OUTER SPACE: A PRESERVE FOR ALL HUMANKIND†

*Leslie I. Tennen**

Outer space offers a wide variety of activities that may be conducted to improve the quality of life for humankind. Public and private entities may desire to participate in space activities, but whether such activities in space are conducted by governmental or non-governmental entities, they must be conducted in accordance with the corpus juris spatialis.

Two provisions of the corpus juris spatialis will have direct application to activities conducted in space by private entities for commercial gain. The non-appropriation principle and the common heritage of mankind philosophy, in pari materia, will both grant and deny private entities the right to conduct certain commercial space activities.

These provisions of the corpus juris spatialis are discussed and analyzed in relation to the availability of the use of space for private gain. This analysis demonstrates that private entities may conduct a variety of peaceful commercial space activities. The corpus juri spatialis, however, prohibits the appropriation of outer space, including the Moon and other celestial bodies, and requires that the benefits derived from the use of space be shared with all humankind.

I. INTRODUCTION

The rapid growth of aerospace technology has lead to remarkable achievements. A mere eleven years elapsed between the United States' first successful launch of Explorer I and the realization of one of mankind's oldest dreams, the landing of *Homo sapiens* on the Moon.

Space use and exploration offers humankind a wide spectrum of activities and functions which can be conducted for research, scientific experimentation, and commercial ventures. Enhancing these space activities is the fact that human endeavors in space no longer need be constrained by the inherent limitations of conventional launch systems. In the coming decades, the United States Space Shuttle will herald the era of economical, routine access to space, for both the public and pri-

* Attorney, Tucson, Arizona. B.A., 1973, J.D., 1976, University of Arizona. Member of the International Institute of Space Law, 1977.

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vate sectors.[1]

However, technological and financial capabilities are not the only requirements which must be satisfied prior to the implementation and operation of commercial ventures in space. Man's activities in space, whether for entrepreneurial purposes or otherwise, must be conducted in accordance with the applicable law, which will have both national and international components. A *laissez-faire* philosophy in space does not exist for either private or public activities. Rather, the *corpus juris spatialis* contains provisions for, and prohibitions against, certain uses of space. This article discusses the availability of space utilization for commercial gain, in light of the international legal régime of space. This inquiry focuses on the use of space in relation to two central policies of space law: (a) the non-appropriation doctrine,[2] and (b) the concept of the common heritage of mankind.[3]

II. CONTEMPORARY AND PROJECTED USES OF SPACE

Since the beginning of man's exploration of space, recognition has been given to the fact that the cosmos contains innumerable resources that can be used to dramatically improve the human condition.[4] Practically speaking, these resources are almost as innumerable as the uses to which they may be put, and are limited only by human innovation and imagination.

The enjoyment of direct and indirect benefits of space exploration and technology began its realization shortly after the initiation of the space program. The direct benefits are twofold: first, the economic impact of government expenditures to the aerospace industry; and second, the results of scientific experiments and the successful functioning of particular space objects, such as telecommunications satellites. The indirect benefits, commonly known as "spinoffs," have been technological advancements adopted by private industry for purposes which were not directly utilized or anticipated by the space program.[5]

Satellites have been the most predominant commercial direct activity of the space program. These satellites are used for a variety of purposes; for example, telecommunications, navigation, agriculture, ge-

1. *See generally* NASA, PUB. SP-407, SPACE SHUTTLE (1976).

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, art. II, 18 U.S.T. 2410, T.I.A.S. No. 6347, 610 U.N.T.S. 205 (entered into force with respect to the United States Oct. 10, 1967) [hereinafter cited as Outer Space Treaty].

3. *See id.* art. I; *see also* C. JENKS, SPACE LAW 192-94 (1965); Gorove, *The Concept of "Common Heritage of Mankind,"* in STUDIES IN SPACE LAW: ITS CHALLENGES AND PROSPECTS 65 (1977).

4. *See generally* G.A. Res. 1348, 13 U.N. GAOR, Supp. (No. 18) 5, U.N. Doc. A/4090(1958).

5. *See generally* NASA, SPINOFF 1979: AN ANNUAL REPORT, GPO No. 033-000-00757-4 (1979).

ology, and remote sensing of the Earth for resources. These space objects will continue in their importance as the public and private activities in space increase. Revenues from private utilization of satellites exceed US$1 billion per year. Several U.S. companies, including COMSAT, RCA, and Western Union, have already placed privately owned satellites in space, and numerous additional satellites are planned.[6]

Novel uses of space, however, will be available with the advent of the Space Shuttle. A single flight of the Shuttle can transport several payloads to space simultaneously. Numerous experiments and activities can thus be accomodated. This factor will serve to reduce the cost for individual activities conducted in space. The Shuttle also has the capability of preparing for a relaunch within two weeks. When the Shuttle fleet of four is complete, the capability will exist to launch up to 65,000 lbs. of payload into Earth orbit more than twice weekly.[7] The Shuttle will enable the implementation of long term projects by furnishing frequent, economical access to and from Earth to near-Earth orbit. The transporting of people, supplies, products, and other necessities to space will be accomplished with much greater ease than was previously possible.

As a result of the Shuttle's capabilities several commercial ventures have been proposed for the construction of permanent facilities in space for providing services or for manufacturing or fabricating products. The proposed installations would facilitate the manufacturing of products in an environment where a higher level of precision can be achieved than is presently possible on Earth. These products include ball bearings, pharmaceuticals, and optical components. Other proposed ventures have considered manufacturing products which cannot be produced in a gravity environment, such as metal foams and novel alloys.

A further group of proposals involve more complex facilities and installations, and the use of space in a variety of contexts. For example, Dr. Gerard K. O'Neill has suggested that a facility in space manufacture solar power satellites (SPS) from lunar surface and subsurface materials.[8] Three different facilities would be utilized by O'Neill. The first would be a mine and a materials transportation center located on the Moon. The second would be a settlement and manufacturing plant located in free space, such as in the L-5 position.[9] Finally, the solar

6. *See generally* 1 SATELLITE WEEK (July 30, 1979).
7. *See* SPACE SHUTTLE, *supra* note 1, at 1-9; SPINOFF 1979, *supra* note 5, at 4-9.
8. *See generally* G. O'NEILL, THE HIGH FRONTIER (1977).
9. The L-5 position is a location in space where the gravitational fields of the Earth and Moon are in balance. A craft in L-5 would orbit an imaginary point in space, rather than around either the Earth or the Moon. There are five such La Grange positions between any two celestial bodies. *See generally* J. LAGRANGE, VI OEUVRES 262-92 (1873).

power satellites (SPS) would be positioned in the geostationary orbit, where they would transmit energy to ground rectennae.

Dr. Brian O'Leary has taken his proposal a step further, suggesting that the satellites and facilities be constructed from asteroidal materials.[10] The asteroids could be mined from two locations. First, there are some small asteroids whose heliocentric orbits intersect the orbit of the Earth. These are known as Apollo-Amor class asteroids. Second, certain small asteroids orbiting in the asteroid belt could be nudged out of their orbits, and repositioned in high Earth orbit, where the necessary resources could be extracted. These SPS programs could be implemented by either public or private funding, and at least one corporation has been formed to further the construction of solar power satellites for economic profit.[11]

Suggestions which are even more exploitative have been planned. These include the construction of a settlement in outer space where "lots" would be sold to private purchasers,[12] and the mining of celestial bodies for the extraction of their natural resources and returning the resources to Earth for sale to private customers at a profit.[13]

As can be seen by the variety of suggestions, many different "uses" of space are possible. These different uses can be divided into several broad and sometimes overlapping categories. The first distinction is between invisible, intangible forces, such as X-rays, solar radiation, and the radio frequency spectrum, as opposed to visible, tangible objects, such as the Moon and other celestial bodies. Other distinctions to be made are between the use of the void of space itself and the use of a particular location or orbit of the void; inexhaustible or renewable resources and finite, exhaustible resources; and resources which can be used in their unaltered form and those which must be altered, depleted, or otherwise destroyed.

These distinctions will be the basis for some legal problems as the use of space becomes a commercial reality. Whether or not a particular activity presents a legal controversy must, of course, await future developments. It is possible, however, to consider the current proposals and their theoretical potency in light of the *corpus juris spatialis, in esse*, and determine if the applicable laws would be respected.

In order to facilitate this discussion, the following categories of "use" of space will be considered: the use of space, including use of the

10. O'Leary, *Asteroidal Resources for Space Manufacturing*, A.I.A.A. Paper No. IAF-77-77 (1977).

11. International Satellite Industries, Inc., was incorporated on Aug. 3, 1978, in the State of Delaware. *But see* notes 41-55 *infra* and accompanying text.

12. Interview with Dr. T.A. Heppenheimer, author of COLONIES IN SPACE (1977), in Princeton, N.J. (May 15, 1979).

13. Interview with Mr. D. Kuck, geologist, in Las Vegas, Nev. (July 12, 1979). *But see* notes 74-86 *infra* and accompanying text.

void itself, and use of particular locations in the void; the use of celestial bodies, including the Moon; and the use of extraterrestrial resources, either for sale of the resources themselves, or for fabrication of such resources into machines that manufacture products which are then offered for sale. These three categories are discussed in relation to the non-appropriation and common heritage doctrines of the *corpus juris spatialis*. The central conclusion of this discussion is that outer space, including the Moon and other celestial bodies, can be utilized by private entities in space for a wide variety of peaceful activities for commercial gain. Neither public nor private entities, however, may appropriate or claim title to the resources of space, and the benefits derived from space must be shared with all humankind.

III. The Basis of the Legal Régime for Outer Space

Following the launch of Sputnik by the Soviet Union, the nation-states of the world quickly recognized the imminent legal implications of space activities. This recognition resulted in the formation of the United Nations Ad Hoc Committee on the Peaceful Uses of Outer Space (COPUOS) in 1958.[14] The Committee was made a permanent body in the following year and charged with the tasks of discussing technical and legal problems regarding space, encouraging efforts toward international cooperation, and drafting legal instruments regarding the activities of man in outer space.[15]

The first major success of COPUOS occurred when the General Assembly unanimously approved the Declaration of Principles Governing the Activities of States in the Exploration and Use of Outer Space.[16] This expression of international sentiment set forth the initial guidelines for the development of human activities in outer space. These principles formed the basis for the first treaty specifically related to space, the Outer Space Treaty of 1967.[17] This treaty established, as a matter of positive international law, that, *inter alia*, states shall have equal rights of exploration and use of outer space;[18] that activities in space are to be conducted in the interests of, and for the benefit of all mankind;[19] and that "[o]uter 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."[20]

The efforts of COPUOS have continued and resulted in world approval of three additional agreements relating specifically to space and

14. *See* G.A. Res. 1348, *supra* note 4.
15. G.A. Res. 1472, 14 U.N. GAOR Supp. (No. 16) 5, U.N. Doc. A/4354 (1959).
16. G.A. Res. 1962, 18 U.N. GAOR Supp. (No. 15) 15, U.N. Doc. A/5515 (1962).
17. Outer Space Treaty, *supra* note 2.
18. *Id.* art. I.
19. *Id.*
20. *Id.* art. II.

space activities. The Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched into Outer Space[21] imposes obligations on states to render all due aid and assistance to distressed astronauts,[22] and to return space objects which come into their possession to the state of launching.[23]

The Liability Convention imposes strict liability upon launching states for damage caused by spacecraft to aircraft in flight, or on the surface of the Earth.[24] Liability for damage caused to another spacecraft is further provided, predicated upon fault.[25]

The latest treaty, the Registration Convention,[26] requires launching states to maintain a registry of objects launched into Earth orbit or beyond,[27] and to supply the Secretary General of the United Nations with information regarding flight trajectories, orbital parameters, and the intended purpose of the craft.[28] Both the Registration Convention and the Liability Convention recognize the common heritage of mankind doctrine in their Preambles.

Consensus on a fifth international agreement by COPUOS recently was reached in the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies.[29] This Agreement prohibits appropriation of the surface or subsurface of the Moon and other celestial bodies,[30] and declares them to be the common heritage of mankind.[31] Although the Moon and Celestial Bodies Agreement is not binding international law at this time, it is an accurate expression of international sentiment, and it appears that the treaty will be approved and entered into force in the near future.

Work is continuing in COPUOS toward resolution of treaties regarding the remote sensing of the Earth, and the direct broadcasting of

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21. Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched into Outer Space, *done* Apr. 22, 1968, 19 U.S.T. 7570, T.I.A.S. No. 6599, 672 U.N.T.S. 119 (entered into force with respect to the United States, Dec. 3, 1968) [hereinafter cited as Return and Rescue Agreement].

22. *Id.* art. 2.

23. *Id.* art. 5.3.

24. Convention on International Liability for Damages Caused by Space Objects, *done* Mar. 29, 1972, art. II, 24 U.S.T. 2389, T.I.A.S. No. 7762, — U.N.T.S. — (entered into force with respect to the United States, Oct. 9, 1973) [hereinafter cited as Liability Convention].

25. *Id.* art. III.

26. Convention on Registration of Objects Launched into Outer Space, *done* Jan. 14, 1975, 28 U.S.T. 695, T.I.A.S. No. 8480, — U.N.T.S. — (entered into force with respect to the United States, Sept. 15, 1976) [hereinafter cited as Registration Convention].

27. *Id.* art. II.

28. *Id.* art. IV.

29. *See* Report of the Committee on Peaceful Uses, 34 U.N. GAOR Supp. (No. —), U.N. Doc. A/AC.105/L.113 Add. 4 (1979) (text of new agreement) [hereinafter cited as Moon and Celestial Bodies Agreement].

30. *Id.* art. XI.2. This agreement applies to the Moon and celestial bodies of this solar system, *id.* art. I.1; however, extraterrestrial materials which reach the Earth by natural means are excluded from the agreement. *Id.* art. I.3.

31. *Id.* art. XI.1.

television by satellite.[32] These conventions and agreements all have their roots in the Outer Space Treaty, which stands as the charter for human activities in space.[33]

IV. Applicability of the Non-Appropriation and Common Heritage Doctrines to Private Interests in Space

The international agreements regarding space are, of course, treaties entered into by states. Thus, it may be questioned whether the legal obligations and principles contained therein are binding upon nongovernmental entities in their use of space. The Outer Space Treaty does not contain a "right of adventure" for private exploitation of space, however, it does recognize that private interests do have a role to play in the continued exploration and use of space.[34]

States party to the Outer Space Treaty have agreed to accept international responsibility to regulate the activities of their nationals in space,[35] and to become internationally liable therefor.[36] This responsibility imposes a positive obligation upon signatory states to ensure that the activities of their nationals in space are conducted in accordance with international law.[37] Furthermore, it is apparent that what is forbidden to states cannot be accomplished by private enterprise associations or individuals.[38] The specific provisions of the *corpus juris spatialis* thus are applicable to both public and private entities.

V. Specific Activities Conducted in Space for Commercial Gain

A. Profits Regarding Location of an Object in Space

The placement of an object in space is a prerequisite to commercial activity in the medium. The object may occupy a particular location in space temporarily, or for an extended period of time, such as a manufacturing facility in the L-5 position. An object may also travel within certain parameters through space, for example, an orbiting satellite. Each of these situations presents differing legal questions.

32. *See* Chen, *Pending Legal Issues Before the Legal Sub-Committee of the United Nations Committee on the Peaceful Uses of Outer Space*, 5 J. Space L. 29 (1977).

33. *See* Fasan, *Space Energy Law and the Hierarchy of Norms*, in 19th Colloquium on the Law of Outer Space 119 (M. Schwartz ed. 1976).

34. *See* Gorove, *Freedom of Exploration and Use in the Outer Space Treaty*, in Studies in Space Law, *supra* note 3, at 49-51; *see also* Diederiks-Verschoor & Gormley, *The Future Legal Status of Nongovernmental Entities in Outer Space: Private Individuals and Companies as Subjects and Beneficiaries of International Space Law*, 5 J. Space L. 125 (1977).

35. Outer Space Treaty, *supra* note 2, art. VI; *see also* Moon and Celestial Bodies Agreement, *supra* note 27, art. XIV.1.

36. Outer Space Treaty, *supra* note 2, art. VI; *see also* Moon and Celestial Bodies Agreement, *supra* note 27, art. XIV.1.

37. *See* Gorove, *Freedom of Exploration and Use in the Outer Space Treaty*, *supra* note 32, at 50-51.

38. *See* Jenks, *supra* note 3, at 201.

Transporting objects into space and then selling the objects as souvenirs presents the least complicated situation regarding the commercial use of space. An object that has travelled into space, even for a short period of time, may have a greater commercial value than would a comparable object which never left the confines of Earth. This activity would present a very limited use of space. The ownership of the object is not affected by its location in space, as the launching or registry state retains jurisdiction and control over their space objects, including the component parts thereof, such as cargo.[39] This limited use of space would not violate the non-appropriation provisions of the *corpus juris spatialis*, since only a temporary occupancy of a limited area of space would be involved. If, however, the objects that traversed through space were offered for sale at a price that included a measure of profit over and above the cost of production and transportation into space, the common heritage of mankind doctrine would impose as a minimum requirement that the objects be offered for sale on a non-discriminatory basis to customers from any state.[40]

A more complex situation would be presented if an object were intended to remain in space for an extended period of time. The placement of a craft in space precludes the use of that same location by any other party, and therefore, presents a question of appropriation. The question becomes more acute when the craft is placed in a particularly useful, but limited, location in space. An example of this type of location is the geostationary orbit. This orbit is approximately 22,300 miles above the surface of the Earth, and a craft in this orbit will circle the globe once every twenty-four hours. If the craft is travelling in the same direction as the Earth's revolution upon its axis, the craft will appear to remain stationary from an observation point on the Earth. There are several advantages which favor satellite utilization of the geostationary orbit, including simplification of ground tracking, and constant telecommunications access by users "below" the satellite.

Certain areas of the geostationary orbit are more useful than others, and serious questions have been raised concerning the number of crafts that can be accommodated within the orbit.[41] In recognition of these facts, the geostationary orbit has been declared to be a limited

39. Outer Space Treaty, *supra* note 2, art. VIII.

40. *Cf. id.* arts. I, XI. Although the objects could travel to space in the cargo bay of the Shuttle, this type of payload will not qualify for the "getaway special" discount price. NASA regulations specify that such payloads must be for research and development purposes only. *See* 14 C.F.R. § 1214.102(d) (1978).

41. *See* Cocca, *Solar and Other Related Energies and Their Impact Upon Space Law*, A.I.A.A. Paper No. IAF-ISL-76-19, at 3 (1976); Perek, *Physics, Uses and Regulation of the Geostationary Orbit, or Ex Facto Sequitur Lex*, in 20TH COLLOQUIUM ON THE LAW OF OUTER SPACE (M. Schwartz ed. 1977); von Kries, *The Legal Status of the Geostationary Orbit*, in 18TH COLLOQUIUM ON THE LAW OF OUTER SPACE 27, 31 (M. Schwartz ed. 1975).

natural resource.[42] Furthermore, several equatorial countries recently declared that their sovereign territory included that portion of the geostationary orbit within their extended boundaries.[43]

Other limited areas of space may also prove to have unique value, such as the five La Grange positions.[44] The placement of a craft in any of these areas necessarily precludes other users from occupying the same area. This factor alone will not, however, prevent peaceful, private uses of these areas of space.

The Outer Space Treaty clearly provides that claims of appropriation will not be supported by the placement of a craft in, or by the use of, a particular location in space.[45] Parties may use space for any purpose, provided that it is peaceful,[46] and in accordance with international law.[47] The freedom of exploration and use of space expressed in Article I of the Outer Space Treaty ensures that space is available for some private uses, even if profit is involved. There is no right, however, to misuse space.[48]

The common heritage of mankind doctrine applies to the use of space by the placement of a craft in a specific location. While the common heritage doctrine is not yet developed to precise definition, it is a substantive doctrine capable of expansion to resolve future controversies.[49] The doctrine finds expression in several provisions of the *corpus juris spatialis*. For example, any party which conducts activities in space must have due regard for the rights of others in the use of space.[50] Further, states are required to take appropriate measures to prevent interference between various activities.[51] Additionally, although states are allowed to exercise jurisdiction and control of a facility in space,[52] exclusive benefits of the use of space is contrary to the common heritage and non-appropriation provisions of space law.[53] Thus, no single *fundator terrani* may saturate a particular location or orbit, and thereby arbitrarily deny other entities the opportunity to make use of that area

42. International Telecommunications Convention, *done* Oct. 25, 1973 art. 33-131, 28 U.S.T. 2495, T.I.A.S. No. 8572 (entered into force with respect to the United States, Apr. 7, 1976).

43. Declaration of the First Meeting of Equatorial Countries, Dec. 3, 1976, known as the Bogota Declaration. *See* ITU, Broadcasting Satellite Conference, Doc. No. 81-E, Annex 4 (Jan. 17, 1977); *text reprinted in* N. JASENTULIYANA & R. LEE, II MANUAL ON SPACE LAW 383 (1979).

44. *See* note 9 *supra* and accompanying text.

45. Outer Space Treaty, *supra* note 2, art. II.

46. *Id.* art. IV.

47. *Id.* art. III.

48. *See* JENKS, *supra* note 3, at 197.

49. *Id.* at 193.

50. Outer Space Treaty, *supra* note 2, art. IX.

51. *Id.* art. VIII.

52. *Id.*

53. *See* Brooks, *Control and Use of Planetary Resources*, in 11TH COLLOQUIUM ON THE LAW OF OUTER SPACE 339, 347 (M. Schwartz ed. 1968).

of space.[54] Determination of the degree to which the benefits of the use of space and profits derived therefrom must be shared will necessarily require the actuality of such activities in order for application. Nevertheless, the common heritage doctrine requires that information concerning scientific advancements and the products or services derived as a result of some particular use of space be made available to the global community on a non-discriminatory basis.[55] This requirement serves as a mandate on both a theoretical and practical level.

A converse situation to the use of satellites for specific functions is the retrieval and recycling of space objects that have ceased to function. Such space junk poses several problems for ongoing activities in space. Operational craft must avoid trajectories that would collide with spent satellites, and many of these objects continue to broadcast signals which clutter the frequency spectrum. Participants might provide a useful, if not necessary, service by retrieving and recycling these objects. Nevertheless, space objects remain the property of the state which caused them to be launched,[56] and any entity subsequently taking possession of the craft without permission would be committing theft.

The law of salvage is inapplicable to these types of crafts, since they would not necessarily have been abandoned by the launching state.[57] Appropriate arrangements with launching or registry states would have to be negotiated in order to lawfully recycle space junk.

B. Use of Celestial Bodies, Including the Moon

While certain products or services may be more efficaciously created in any gravity-free environment, certain activities, such as tourism of celestial bodies, must be conducted on the surface of the specific body. The *corpus juris spatialis* applicable to facilities on celestial bodies is similar to that concerning a facility in free space. For example, the launching or registry state retains jurisdiction and control of a space facility, whether the installation is in free space or on a celestial body.[58] This jurisdiction includes *in personam* jurisdiction over the personnel of the facility.[59] Nevertheless, there are several specific provisions of

54. *See* Tennen, *International Law and the Use of Outer Space for the Production of Solar Power*, in 20TH COLLOQUIUM ON THE LAW OF OUTER SPACE 456, 462-63 (M. Schwartz ed. 1977).

55. *See* Outer Space Treaty, *supra* note 2, art. XI.

56. *Id.* art. VIII.

57. *See* Haley, *Space Salvage—Artifacts and Personnel in Space and on Terrestrial Jurisdictions*, in 8TH COLLOQUIUM ON THE LAW OF OUTER SPACE 119 (M. Schwartz ed. 1965); *but see* Hall, *Comments on Salvage and Removal of Man-Made Objects from Outer Space*, in 9TH COLLOQUIUM ON THE LAW OF OUTER SPACE 117 (M. Schwartz ed. 1966).

58. Outer Space Treaty, *supra* note 2, art. VIII; *see also* Moon and Celestial Bodies Agreement, *supra* note 27, art. XII.1.

59. *See* Gorove, *Criminal Jurisdiction in Outer Space*, in STUDIES IN SPACE LAW, *supra* note 3, at 141.

space law that relate exclusively to facilities and the activities that can be conducted on celestial bodies.

The jurisdiction and control of the launching or registry state over the facility may extend for a reasonable distance from the installation[60] in the interest of security. The facility may be located on, and may be attached to the surface or within the subsurface of the celestial body.[61] A facility on a celestial body, however, may use only that area which is required for the needs of the station.[62] If the facility is operated within these prescriptions, the non-appropriation doctrine will not be violated by the placement of a facility on a celestial body.

The common heritage of mankind philosophy, which underlies and governs the *jus gentium* and *corpus juris spatialis*, will also impose requirements upon a private facility on a celestial body operated for commercial gain. The use of celestial bodies must be for peaceful purposes,[63] and must not interfere with the activities of other parties on the celestial body.[64] Appropriate regard must also be given to the effect a given activity will have on the future use of the celestial body, and to the interests of future generations.[65] Participants in the exploration and use of space are admonished to consider the need to promote higher standards of living conditions, of economic and social progress, in accordance with the U.N. Charter.[66]

The Secretary General of the United Nations must be informed of the activities conducted on the celestial bodies.[67] Furthermore, there is a right of visitation of facilities and installations on celestial bodies provided by the *corpus juris spatialis*.[68] Under the present law, this right of visitation is based upon the undefined requirement of reciprocity.[69] The Moon and Celestial Bodies Agreement will eliminate the requirement of reciprocity, while restating the right of visitation.[70]

Outer space and the celestial bodies are available for use by commercial enterprises of a wide variety. Temperance is strictly imposed, however, by the requirements of the *jus gentium*, in general, and the *corpus juris spatialis*, in particular. The most important of the existing

60. *See* Moon and Celestial Bodies Agreement, *supra* note 27, arts. VIII, IX.
61. *Id.* art. VIII.2(b).
62. *Id.* art. IX.
63. *Id.* art. III.
64. *Id.* arts. VI.2, VIII.3.
65. *Id.* art. IV.
66. *Id.*
67. Outer Space Treaty, *supra* note 2, art. XI; Moon and Celestial Bodies Agreement, *supra* note 27, art. V.
68. Outer Space Treaty, *supra* note 2, art. XII.
69. *Id.*
70. *Compare* Outer Space Treaty, *supra* note 2, art. XII, *with* Moon and Celestial Bodies Agreement, *supra* note 27, art. XV. Neither agreement, however, provides for a right of visitation to facilities in free space. *See* Tennen, *Solar Power*, *supra* note 54, at 464.

restraints are the prohibition against national appropriation[71] and the doctrine recognizing outer space to be the common heritage of mankind,[72] each of which are equally applicable to private entities and to states.[73] This inquiry now focuses upon the use of extraterrestrial resources for private gain.

C. Use of Resources Extracted From Celestial Bodies

The use of materials and minerals extracted from celestial bodies presents unique legal questions. These questions, in general, derive from the doctrine concerning the common heritage of mankind. The *corpus juris spatialis*, and the Moon and Celestial Bodies Agreement in particular, specifically regulate the activities of mankind in the use of extraterrestrial resources.

Public and private entities are free to explore and utilize outer space and celestial bodies, and to establish facilities thereon, provided that the exploration and use are conducted for peaceful purposes and otherwise in accordance with international law.[74] Participants are not, however, granted a comparable freedom to use extraterrestrial resources. Rather, the common heritage doctrine mandates that the resources of celestial bodies be utilized in the manner which best benefits all mankind.[75]

Participants in space may collect minerals and other resources from the surface and subsurface of celestial bodies in support of scientific investigation.[76] These resources shall remain in the possession and control of the collecting entity, which may use such materials in support of its scientific investigation.[77] A privately established facility, operated primarily for research and development purposes, would probably qualify as a scientific facility. Resources collected in this manner, however, are to be made available to the international community for scientific purposes.[78] Nevertheless, in no event are the resources of the Moon and other celestial bodies to become the property of any public or private entity.[79] In other words, incidents of ownership may not attach, and no entity may claim title to the resources.

The *corpus juris spatialis* thus recognizes a general freedom to place crafts or facilities in space and on celestial bodies to conduct peaceful activities. Parties may not conduct activities which would

71. *See* Moon and Celestial Bodies Agreement, *supra* note 27, art. XI.
72. *Id.* art. XI.1.
73. Outer Space Treaty, *supra* note 2, art. VI; *see also* Moon and Celestial Bodies Agreement, *supra* note 27, art. XIV.1.
74. *See* Moon and Celestial Bodies Agreement, *supra* note 27, arts. II, III.
75. *Id.*
76. *Id.* art. VI.
77. *Id.* art. VI.2.
78. *Id.*
79. *Id.* art. XI.3.

harm the environments of celestial bodies,[80] nor may the surface, subsurface or resources be appropriated.[81]

The *corpus juris spatialis* grants recognition to the rights of all humankind to benefit from the use of extraterrestrial resources. In order to effectuate this recognition, the Moon and Celestial Bodies Agreement calls upon states to establish an international régime[82] to govern the peaceful and orderly utilization of these resources.[83] This international régime will promote the rational management of the use of extraterrestrial resources, and encourage public and private participation in the utilization of these resources.[84]

Special consideration shall be given by the international régime to the needs of the developing countries, as well as to the efforts of the parties contributing to the utilization of the resources.[85] The international régime will regulate the extraction, fabrication, and utilization of extraterrestrial resources, and in addition will determine the extent to which the economic gain derived will be distributed.

As a matter of equity, the international régime should allow a reasonable rate of return on capital invested in utilizing celestial resources. Nevertheless, profits derived from the resources themselves, whether based upon the scarcity of the material, or the novelty of its source, should not be sanctioned by the international régime.[86] The *corpus juris spatialis* prohibits the use of extraterrestrial resources for purely exploitative, commercial purposes, whether conducted by public or private entities. The future international régime will regulate the utilization of these resources to ensure that the derived benefits will be shared by all humankind.

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80. *Id.* art. VII.1.

81. *Id.* art. XI.3.

82. *Id.* art. XI.5.

83. *Id.* art. XI.7. The international régime anticipated in the Moon and Celestial Bodies Agreement may arise from an existing organization. *See* JENKS, *supra* note 3, at 201. The régime could also arise as an independent international space agency. *See* J. Tamm, The Outer Space Treaty: Interpretation and Implementation (May 1970) (dissertation presented to the Institute of Air and Space Law, McGill University); L. Tennen, International Organizations and the Future of Space Law: The Committee on Cosmic Enterprises (1979) (unpublished monograph). In order to operate effectively, the international régime must have "the authority to grant, deny, or to limit particular uses or explorations of outer space as well as the power to regulate and control such activities." Berlin & Tennen, *The Role of the United Nations in the Colonization of Outer Space, or Chicken Little was Right*, in 19TH COLLOQUIUM ON THE LAW OF OUTER SPACE 215, 218 (M. Schwartz ed. 1976).

84. Moon and Celestial Bodies Agreement, *supra* note 27, art. XI.7.

85. *Id. See also* Rosenfeld, *Solar Energy and the "Common Heritage of Mankind,"* in 21ST COLLOQUIUM ON THE LAW OF OUTER SPACE 58 (M. Schwartz ed. 1978).

86. *See* Sterns & Tennen, *The Art of Living in Space: A Preliminary Study for the Local Government of a Space Settlement*, (1979) 4TH PRINCETON/AIAA CONFERENCE ON SPACE MANUFACTURING FACILITIES; *see also* Sterns & Tennen, *International Recognition of the Art of Living in Space: The Emergence of Settlement Competence*, in 22ND COLLOQUIUM ON THE LAW OF OUTER SPACE (M. Schwartz ed. 1979).

VI. CONCLUSION

Each increase in aerospace technology presents new uses of outer space. Space activities might be conducted by public entities for national and international purposes. Private entities may desire to conduct activities in space for commercial gain. However, private ventures in space must be conducted in accordance with the *jus gentium* and *corpus juris spatialis*.

Two central provisions of the *corpus juris spatialis* will greatly influence the private uses of space. These provisions are the non-appropriation doctrine, and the philosophy of the common heritage of mankind. This article has examined the availability of space for use by private entities for commercial gain, in relation to these central principles of space law. The particular requirements imposed by the *corpus juris spatialis* have been identified and analyzed. There is a wide variety of uses of space that private entities may conduct for peaceful purposes and commercial gain. Private entities may establish facilities which are located in free space, and on or below the surface of celestial bodies. Outer space, including the Moon and other celestial bodies, however, is not subject to appropriation. In addition, the benefits derived from the use of space are to be considered as the common heritage of mankind, and therefore, shared with all of humanity.

Extraterrestrial resources are also not subject to appropriation, and private entities may not claim title to, or ownership in, any such resources. When the use of extraterrestrial resources becomes feasible, an international régime must be established to regulate their use.

The *corpus juris spatialis* thus recognizes that there is a presumption of interdependence of human activities in space.[87] The universe is the common heritage of mankind, and all human beings have a right to participate in and benefit from the use of space. The cosmos is not, therefore, an arena free for the conquest and exploitation by entities with the most advanced capabilities.[88] Rather, activities in space must be conducted while recognizing the rights of humanity. Outer space is, and should remain, a preserve for all humankind.

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87. *See* JENKS, *supra* note 3, at 194.

88. *But see* Okolie, *Space Law and Energy Relationship with the Outer Space Station: A Question of International Heritage of Mankind*, in 19TH COLLOQUIUM ON THE LAW OF OUTER SPACE 135, 144-45 (M. Schwartz ed. 1976).