaining functional jurisdiction as "akin to the extra-territorial jurisdictional powers of a State [rather] than a claim based on the principle of sovereignty").

69 CSABAFI, *supra* note 64, at 131.

required for the needs of the station . . . ."[70] While it does not detail how large a non-interference zone is appropriate, the language of the Article implies that some protective zone is proper.

Consistent with the ITU system and based on the foregoing analogies, States should be entitled to a three-dimensional[71]zone of exclusion surrounding their space structures if those areas will serve a protective purpose and minimize interference.[72] However, like a time-limited right to occupy outer space that is functionally bounded, thephysical scope and extent of a State's rights should also be determined on the basis of the activity to be carried out andbe reasonably related to what is required for exploration and use.[73] The limits imposed on such occupation prevent the use from crossing into impermissible appropriation.

V. Conclusion

In this paper, I have argued that "appropriation" only occurs when a State exercises the full bundle of rights available with respect to property. One of the fundamental rights is the ability to choose whether or not to use the property. If such non-use is disallowed, the fundamental rights in property are thus curtailed in some meaningful way and the user has not appropriated the property at issue. Drawing on an analogy to the ITU, which limits users of orbits to periods of use based on the operator-defined life expectancy, I suggest that analogous limits to the long-term use of the surfaces of celestial bodies based on functional lifetime provides a permissible baseline. Looking next at the spatial limitations of such use, I believe that an extended zone of functional jurisdiction is consistent with the terms of the Outer Space Treaty and is necessary to protect the activities of States and other actors during their usage of outer space.

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70 Moon Agreement,*supra* note 54, at art. 9.

71 *Cf.* Dirk H.R. Spennemann, *Extreme Cultural Tourism From Antarctica to the Moon*, 34 ANNALS TOURISM RES. 898, 909-10 (2007) (proposing three-dimensional exclusion zones around lunar heritage sites to protect them from spacecraft exhaust).

72 *But see*Bittlinger, *supra* note 58, at 9 (expressing the inability to justify keep-out zones based on the current practice of geosynchronous satellites in part because the minimum distance to prevent interference of satellites is designed to be mutually beneficial and in the interest of both satellite operators).

73 ILA REPORT, *supra* note 9, at 430 (referencing the remarks of Sir Francis Vallat suggesting that countries may not reserve areas of outer space, but that "it is only when the exploration and use takes place *in effect* that States should be allowed to exercise certain rights over such areas"). *Cf.* Patricia Sterns & Leslie Tennen, *Should the Lunar Crater Saha be Accorded Special Legal Protection?*, 42 PROC. COLLOQ. L. OUTER SPACE 393, 395-97 (1999) (discussing the possibility and scope of protecting a radiotelescope on the far side of the moon from harmful interference under Article 7(3) of the Moon Agreement, which allows for the setting aside of regions of special scientific interest as preserves).

The issue of long-term use of outer space raises a number of related issues that unfortunately cannot be discussed in this short paper. For example, I discuss customs that have developed related to the use of GSO, but one could also argue that the lack of treaty-based space debris rules provides a counter example showing States' allowance of long-term occupation that is not tied to the period of functional activity. Another issue that this raises is the extent to which the launching State may actually forfeit its rights when it abandons a structure because of the right and responsibility of maintaining jurisdiction and control over space objects pursuant to Article VIII of the Outer Space Treaty. Finally, under a use-based regime as I have proposed, it becomes harder to justify the protection of particular sites in outer space with significant historic, cultural or scientific value.

Although there are currently no active structures on the surface of the moon or other celestial bodies, mankind will continue to reach for the stars. In a modern day Manifest Destiny, explorers will one day soon "slip[] the surly bonds of Earth"[74] and spread outward into our solar system. Before this day comes, it is important to consider how such expansion should take place and how we balance the rights and obligations of such activity. In order to promote the efficient and equitable use of outer space and celestial bodies, there must be a workable framework that gives users the rights they need to justify the huge costs they will bear in establishing long-term habitats in outer space. At the same time, however, less developed countries must have assurances that there will be some space left for them when they reach a sufficient level of technical capability to take to the heavens.

[74] John Gillespie Magee, Jr., *High Flight* (quoted in RESPECTFULLY QUOTED: A DICTIONARY OF QUOTATIONS REQUESTED FROM THE CONGRESSIONAL RESEARCH SERVICE 603 (Library of Congress ed., 1989)).