

2002

Multinational Investment in the Space Station: An Outer Space Model for International Cooperation?

Lara L. Manzione

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Recommended Citation

Manzione, Lara L. "Multinational Investment in the Space Station: An Outer Space Model for International Cooperation?" American University International Law Review 18, no. 2 (2002): 507-535.

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MULTINATIONAL INVESTMENT IN THE SPACE STATION: AN OUTER SPACE MODEL FOR INTERNATIONAL COOPERATION?

LARA L. MANZIONE*

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INTRODUCTION

The first question that arises when discussing investment in outer space is why. Why are individuals, states, transnational corporations, and other entities interested in developing areas of the universe that involve great risk to the developers in terms of human and financial costs, especially when there are many areas eager for investment and ripe with potential on the planet itself? There are varied answers, of course, from the adventurous explanation used for mountain

* Lara L. Manzione, a former administrative law judge for the State of Connecticut, recently received her LL.M. in international law from the Golden Gate University School of Law. She was inspired to write this article as a result of her participation in the Manfred Lachs International Outer Space Law Moot Court Competition where her team reached the finals of the United States. She wishes to thank Professor Christian Nwajuku Okeke for his constant encouragement and Attorney Todd Bissett for his expertise.

climbing (because it's there), to that for technological growth (because we can) to the scientific rationale (because it may offer new solutions).¹

Regardless of the reason, investment in outer space is inevitable and, in fact, has already begun. States, corporations, and other entities have launched satellites into the Earth's orbit to provide links for telecommunications, including cellular phones, global positioning systems, and direct television broadcasting. States and other organizations use these satellites to conduct remote sensing to gather data concerning weather patterns, environmental changes, and Earth-based natural resources, as well as man-made facilities.² These activities have been for purely scientific uses, national security or military reasons, commercial and consumer purposes, and a combination of these.³

Perhaps the most ambitious project concerning international investment in outer space to date is the joint effort of fifteen nations⁴

1. See DELBERT D. SMITH, *SPACE STATIONS: INTERNATIONAL LAW AND POLICY* 32, 232, n.3 (1979) (explaining that scientific endeavors in outer space provide unique opportunities for research due to "weightlessness, a perfect vacuum, the virtually unlimited light and energy source of the sun . . . super-cold temperatures and the availability and exploitation of new extraterritorial raw material resources").

2. See Ezra J. Reinstein, *Owning Outer Space*, 20 NW. J. INT'L L. & BUS. 59 (1999) (discussing investments made in space).

Already the wealth of space is being developed in the form of telecommunications and remote satellite observation. The private-sector investment in telecommunications satellites alone was projected to total \$54.3 billion (including launch) between 1996 and 2000 – and this figure doesn't include other commercial space ventures, nor does it include investment in Russian and Chinese satellites. A further \$70 billion was projected to be invested in satellite communications ground stations over the same period.

Id.

3. See *id.* (discussing investments various countries have made in space through satellites).

4. See Agreement Among the Government of Canada, Governments of Member States of the European Space Agency, the Government of Japan, the Government of the Russian Federation, and the Government of the United States of America Concerning Cooperation on the Civil International Space Station, *opened for signature* Jan. 29, 1998, United States Space Law: National & International Regulation 98-1 (S. Gorove, ed., 1998) [hereinafter *Space Station Treaty*] (noting that partners to the treaty include Canada (through the Canadian Space Agency), Belgium, Denmark, France, Germany, Italy, Netherlands, Norway,

to construct the International Space Station ("ISS"). The stated objective of the ISS is to "enhance the scientific, technological, and commercial use of outer space."⁵ The signatories to the main agreement governing its construction and usage are realizing the advantages of sharing the risks and rewards of undertaking such a monumental effort in outer space.⁶ Partners in building the ISS each contributed or will contribute a section or component of the facility.⁷ The value of the facility is estimated to be ninety-five billion dollars, a cost prohibitive even to the wealthiest nation on its own.⁸

Although the ISS is exemplary in many ways, it also highlights many of the problems associated with the disparities between states in the North and South and does not focus on the environmental consequences of outer space development activities.⁹ Furthermore, the ISS, as one of the first manned structures located in the Earth's orbit,¹⁰ raises a number of difficult legal issues, which until now have

Spain, Sweden, Switzerland, and the United Kingdom (through the European Space Agency), Japan, Russia (through the Russian Space Agency), and the United States (through the National Aeronautics and Space Administration or "NASA").

5. *Id.* art 1, para. 1.

6. See *Space Station Treaty, Annex: Chronology of the ISS Development* (1993-2001) (providing a detailed history of the evolution of the ISS, including the participating space agencies and personnel), available at http://www.russianspaceweb.com/iss_chronology.html (last visited Nov. 2, 2002).

7. See I. H. PH. DIEDERICKS-VERSCHOOR, *AN INTRODUCTION TO SPACE LAW* 100 (1999) (stating that in November 1998, Russia launched Zarya, the first module of the ISS). An American-launched module, called Unity, was attached to Zarya in December of 1998. Columbus, the laboratory module, will be launched by the European Space Agency. See *id.*

8. See *Russia Plans More Space Tourism* (noting that the uncompleted station is co-owned by the United States, Russia, Canada, Japan, and Members of the European Space Agency), available at <http://www.cnn.com/2001/TECH/space/04/29/shuttle.tourists/index.html> (last visited Nov. 21, 2002).

9. See David Tan, *Towards a New Regime for the Protection of Outer Space as the "Province of All Mankind,"* 25 YALE J. INT'L L. 145 (2000) (offering a comprehensive review of the efficacy of existing space treaties and the control of space pollution).

10. See DIEDERICKS-VERSCHOOR, *supra* note 7, at 90 (stating that the ISS was preceded by now defunct or non-existent space stations such as the Salyut-Soyuz, Skylab (a U.S. station launched in the early 1970s), Spacelab (a joint project starting in 1973 between the United States and the European Space Research Organization, now ESA), and the Mir Orbital Complex (a Soviet station

been the subject of purely academic debate.¹¹ Questions such as the attribution of liability for activities in outer space and where territorial air space ends and outer space begins, are a few of the subjects contemplated by the extant international outer space treaties; but these questions are not sufficiently answered.¹²

Improvements in technology increase the viability of outer space as the next frontier for international investment and development. In addition to the current commercial applications of outer space usage, such as remote sensing and direct television broadcasting, real possibilities exist for mining mineral deposits on the surface of the moon and nearby asteroids,¹³ erecting solar panels on the moon as a source of energy generation to be transmitted to earth via

established in the 1980s)); *see also* NATHAN GOLDMAN, SPACE POLICY: AN INTRODUCTION 143-44 (1992) (discussing contemporary trends in space policy).

11. *See e.g.*, Reinstein, *supra* note 2 (discussing the need for property law in outer space).

12. *See* Reinstein, *supra* note 2, at 59, 61-62 (asserting that many people identify a lack of legal certainty as the reason for the rather limited investment in outer space to date).

If exploitation of outer space's bounty is our goal, we must establish a space property legal system that creates both incentives and predictability. Space development is a highly risky endeavor, as well as mind-bogglingly expensive. Who would expend the effort in developing a space colony, if they were not certain of the project's legality? Valuable projects – energy collection, mining, and colonization – are by no means inevitable. If the law of outer space rejects such uses, or even makes their legality uncertain, it is unlikely that the necessary technology would ever be created.

Id.

13. *See id.* at 60 (discussing mining in space).

Perhaps the most lucrative area of development is the mining of celestial bodies... On the moon, an assay of only 30 [square] km of the lunar surface during Apollo-17 turned up deposits of Helium-3, a radiation-free fusion reactor fuel, practically non-existent on Earth, that is more efficient than any radioactive fuel currently available... So-called near-Earth asteroids . . . six are closer to Earth than our moon and more than 50 closer than Mars, might also be optimal targets for early development... The smaller of these asteroids have negligible gravitational fields, which would reduce fuel costs far below what is necessary for a lunar mission... Many of these [asteroids] seem to be rich in raw materials that are either rare and valuable on Earth, or common on Earth, needed in space, but expensive to launch.

Id.

microwaves,¹⁴ and space tourism. Countries participating in these potential future ventures may look to the ISS and its constitutive document as a model for international cooperation, but should consider the difficulties of living up to the ideals expressed in the Charter of the United Nations and the Outer Space Treaty.

I. HISTORY OF THE USE OF OUTER SPACE & ISS

Outer space begins where territorial air space ends.¹⁵ Although this demarcation is not defined in any international treaty or scientific journal, many legal scholars generally regard the delimitation at approximately 100-110 km above sea level on the surface of the Earth.¹⁶ While the actual demarcation is an interesting academic question, its resolution is unnecessary to answer many of the issues concerning the ISS because it orbits the Earth at approximately 385 km (240 miles) above the Earth's surface.¹⁷ This orbit is at a sufficient distance from Earth, under any definition, to squarely place the ISS within the ambit of the main treaties governing activities in outer space.¹⁸ These treaties comprise the only comprehensive

14. See Ricky J. Lee, *Reconciling International Space Law with the Commercial Realities of the Twenty-First Century*, 4 SING. J. INT'L & COMP. L. 194, 236-37 (2000) (stating that "[a]n average orbiting SPS ("Solar Power Satellite") can provide ten million kilowatts of power, which is sufficient to provide a metropolitan area of four million people with electricity"). The SPS would receive about fifteen times the solar energy received on Earth and would be available around the clock." *Id.*

15. See DIEDERICKS-VERSCHOOR, *supra* note 7, at 17-23 (offering a summary of the law of territorial air space and the leading arguments for where the demarcation, if any, should be drawn).

16. See NANDASIRI JASENTULIYANA, *INTERNATIONAL SPACE LAW AND THE UNITED NATIONS* 50-56, n.89 (1999) (giving a detailed and historical discussion of the pros and cons of defining outer space).

17. See Space Station Treaty, *supra* note 4, art. 1, para. 3 (finding that "[t]he permanently inhabited civil international Space Station will be a multi-use facility in low-earth orbit"); see also *Tourist Floating On Air Over Visit to Space Station*, (reporting that Dennis Tito was to spend six days at the Space Station as a tourist), available at <http://www.cnn.com/2001/TECH/space/04/30/space.tito.02> (last visited Nov. 9, 2002).

18. See generally Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, *opened for signature* Dec. 18, 1979, 1986 A.T.S. 14, 18 I.L.M. 1434 [hereinafter *Moon Treaty*]; Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into

system addressing space activity and are classified as public international law "because there is not yet sufficient commercial/industrial presence in space operations for the development of a coherent body of relevant rules of private international law."¹⁹

The Legal Subcommittee of the United Nations Committee on the Peaceful Uses of Outer Space ("COPUOS") drafted the main treaty on international outer space affairs, the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies ("Outer Space Treaty"), in the 1950s and 1960s during the Cold War between the two major space-faring nations at the time, the United States and the Union of Soviet Socialist Republics.²⁰ Also at this time, the United States and the Union of Soviet Socialist Republics were

Outer Space, *opened for signature* Apr. 22, 1968, 19 U.S.T. 7570, 672 U.N.T.S. 119 [hereinafter *Rescue Agreement*]; Convention on International Liability for Damage Caused by Space Objects, *opened for signature* Mar. 29, 1972, 24 U.S.T. 2389, T.I.A.S. 7762, 961 U.N.T.S. 187, 10 I.L.M. 965 [hereinafter *Liability Convention*]; 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 [hereinafter *Registration Convention*]; 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, 6 I.L.M. 386 [hereinafter *Outer Space Treaty*] (finding that this orbit is at a sufficient distance from the Earth, under any definition, to squarely place the ISS within the ambit of the five generally recognized treaties governing activities in outer space). "The Space Station shall be developed, operated, and utilized in accordance with international law, including the Outer Space Treaty, the Rescue Agreement, the Liability Convention, and the Registration Convention." Space Station Treaty, *supra* note 4, art. 2, para. 1.

19. STEPHEN E. DOYLE, CIVIL SPACE SYSTEMS: IMPLICATIONS FOR INTERNATIONAL SECURITY 187 (1994).

20. See GOLDMAN, *supra* note 10, at 23 (noting that COPUOS is the "world's de facto space legislature – debating, drafting, and negotiating international law for outer space"); see also JASENTULIYANA, *supra* note 16, at 23-41 (stating that COPUOS, established by the United Nations in 1958, produced drafts of the Outer Space Treaty, the Rescue Agreement, the Liability Convention, and the Registration Convention among other international resolutions and documents); Tan, *supra* note 9, at 165 (explaining that COPUOS uses the "consensus methodology, also known as the rule of unanimous consent, [and] impels each negotiating member to search for the lowest common denominator"). "It contributes to the difficulty of negotiations because sometimes a single state can resist the development of a common position and demand concessions as the price of securing unanimous consent." *Id.*

engaged in a "Space Race" to be the first nation to send a man into outer space or to the surface of the moon.²¹ The Soviets won the former contest,²² while the Americans won the latter.²³ Integrating these political realities as context, the Outer Space Treaty includes many of the good-neighbor and peace-loving principles contained in the Charter of the United Nations.²⁴ The Outer Space Treaty does not, however, address the nuts and bolts of commercial development or exploitation of outer space, but rather preserves the area of outer space for the benefit of all mankind.²⁵ "The 'value' of space law . . . was [used] 'as an instrument to deny control of outer space to any single power.'"²⁶

In the 21st Century, not all U.N. member states interpret the principles of the Outer Space Treaty in the same manner and a divide evolved between those states in the more-developed North and those in the lesser-developed South.²⁷ Most developed nations espouse the

21. See *Greatest Space Events of the 20th Century: the 1960s* (detailing a timeline of the space race between the Soviet Union and the United States), available at http://www.space.com/news/spacehistory/greatest_space_events_1960s.html (last visited Nov. 4, 2002).

22. See Ricco Villaneuva Siasoco, *One Small Step* (affirming that Yuri Gagarin, a Soviet, became the first man in outer space in 1961), available at <http://www.factmonster.com/spot/moonwalk1.html> (last visited Nov. 2, 2002).

23. See *id.* (stating that on July 20, 1969, the ship Apollo XI landed and two Americans, Neil Armstrong and Edwin E. Aldrin, walked on the surface of the moon).

24. See generally U.N. CHARTER pmbl. (promoting tolerance and peacefulness as "good neighbours").

25. See *Outer Space Treaty*, *supra* note 18, art.1, para. 1 (stating that "[t]he exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind").

26. See Reinstein, *supra* note 2, at 66 (citing ROBERT D. CRANE, *PLANNING FOR SPACE LEGAL POLICY* 1 (1961), discussing current problems with space law).

27. See e.g., SMITH, *supra* note 1, at 137-72 (providing a detailed historical summary of the arguments on all sides of the debate). Interestingly, at the time of the enactment of the Outer Space Treaty, scholars were more concerned with the interpretation of the language concerning benefits and interests in terms of peaceful versus military and non-military uses, rather than the equal or equitable sharing of the benefits and interests outer space may provide. See *id.*

view that the development of outer space should benefit those who develop it, while most developing nations prefer an approach that shares the profits of the developing states with all nations.²⁸ Indeed, a "Group of 77" developing nations emerged to virtually "demand a share of all earnings from space enterprises . . . during the negotiation of the Moon Treaty."²⁹

The lesser developed South Pacific island state of Tonga is an exception to this pattern. It has taken advantage of its equatorial location by securing an allotment of satellite orbital slots from the International Telecommunication Union ("ITU")³⁰ and is anomalous to other Southern States for its participation in outer space development.³¹ Its actions, however, were not without repercussions. "When Tonga registered for the lucrative orbital slots on the geostationary orbit and then proceeded to rent them to commercial operators, there was an uproar in the ITU, but there were no effective mechanisms for other States to take action against Tonga."³²

28. See Nandasiri Jasentuliyana, *Ensuring Equal Access to the Benefits of Space Technology for All Countries*, in *THE USE OF AIRSPACE AND OUTER SPACE FOR ALL MANKIND IN THE 21ST CENTURY* 209-10 (Chia-Jui Cheng ed., 1995) (conveying that "[w]hile the developed countries had their interpretation of the Treaty, the developing countries believed that Article I [of the Outer Space Treaty] was not only an appeal for all States to conduct their space activities on a cooperative international basis, but actually implied that they had an obligation to do so"). "While there has been much debate among legal scholars over the obligatory nature of Article I, the fact that since the beginning of the space age certain countries have benefited much more than others from space activities is undisputed." See *id.*

29. Reinstein, *supra* note 2, at 137-72.

30. See Constitution and Convention of the International Telecommunications Union (Geneva 1992), *amended by* Final Acts of the Plenipotentiary Conference (Kyoto 1994) [hereinafter ITU Constitution] (recognizing the importance of international agreement with regard to telecommunication rights and privileges internationally), available at <http://www.itu.int/publications/cchtm> (last visited on Oct. 20, 2002).

31. See Don Riddick, *Why Does Tonga Own Outer Space?*, 19 AIR & SPACE L. 15 (1994) (discussing Tonga's interesting history of claiming and selling rights to outer space); see also Jonathan Ira Ezor, *Costs Overhead: Tonga's Claiming of Sixteen Geostationary Orbital Sites and the Implications for U.S. Space Policy*, 24 LAW & POL'Y INT'L BUS. 915 (1993) (pointing out that Tonga was only allowed to retain six out of the sixteen orbital sites it had requested).

32. Lee, *supra* note 14, at 202 (revealing the inspiration for reformation of certain regulator regimes).

Additionally, Indonesia is also a lesser-developed nation that has owned and operated its own satellite, Palapa, since at least 1976, but does not participate in other outer space ventures.³³ Besides the United States and Russia, “[s]pace launch facilities are now operational in . . . China, French Guiana, India, Israel, Japan, [and] Kazakstan.”³⁴

The North-South divide is strongly pronounced in the ISS’s constitutive document, the Agreement Among the Government of Canada, Governments of Member States of the European Space Agency, the Government of Japan, the Government of the Russian Federation, and the Government of the United States of America Concerning Cooperation on the Civil International Space Station (“Space Station Treaty”).³⁵ From its title alone, it is evident that only developed states are parties to the agreement creating the ISS. While the ISS is in many ways a model of multinational cooperation, it is mostly an agreement among the more developed states of Europe, North America, Japan, and Russia.³⁶ Arguably, lesser developed states may not currently have sufficient resources to add to this particular international effort, however, their virtual exclusion from the venture raises troubling questions in light of the ideals that the Charter of the United Nations and the main international treaty governing activities in outer space espouses.³⁷

33. See Toshio Kosuge, *Satellite Communications Systems and Legal Issues in the Asia-Pacific Region*, in *THE USE OF AIRSPACE AND OUTER SPACE FOR ALL MANKIND IN THE 21ST CENTURY* 58 (Chia-Jui Cheng ed., 1995) (discussing Indonesia’s role in outer space).

Palapa is ideal for Indonesia, which consists of 13,667 islands . . . In 1992, Palapa offered the ASEAN countries satellite coverage of Japan, Korea, Taiwan, Hong Kong, the Pacific Islands and coastal China . . . [but] subject[ed it] to competition from a consortium comprising an Indonesian company, PT Mediacitra Indostar and International Technologies, which intends to launch a satellite, Indostar 1, to provide TV and radio services throughout Indonesia.

Id.

34. Nicholas L. Johnson, *The Earth Satellite Population: Official Growth and Constituents*, in *PRESERVATION OF NEAR-EARTH SPACE FOR FUTURE GENERATIONS* 7 (John A. Simpson ed., 1994).

35. See Space Station Treaty, *supra* note 4.

36. See *id.* (listing the various parties agreeing to the provisions therein).

37. See U.N. CHARTER pmbl. (promoting the “advancement of all peoples”).

The Space Station Treaty grants rights to the parties commensurate with each state's responsibilities and incorporates a number of Memorandums of Understanding ("MOUs") and implementing agreements drafted between the lead Partner to the Space Station Treaty, the United States,³⁸ and the other Partners.³⁹ These Partners, however, are under no specific duty to include lesser-developed states in their activities.⁴⁰ In fact, none of the language present in many other international treaties addressing the special status of lesser developed nations, however precatory it may be, is incorporated into the Space Station Treaty.⁴¹ This omission may be explained by the fact that the Space Station Treaty is more akin to a multilateral investment contract than an international treaty.⁴²

38. See Space Station Treaty, *supra* note 4, art. 14, paras. 1-2 (defining the rights and obligations of the countries to the Space Station). "The Partners will join their efforts, under the lead role of the United States for overall management and coordination, to create an integrated international Space Station." *Id.*

39. See *id.* art. 14, paras. 1-2 (stating that "[t]he Partners intend that the Space Station will evolve through the addition of capability and shall strive to maximize the likelihood that such evolution will be effected through contributions from all the Partners").

To this end, it shall be the object of each Partner to provide, where appropriate, the opportunity to the other Partners to cooperate in its proposals for additions of evolutionary capability . . . This agreement sets forth rights and obligations concerning only the elements listed in the Annex, except that this Article and Article 16 shall apply to any additions of evolutionary capability. This agreement does not commit any Partner State to participate in, or otherwise grant any Partner rights in, the addition of evolutionary capability.

Id.

40. See *id.* art. 1 (limiting the scope of the agreement to the signatories and failing to include lesser-developed nations).

41. See, e.g., *Outer Space Treaty*, *supra* note 18; *Moon Treaty*, *supra* note 18 (including obligations and rights for signing parties, but failing to include benefits to other nations).

42. See *Martin Marietta v. INTELSAT*, 763 F.Supp. 1327 (D. Md. 1991), *rev'd in part* 978 F.2d 140 (4th Cir. 1992) (exemplifying U.S. case law concerning outer space activities which holds that private contracts entered into by parties with equal bargaining power will be enforced); see also *Union of India v. McDonnell Douglas Corporation* (Q.B. December 22, 1992) (discussing a similar line of thought followed by the English High Court ruling that where parties neglect to make an explicit choice of law provision, the Court will select the law to be applied based on inferences in the agreement); Rachel B. Trinder, *US Space Law: The Practical Implications of Recent Case Law Developments on Minimization of*

Many scholars believe that "entry into the space technology arena requires substantial capital investment, large numbers of sophisticated scientists and technicians and a substantial industrial base . . . factors often found lacking among smaller, agrarian society, developing countries."⁴³ While this statement is true, by and large, notable exceptions exist, such as Brazil, India, and Indonesia, mostly due to their national programs to "establish basic technological capability in-country."⁴⁴ In June 1996, in order to address these perceived and real barriers to entry, COPUOS adopted by consensus the "Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interests of All States, Taking into Particular Account the Needs of Developing Countries."⁴⁵ The General Assembly formally adopted this Declaration as a Resolution in December 1996.⁴⁶ Although U.N. Resolutions are not binding as international law per se, over time, if such resolutions are followed by states, they may be regarded as evidence of state practice, and thus may constitute customary international law.⁴⁷

The Outer Space Treaty, as an international agreement, binds all states which explicitly agree to be bound by it, namely the signatories. The Treaty addresses the issue of access to structures such as the ISS by stating that:

All stations, installations, equipment and space vehicles on the moon and other celestial bodies shall be open to representatives of other States Parties to the Treaty on a basis of reciprocity. Such representatives shall

Litigation, in THE USE OF AIRSPACE AND OUTER SPACE FOR ALL MANKIND IN THE 21ST CENTURY 69-81, n.14 (Chia-Jui Cheng ed., 1995).

43. See DOYLE, *supra* note 19, at 115.

44. See *id.* at 116.

45. See *Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of all States, Taking into Particular Account the Needs of Developing Countries*, G.A. Res. 51/122, U.N. Doc. A/AC.105/572/Rev. 1 (1996) (adopting a resolution attempting to bring together many nations' space program).

46. See JASENTULIYANA, *supra* note 16, at 46 (detailing the procedures by which the Declaration was adopted formally).

47. See Statute of the International Court of Justice, 1978 I.C.J. Acts & Docs. 59, 77, 59 Stat. 1055, T.S. No. 993 (June 26, 1945) (outlining the different types of binding international law).

give reasonable advance notice of a projected visit, in order that appropriate consultations may be held and that maximum precautions may be taken to assure safety and avoid interference with normal operations in the facility to be visited.⁴⁸

This provision requires that stations, such as the ISS, remain open for access, albeit on a reciprocal basis.⁴⁹ Because the Space Station Treaty requires access on a reciprocal basis, it conforms with the specific language of the Outer Space Treaty.⁵⁰ However, the Space Station Treaty may violate the spirit of the Outer Space Treaty, as expressed in Article I:

The exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, *irrespective of their degree of economic or scientific development*, and shall be the province of all mankind.⁵¹

The Space Station Treaty only provides access to the ISS on a reciprocal basis, and thus, automatically excludes lesser-developed States, specifically because of "their degree of economic or scientific development."⁵² Without specific ameliorative provisions, such as those contained in the Remote Sensing Principles, parity will not be reached.⁵³

48. *Outer Space Treaty*, *supra* note 18, art. 12 (establishing an open policy for nations to use equipment of other nations on celestial bodies).

49. *See id.* (requiring availability and consultation prior to visits).

50. *See Space Station Treaty*, *supra* note 4, art. 9 (discussing usage of the Space Station).

51. *Outer Space Treaty*, *supra* note 18, art. I (highlighting the importance of the cooperation of all nations in furthering space exploration) (emphasis added).

52. *Id.* (indicating why certain countries seem to be automatically excluded from access to the ISS).

53. *See, e.g., Principles Relating to Remote Sensing of the Earth from Outer Space*, U.N. GAOR 41st Sess., Res. 41/65, Annex, Supp. No. 21, at 115, U.N. Doc. A/Res/41/65, princ. II (1986) (stating that "[r]emote sensing activities shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic, social or scientific and technological development, and taking into particular consideration the needs of the developing countries"); *see id.* at princ. IV (recounting that "[r]emote sensing activities shall be conducted in accordance with the principles contained in Article I of the [Outer Space] Treaty . . . which, in particular provides that the exploration and use of outer space shall be carried out for the benefit and in the interests of all countries, irrespective

II. DEFINITIONAL AND OTHER LEGAL ISSUES CONCERNING INVESTMENT IN OUTER SPACE AND THE ISS

While the Space Station Treaty attempted to address many of the traditional concerns about investment in outer space, it is not thorough enough to establish legal certainty for investors. A preliminary issue concerns the launch of any vehicle bound for the ISS.⁵⁴ In order to reach the ISS, a vehicle must pass through the territorial air space of many sovereign nations.⁵⁵ At least one scholar has argued that since no country objected after the first space launch,⁵⁶ this practice of briefly violating territorial air space became accepted as "instant" customary international law.⁵⁷ To date, no State has challenged the legal right of an outer space vehicle to cross through another's territorial air space while traveling into outer space. Interesting questions may occur, however, in the case of so-called hybrid vehicles capable of operating in both outer space and

of their degree of economic or scientific development, and stipulates the principle of freedom of exploration and use of outer space on the basis of equality"); *id.* at princ. XIII (revealing that "[t]o promote and intensify international co-operation, especially with regard to the needs of developing countries, a State carrying out remote sensing of the Earth from space shall, upon request, enter into consultations with a state whose territory is sensed in order to make available opportunities for participation and enhance the mutual benefits to be derived therefrom").

54. See Space Station Treaty, *supra* note 4, arts. 12, 16, 17 (defining and determining liability for "launch vehicles" headed to and from Earth).

55. See Lee, *supra* note 14, at 211 (discussing air space and jurisdictional issues).

56. See Susan Cahill, *Give Me My Space: Implications for Permitting National Appropriation of the Geostationary Orbit*, 19 WIS. INT'L L.J. 231, 241 (2001) (declaring that this proposition does not address the sovereignty claims over geostationary orbits expressed in the Bogota Declaration of 1976 and asserted by Brazil, Colombia, Congo, Ecuador, Indonesia, Kenya, Uganda, and Zaire).

57. See GOLDMAN *supra* note 10, at 24-5 (noting that Manfred Lachs was the first legal scholar to espouse this concept).

Because space law is so new, customary space law has had little time to develop. One example of customary international space law is the proposition that the spacecraft of one nation can fly over the 'territory' of another country. Before Sputnik the question was open. In air law, the nation retained sovereignty over its airspace.

Id.

air.⁵⁸ Even assuming, arguendo, that a vehicle launching into outer space is an outer space vehicle and therefore subject to the Liability Convention, other legal problems, such as the apportionment of liability, still arise.⁵⁹

Under the Liability Convention, if a space object causes damage on the surface of the Earth or to aircraft in flight, absolute liability attaches to the launching state.⁶⁰ The launching state is defined as the "State which launches or procures the launching of a space object . . . [or] . . . a State from whose territory or facility a space object is launched."⁶¹ In cases of accidents other than on the surface of the Earth, a fault-based standard of liability exists.⁶² If there is more than one launching state, joint and several liability exists between or among them, and a standard of comparative negligence may be employed, if appropriate.⁶³ Furthermore, the Liability Convention must be read in concert with the Outer Space Treaty, which requires States to bear international responsibility for activities in outer space undertaken by governmental or non-governmental organizations, and which necessarily includes private enterprises acting within their

58. See *Reusable Launch and Space Vehicle History* (detailing evolution of launch vehicles) available at <http://www.hobbyspace.com/Links/RLV/RLVHistory.html> (last visited Nov. 4, 2002).

59. See CARL Q. CHRISTOL, *THE MODERN INTERNATIONAL LAW OF OUTER SPACE* 811-41 (describing space transportation systems including space vehicles).

60. See *Liability Convention*, *supra* note 18, art. II (promoting absolute liability for States that cause damage with a space object on the surface of the Earth or to aircraft flight); see also GLENN H. REYNOLDS AND ROBERT P. MERGES, *OUTER SPACE: PROBLEMS OF LAW AND POLICY* 303 (2d ed. 1997) (explaining that "[t]he strict liability principle for space launches is based on the notion that these are 'ultrahazardous activities,' that is, activities which 'necessarily involve a risk of serious harm to the person, land or chattels of others which cannot be eliminated by the exercise of the utmost care' and which are 'not a matter of common usage'") (quoting RESTATEMENT (SECOND) OF TORTS §§ 519, 5520 (1977)).

61. *Registration Convention*, *supra* note 18, art. I (defining the terms necessary to the Convention).

62. See *Liability Convention*, *supra* note 15, art. III (explaining the liability assessed for these kinds of situations).

63. See *id.* arts. IV, V (determining negligence for damages under various circumstances).

territory.⁶⁴ Under this legal system, a State may therefore be held responsible for the acts of a corporation registered in its territory that procures a launch in a different State, irrespective of the host State's knowledge or involvement in the launch.⁶⁵

While the Space Station Treaty specifically references and incorporates the Liability Convention,⁶⁶ it also attempts to ameliorate much of the Treaty's uncertainty by including an express cross-waiver of liability applicable to the "Partner States and related entities in the interest of encouraging participation in the exploration, exploitation, and the use of outer space through the space station."⁶⁷ The term "related entities" includes contractors, subcontractors, users or customers, and suppliers of any kind.⁶⁸ In contrast to the Liability Convention, the Space Station Treaty clearly defines the term "damage"⁶⁹ and separates the definition of the launch vehicle into

64. See *Outer Space Treaty*, *supra* note 18, art. VI (requiring States to bear certain responsibilities); see also Bin Cheng, *Liability Regulations Applicable to Research and Invention in Outer Space and their Commercial Exploitation*, in RESEARCH AND INVENTION IN OUTER SPACE: LIABILITY AND INTELLECTUAL PROPERTY RIGHTS 86-89 (Sa'id Mostesher ed., 1995) (attempting to define what qualifies as "national activities").

65. See, e.g., Lee, *supra* note 14, at 230-31 (describing how this example came to life in the OTRAG case, where Germany actively discouraged a German company from assembling rockets and launching them from private facilities in Libya and Congo).

66. See *Space Station Treaty*, *supra* note 4, art. 17. Article 17 states:

1. Except as otherwise provided in Article 16, the Partner States, as well as ESA, shall remain liable in accordance with the Liability Convention. 2. In the event of a claim arising out of the Liability Convention, the Partners (and ESA, if appropriate) shall consult promptly on any potential liability, on any apportionment of such liability, and on the defense of such claim. 3. Regarding the provision of launch and return services provided for in Article 12(2), the Partners concerned (and ESA, if appropriate) may conclude separate agreements regarding the apportionment of any potential joint and several liability arising out of the Launching Convention.

Id. paras. 1-3.

67. See *id.* art. 16, para. 2 ("This cross-waiver of liability shall be broadly construed to achieve this objective.")

68. See *Outer Space Treaty*, *supra* note 18, art. 16, para. 2 (defining the term 'related entity').

69. See *Space Station Treaty*, *supra* note 4, art. 16, para. 2(c) (defining 'damage' as "(1) bodily injury to, or other impairment of health of, or death of, any

two parts,⁷⁰ the “vehicle”⁷¹ and its “payload.”⁷² The Space Station Treaty also outlines a list of “Protected Space Operations” for which the cross-waiver applies.⁷³ It also indicates circumstances that do not trigger the cross-waiver.⁷⁴ The Space Station Treaty clearly includes

person; (2) damage to, loss of, or loss of use of any property; (3) loss of revenue or profits; or (4) other direct, indirect or consequential damage”).

70. See Lee, *supra* note 14, at 233. Lee explains,

[t]reating the launch vehicle and the payload as two separate objects would mean that the launch operator of the launch vehicle would only be liable for any damage caused by the launch vehicle . . . [o]nce the payload has separated, the satellite operator would then be liable, if at fault, for any damage caused by the satellite in space for as long as the satellite remains active.

Id.

71. See Space Station Treaty, *supra* note 4, art. 16, para. 2(d) (defining the term ‘launch vehicle’ as “an object (or any part thereof) intended for launch, launched from Earth, or returning to Earth which carries payloads or persons, or both”).

72. See *id.* art. 16, para. 2(d) (describing the definition of ‘payload’ to mean “all property to be flown or used on or in a launch vehicle or the Space Station”).

73. See *id.* art. 16, para. 2(f) (defining the term ‘Protected Space Operations’ as “all launch vehicle activities, Space Station activities, and payload activities on Earth, in outer space, or in transit between Earth and outer space in implementation of this Agreement, the MOUs, and implementing arrangements”).

It includes, but is not limited to: (1) research, design, development, test, manufacture, assembly, integration, operation, or use of launch or transfer vehicles, the Space Station, or a payload, as well as related support equipment and facilities and services; and (2) all activities related to ground support, test training, simulation, or guidance and control equipment and related facilities or services . . . ‘Protected Space Operations’ excludes activities on Earth which are conducted on return from the Space Station to develop further a payload’s product or process for use other than for Space Station related activities in implementation of this Agreement.

Id.

74. See *id.* art. 16, para. 3(d). Article 16 states:

Notwithstanding the other provisions of this Article, this cross-waiver of liability shall not be applicable to: (1) claims between a Partner State and its related entity or between its own related entities; (2) claims made by a natural person, his/her estate, survivors or subrogees (except when a subrogee is a Partner State) for bodily injury to, or other impairment of health of, or death of such natural person; (3) claims for damage caused by willful misconduct; (4) intellectual property claims; (5) claims for damage resulting from a failure of a Partner State to extend the cross-waiver of liability to its related entities, pursuant to subparagraph 3(b) above.

Id.

the launching of a vehicle en route to the ISS as part of the "Protected Space Operations" and attempts to contract out of the debate over the legal status of a hybrid vehicle that possesses the ability to traverse both air space and outer space.⁷⁵

The Space Station Treaty also improves upon the existing outer space treaty regime by defining the individual components of the ISS provided by the Partners as "space objects."⁷⁶ Once again, while specifically describing components of the ISS as "space objects," clarifying the term for purposes of the Space Station Treaty, it does not in any way improve the general understanding of the term in circumstances not involving the ISS.⁷⁷ "[M]any issues and difficulties arise as a direct consequence of this broad definition [of space object.]"⁷⁸

Another undefined term currently used in the outer space treaty regime, which is not clarified by the Space Station Treaty, is "astronaut."⁷⁹ Under the treaty regime, an astronaut may be something different from "personnel" on board a vessel in outer

75. See Space Station Treaty, *supra* note 4, art. 16, para. 2(f) (defining the term "Protected Space Operations").

76. See *id.* art. 5, para. 1 (stating that "[i]n accordance with Article II of the Registration Convention, each Partner shall register as space objects the flight elements listed in the Annex which it provides, the European Partner having delegated this responsibility to ESA [European Space Agency], acting in its name and on its behalf").

77. See Space Station Treaty, *supra* note 4, art. 5 (requiring registration of space objects).

78. See Lee, *supra* note 14 at 212-13 (providing as an example that Sweden's Space Activities Act does not consider sounding rockets to be space rockets and therefore does not consider their launching to be a space activity"). Under this interpretation, these rockets would not be subject to the Rescue Agreement. See *id.*

79. See, e.g., *Outer Space Treaty*, *supra* note 18, art. V, para. 1 (requiring that "States Parties to the Treaty shall regard astronauts as envoys of mankind in outer space"); *Rescue Agreement*, *supra* note 18, at pmb1, art. 1 (noting the title as "Agreement on the Rescue of Astronauts and providing that each "[c]ontracting Party which receives information or discovers that the personnel of a spacecraft have suffered accident"); *Moon Treaty*, *supra* note 18, art. 10, para. 1 (indicating that "[S]tates Parties shall adopt all practicable measures to safeguard the life and health of persons on the moon"). "For this purpose they shall regard any person on the moon as an astronaut within the meaning of Article V of the [Outer Space] Treaty . . . and as part of the personnel of a spacecraft within the meaning of the [Rescue] Agreement ." *Id.*

space.⁸⁰ To complicate matters, at least one legal scholar poses the question of whether individuals working and residing at a space station for lengthy periods of time should be considered “astronauts” during their term and whether their activities on board should be deemed a “space flight.”⁸¹ The Space Station Treaty circumvents these real or apparent distinctions, not by the use of a specific term or terms,⁸² but rather by covering the activities of all individuals involved in outer space activity under the heading of “Protected Space Operations.”⁸³ This definition is particularly important in the context of space tourism because it clarifies that regardless of whether an individual is piloting a craft, conducting experiments or merely looking out the window, the Space Station Treaty covers that person.⁸⁴ While there have only been two space tourists to date,⁸⁵ the

80. See *Rescue Agreement*, *supra* note 18, art. 1 (indicating certain measures taken to rescue “personnel,” which does not necessarily include astronauts).

81. See Stephen Gorove, *Legal Problems of Manned Space Flight*, in *THE USE OF AIRSPACE AND OUTER SPACE FOR ALL MANKIND IN THE 21ST CENTURY* 242 (Chia-Jui Cheng ed., 1995) (questioning what qualifies as a space flight).

82. See Space Station Treaty, *supra* note 4, art. 11, paras. 1-2 (stating that the terms “crew,” “qualified personnel,” and “crew members” are used refer to the individuals on board the ISS); *id.* art. 22, para 1(h) (noting that the term “personnel” is used when referring to the potential exercise of criminal jurisdiction); *id.* art. 11, para 2 (finding a provision for a “Code of Conduct” to be developed and followed by all Partners sending crew to the ISS).

83. See *id.* art. 16, para. 2(f) (listing various entities and actions covered under the definition of “Protected Space Operations”).

84. See *id.* (discussing liability for numerous situations).

85. See *Report: NASA Agrees to Let Tourist Go into Space* (naming the first space tourist as sixty-year-old Californian Dennis Tito, a businessman who reportedly paid approximately twenty million dollars to participate) *available at* <http://www.cnn.com/2001/TECH/space/04/02/alpha.tourist.02/> (last visited Nov. 2, 2002); see also *First African in Space boards ISS* (reporting that the second the second civilian to pay twenty million dollars to journey into space was Mark Shuttleworth) *available at* <http://www.cnn.com/2002/TECH/space/04/27/space.docking/index.html> (last visited Nov. 2, 2002). The possibility of this type of visit to the ISS is provided for in the Space Station Treaty under certain circumstances. See Space Station Treaty, *supra* note 4, art. 9, para. 2 (“The Partners shall have the right to barter or sell any portion of their respective allocations. The terms and conditions of any barter or sale shall be determined on a case-by-case basis by the parties to the transaction.”).

Each Partner may use and select users for its allocations for any purpose consistent with the object of this Agreement and provisions set forth in the MOUs and implementing arrangements, except that: (a) any proposed use of a

success of their missions increases the likelihood of further interest, and therefore investment and development in this area.⁸⁶

Another critical factor in any investment agreement relates to the handling of intellectual property rights and the transfer of technology. While these issues are not contemplated in the existing outer space treaty regime, they are clearly spoken to in the Space Station Treaty.⁸⁷ A complex set of rules exists to govern the exchange of goods and data, and is supplemented by MOUs, implementing agreements, and national laws.⁸⁸ In the Space Station Treaty, intellectual property is defined as having the meaning expressed in Article 2 of the Convention Establishing the World Intellectual Property Organization and is similarly supplemented by national laws.⁸⁹ An example is the domestic law of the United States, or the "Patents in Space Act," which treats items or parts of items made, used, or sold in outer space in the same manner as if they had been under the jurisdiction of the United States, with certain exceptions.⁹⁰

user element by a non-Partner or private entity under the jurisdiction of a non-Partner shall require the prior notification to and timely consensus among all Partners through their Cooperating Agencies; and (b) the Partner providing an element shall determine whether a contemplated use of that element is for peaceful purposes, except that this subparagraph shall not be invoked to prevent any Partner from using resources derived from the Space Station infrastructure.

Id., art. 9, para 3.

86. See *Russia 'Plans More Space Tourism,' supra* note 8, at 2 (stating that "NASA, the Russian Space Agency and the other countries in the space station program released criteria in January [2002] for those willing to plunk down millions for a space station vacation. . . . Twenty-three-year-old Lance Bass of the singing group 'N Sync is vying for the tourist seat on the next Soyuz flight in October [2002]"); Victoria Griffith, *Business of Space – Is Tourism the Best Way of Paying the Bills?*, FIN. TIMES, Oct. 9, 2002, at P2 (noting that the planned space tour was cancelled after Bass was unable to pay the first installment of the twenty million dollar ticket).

87. See Space Station Treaty, *supra* note 4, art. 21 (devoting an entire section to the subject of intellectual property).

88. See *id.*, art. 19, paras. 1-8, art. 20 (detailing procedures by which Partner States must exchange necessary technical data and goods).

89. See *id.* art. 21, para. 1 (determining the rights of Partner States and the laws applied to intellectual property).

90. See Patentability of Inventions and Grant of Patents, 35 U.S.C. § 105, P.L. 101-580 (1990) (establishing U.S. jurisdiction for outer space inventions in certain

Another critical legal question of import to outer space investment concerns the mechanisms available for the settlement of disputes that will undoubtedly arise with regard to outer space.⁹¹ The Liability Convention provides that damages caused by space objects in certain locations must be compensated in an amount:

determined in accordance with international law and the principles of justice and equity, in order to provide such reparation in respect of the damage as will restore the person, natural or juridical, State or international organization on whose behalf the claim is presented to the condition which would have existed if the damage had not occurred.⁹²

If the claim cannot be settled through diplomatic channels, the Liability Convention provides that a Claims Commission can be established at the request of either party.⁹³ Similar to other branches of international law, the Claims Commission awards are not enforceable.⁹⁴ While this scheme is not perfect, an even less satisfactory dispute resolution protocol is included in the Moon Treaty.⁹⁵ The Moon Treaty's provisions do not elaborate on the bare

circumstances); see also REYNODS & MERGES, *supra* note 60, at 303 (discussing the extraterritorial application of this law and its legislative body); Dieter Stauder, *Issues of Intellectual Property in Relation to Research and Invention in Outer Space: European Community Perspective*, in RESEARCH AND INVENTION IN OUTER SPACE: LIABILITY AND INTELLECTUAL PROPERTY RIGHTS (Sa'id Mosteshar ed., 1995) (outlining the European perspective on the issue of jurisdiction).

91. See Pablo Mendes de Leon, *Settlement of Disputes in Air and Space Law*, in THE USE OF AIRSPACE AND OUTER SPACE FOR THE BENEFIT OF ALL MANKIND IN THE 21ST CENTURY 335-36 (Chiang-Jiu Cheng ed., 1995) (stating that "[t]he subject of dispute settlement in space law is rather academic in the sense that no disputes requiring the application of international space law have so far occurred). "Moreover, the five general space treaties . . . are very scarce in providing mechanisms for the settlement of disputes." *Id.*

92. *Liability Convention*, *supra* note 18, art. XII.

93. See *id.* arts. XIV-XIX (establishing the Claims Commission to determine liability for claims that have not been settled).

94. See Mendes de Leon, *supra* note 91, at 337 (stating "[i]n other words, the state which suffered damage under the Liability Convention has no guarantee that it will receive full compensation, nor that, if a decision for compensation is granted by the Claims Commission, enforcement measures are at its disposal").

95. See *Moon Treaty*, *supra* note 18, art. XIII (assessing responsibility of dispute resolution to "the State Parties to the treaty" and possibly international organizations).

minimum of the principles recommended in the U.N. Charter.⁹⁶ To address the lack of appropriate tools for resolving these types of disputes, the International Law Association suggested a Draft Convention on the Settlement of Space Law Disputes.⁹⁷ Parties may also avail themselves of the International Court of Air and Space Arbitration, established in 1994 by the *Societe Francaise de Droit Aerien et Spatial*.⁹⁸ Another possibility might be to use the

96. See U.N. CHARTER, *supra* note 24, art. 33, para. 1 (providing that “[t]he parties to any dispute, the continuance of which is likely to endanger the maintenance of international peace and security, shall, first of all, seek a solution by negotiation, enquiry, mediation, conciliation, arbitration, judicial settlement, resort to regional agencies or arrangements, or other peaceful means of their own choice”); see also *Moon Treaty*, art. 15, para 2. Article 15 states:

A State Party which has reason to believe that another State Party is not fulfilling the obligations incumbent upon it pursuant to this Agreement or that another State Party is interfering with the rights which the former State has under this Agreement may request consultations with that State Party. A State Party receiving such a request shall enter into such consultations without delay. Any other State Party which requests to do so shall be entitled to take part in the consultations. Each State Party participating in such consultations shall seek a mutually acceptable resolution of any controversy and shall bear in mind the rights and interests of all States Parties. The Secretary-General of the United Nations shall be informed of the results of the consultations and shall transmit the information received to all States Parties concerned.

Id. Article 15 continues:

If the consultations do not lead to a mutually acceptable settlement which has due regard of the rights and interests of all States Parties, the parties concerned shall take all measures to settle the dispute by other peaceful means of their choice appropriate to the circumstances and the nature of the dispute. If difficulties arise in connection with the opening of consultations or if consultations do not lead to a mutually acceptable settlement, any State Party may seek the assistance of the Secretary-General, without seeking the consent of any other State Party concerned, in order to resolve the controversy. A State Party which does not maintain diplomatic relations with another State Party concerned shall participate in such consultations, at its choice, either itself or through another State Party or the Secretary-General as intermediary.

Id. art. 15, para. 3.

97. See *Convention on the Settlement of Space Law Disputes*, Int’l L. Assoc., Res. No. 13/2000, available at <http://www.ila-hq.org/pdf/Space%20Law/RESspace.pdf> (last visited Nov. 9, 2002).

98. See DIEDERICKS-VERSCHOOR, *supra* note 7 (explaining that the special arbitration court is the only international arbitration arena dedicated to air and space matters). “Arbitration costs shall be based on French standards which are considered very reasonable in such a system. Consequently, costs will be lower

International Convention for the Settlement of Investment Disputes⁹⁹ as a model, and tailor its terms so they apply in the outer space context. The legal principles announced by the International Court of Justice regarding liability and responsibility also should not be overlooked.¹⁰⁰

III. LOGISTICAL AND OUTER SPACE-RELATED DIFFICULTIES TO INVESTMENT

The uncertainty regarding the aforementioned legal issues has been a barrier for many companies otherwise eager to invest in outer space. Another major hurdle to overcome is the difficulty in financing space ventures due to the extreme costs of entry and the inherently risky nature of space activities.¹⁰¹ To date, only a handful of companies have been able to invest in outer space due to the lack of willingness on the part of traditional lenders and the paucity of successful prior ventures in this field.¹⁰² Although a few investment banks set up funds for space investments and consulting practices,

than in lawsuits in the national courts of many countries or in certain other arbitration organizations." *Id.*

99. Convention on the Settlement of Investment Disputes Between States and Nationals of States, Mar. 18, 1965, 17 U.S.T. 1270, 575 U.N.T.S. 159.

100. See *Chorzow Factory (F.R.G. v. Pol.)*, 1928 P.C.I.J. (ser. A) No. 17, at 47 (holding that reparations "must, as far as possible, wipe out all the consequences of the illegal act and re-establish the situation which would, in all probability, have existed if that act had not been committed"); see also *Corfu Channel (U.K.)* 1949 I.C.J. 4, at 22 (concluding that the State must "not . . . allow knowingly its territory to be used for acts contrary to the rights of other States").

101. See generally Julian Hermida, *Space Financing*, 13 AIR & SPACE L. 1 (1998); Cynthia S. Dubin, *Financing Space Research and Inventions*, in RESEARCH AND INVENTION IN OUTER SPACE: LIABILITY AND INTELLECTUAL PROPERTY RIGHTS 7-18 (Sa'id Mosteshar ed., 1995).

102. See SMITH, *supra* note 1, at 69 (describing the complications associated with securing space project investors). Smith further explains that,

Perhaps the most significant business risk involves the time and expense necessary to develop space-station technology from the experimental to the operational mode. The high level of business risk serves as a limitation upon the private corporation institutional form as a means to procure and operate space stations. Nevertheless, there are trends in the private sector that point to a reduction of the business risks for space ventures and thus tend to enhance private-sector possibilities for involvement in space stations.

Id.

"[m]ost of these efforts have remained financially unrewarding."¹⁰³ The attempts to develop outer space have resulted in failures, many of which were highly publicized.¹⁰⁴ Insurance companies that cover outer space investment have also suffered financially because of space accidents and failures.¹⁰⁵ In addition, as of the end of 1990, "the maximum amount of space insurance capacity available for underwriting a space risk was approximately \$300 million."¹⁰⁶ One area of outer space activity, which has been relatively successful, is the launch of satellites, notwithstanding the difficulty of using the satellite itself as collateral for financing.¹⁰⁷

103. See GOLDMAN, *supra* note 10, at 73 (discussing previous attempts to provide funding to space ventures).

In Houston, Decuman Securities, an investment banking concern, established the Commercial Space Section as one of its major arms of concern. In New York, J. R. Packer and Co. established Space Fund I solely for space investments . . . American Express – Shearson Lehman spearheaded a limited-partnership arrangement to fund the Orbital Sciences Corporation in the early 1980s. The Center for Space Policy also created its Space Investment Group to work with start-up companies.

Id.

104. See *id.* at 114 (stating that high profile space accidents include the Apollo 204 fire in 1967 and the explosion of the Challenger Space Shuttle in 1986).

105. See *id.* at 73 (explaining that both Aetna and Prudential Life Insurance Companies lost millions of dollars in space investments, as did the insurers of communication satellites).

106. See DIEDERICKS-VERSCHOOR, *supra* note 7, at 121 (explaining that there are four general categories in which an insurable interest exists. Those categories are:

(1) damage to property owned by the insured; (2) damage to property not owned by the insured, but upon which the insured's business depends; (3) potential legal liability of the insured for third party claims; and (4) potential financial loss from occurrences which do not necessarily involve physical loss or damage to property or injury to persons.

Id.

107. See Hermida, *supra* note 101, at 17 (discussing the difficulties of gaining investors for space ventures and areas where such investments may be more likely). "In light of the absence of international rules dealing with the protection of rights in space objects, some commentators have advocated for the creation of an International Convention for Space Activity Investors. Proposals have been made to adapt the Registration Convention and use it to record rights and interests in space objects." *Id.*

States have launched satellites and other objects into outer space since 1957, but many are no longer operational.¹⁰⁸ These inactive objects, currently at a population in excess of eight thousand, are orbiting the planet in "near-Earth space . . . [and] are trackable by terrestrial sensors."¹⁰⁹ This count does not include the much smaller fragments, which are untraceable, whose number is likely to be ten times greater than the number of known objects.¹¹⁰ All of these objects constitute space debris, a very real problem for increased development in outer space.¹¹¹

Space debris is a serious concern because it is so prevalent in the finite near-Earth space.¹¹² Space debris is especially hazardous due to its high velocity and the ability of even a chip of paint to puncture a space suit.¹¹³ Also, either solid rocket fuels or nuclear materials, both of which have negative environmental consequences, must power satellites.¹¹⁴ Certain nuclear-powered satellites contain radioactive components, which may cause significant damage upon reentry into

108. See *History of Sputnik 1* (stating that Sputnik 1 was launched on October 4, 1957), available at <http://www.hq.nasa.gov/office/pao/History/sputnik> (last visited Oct. 21, 2002).

109. See Johnson, *supra* note 34.

110. See Dietrich Rex, *The Current and Future Space Debris Environment as Assessed in Europe*, in PRESERVATION OF NEAR-EARTH SPACE FOR FUTURE GENERATIONS 39 (John A. Simpson ed., 1994) (discussing the numerous categories of space debris). "With respect to the risk of impacts on active satellites or space stations, [the one to ten centimeter class] is the most important class. These objects are too large to render them ineffective by shielding, but they are too small to be detected from ground by normal radar stations." *Id.*

111. See *id.* (defining space debris).

112. See Lee, *supra* note 14, at 227-9 (discussing liability issues concerning space debris).

113. See *id.* at 227 (finding that "[w]ith speeds averaging more than 35,000 km/hr a 0.5 mm chip of paint can puncture a spacesuit"). "Slightly larger debris of around 1 cm diameter can destroy space stations, space shuttles or satellites. . . . the most celebrated [collision] . . . [was] where a particle of thermal paint 0.2 mm in diameter struck the windshield of Challenger [on the STS-7 Shuttle mission in 1983]." *Id.*

114. See Carl Q. Christol, *Protection of the Space Environment – Debris and Power Sources*, in THE USE OF AIRSPACE AND OUTER SPACE FOR ALL MANKIND IN THE 21ST CENTURY 253 (Chia-Jiu Cheng ed., 1995) (discussing the environmental impact of rocket fuels).

the Earth's atmosphere.¹¹⁵ Based on this information, COPUOS drafted a resolution concerning the use of nuclear power for fueling objects in outer space.¹¹⁶

Technological methods were introduced to limit the creation of additional space debris, shorten the length of time for objects in upper orbits, and shield structures against certain types of smaller debris.¹¹⁷ Wide scale application of technology to remove extant debris, however, was not a goal of the space-faring community, because "the scavenging for removal of space debris is largely impractical and highly expensive."¹¹⁸ In 1995, the International Law Association's Space Law Committee adopted a final draft of an "International Instrument Concerning the Protection of the Environment from Damages Caused by Space Debris," which may be consulted or even relied upon when COPUOS addresses the topic.¹¹⁹

Another real-life problem of investment in outer space concerns the implementation of regulations on outer space activity imposed by

115. See Tan, *supra* note 9, at 150 (stating that "[i]t is in the interest of states that the space environment be free from the radioactive pollution caused by NPS [nuclear power sources] since any radiological contamination of outer space is likely to have an adverse effect on the Earth's environment").

116. See Johnson, *supra* note 34, at 12 (explaining that "[t]he issue was brought to the forefront in 1978 when the Kosmos 954 spacecraft, which carried a nuclear reactor with an initial fuel loading of approximately 30 kg of enriched uranium, malfunctioned and reentered the atmosphere, impacting primarily in the Canadian tundra"). The ultimate result was the U.N. resolution entitled "Principles Relevant to the Use of Nuclear Power Sources in Outer Space." G.A. RES. 47/68, U.N. GAOR, 55TH SESS., SUPP. NO. 49, AT 88, U.N. DOC. A/47/49 (1992).

117. See Qi Yong Liang, *Facing Seriously the Issue of Protection of the Outer Space Environment*, in PRESERVATION OF NEAR-EARTH SPACE FOR FUTURE GENERATIONS 119 (John A. Simpson ed., 1994) (stating that objects in the upper orbits have a longer lifespan due to the lack of gravity). Taking this information into account, China "redesigned the launching trajectory of some geostationary satellites so that the perigee of the geosynchronous transfer orbit could be lowered from 400 km to 200 km. In this way, the orbital life-time of upper stages would be substantially shortened." *Id.*

118. U.R. Rao, *Space Debris – Mitigation and Adaptation*, in PRESERVATION OF NEAR-EARTH SPACE FOR FUTURE GENERATIONS 121 (John A. Simpson ed., 1994); see also Rex, *supra* note 110, at 46-54.

119. See JASENTULIYANA, *supra* note 16, at 59 (commenting on other topics addressed by COPUOS).

an Earth-based body. Because outer space is by definition located at a great distance from Earth and only a limited number of States have the capability to reach it on their own, no one particular organization is the obvious choice to monitor or enforce compliance with such regulations.

Even if the United Nations created a division to regulate outer space activities, substantial additional funds will be needed to pay for the costs of such regulation.¹²⁰ One possible idea is to create a new "World Space Organization" with a "(1) political members' assembly structure and supervisory council of some kind, (2) a directorate, (3) an advisory/support staff, (4) a resources staff, and (5) appropriate functional staff, depending upon the nature of the roles and functions the organization is assigned."¹²¹ Another proposal suggests that the "COPUOS working group should nominate individuals with the legal and technical expertise necessary to guide lunar resource development and a global vision that transcends national boundaries and persons that represent their governments in any official capacity should be excluded from selection."¹²² These proposals, however, all lack funding mechanisms.

If such a governing association is not instituted, investment in outer space may proceed in an inefficient manner, likely to the

120. See *Office for Outer Space Affairs* (describing the administrative body responsible for space law issues within the United Nations organization), available at http://www.oosa.unvienna.org/SpaceLaw/spacelaw_pf.html (last visited Nov. 4, 2002). The United Nations has an Office for Outer Space Affairs (OOSA) located at the United Nations Office in Vienna, Austria. See *id.* OOSA is the Secretariat for the Legal Subcommittee of COPUOS (Committee on Peaceful Uses of Outer Space) and has hosted several conferences over the years to address outer space issues, the most recent of which was the held in 1999. See generally JASENTULIYANA, *supra* note 16.

121. DOYLE, *supra* note 19; see also Carl Q. Christol, *Proceedings of the 24th Colloquium on the Law of Outer Space (1982)* 173-80, reprinted in *SPACE LAW: PAST, PRESENT AND FUTURE* 427-42 (1991) (discussing alternative models for a future international space organization).

122. Lee, *supra* note 14 (citing Webber, *Extraterrestrial Law on the Final Frontier: A Regime to Govern the Development of Celestial Body Resources*, 71 GEO. L.J. 1427 (1983), discussing composition of legal regimes to prevent exploitation of celestial bodies).

detriment of lesser-developed states.¹²³ Counterintuitive to common understanding, outer space is not limitless, particularly in terms of investment. The most valuable space for development is close to Earth and already the orbital slots for satellites are full.¹²⁴ Additionally, the locations of near-Earth space most feasible in terms of mining or erecting structures for capturing solar energy are also limited and may be depleted or occupied before developing states are sufficiently poised to invest in them.¹²⁵ Current activity is also polluting the outer space environment with space debris at a rapid

123. See Reinstein, *supra* note 2, at 72 (exploring the possible downsides of not having regulation of space development). "But as much as commercial development of space would benefit all mankind, it is just as important that the development be controlled. Any legal regime should guard against inefficient exploitation, waste, and environmental despoliation. Furthermore, space should not become the next Wild West. Destruction and sabotage must be discouraged." *Id.*

124. See JASENTULIYANA, *supra* note 16, 291-92 (finding that "[d]espite the general legal principle of equal access, a country wishing to put a communications satellite into the geostationary orbit has had to ensure that it did not interfere with any system previously registered with the International Telecommunication Union, essentially placing a burden on the proposed new system"). "Since the technologically advanced countries were the first ones to set up communication satellite systems, the developing countries felt that the current registration procedures inequitably restricted their access to the geostationary orbit." *Id.*; see also ITU Constitution, *supra* note 30, art. 45, para. 1. Art. 45, para. 1 states:

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 Members or of recognized operating agencies, or of duly authorized operating agencies which carry on a radio service, and which operate in accordance with the provisions of the Radio Regulations.

Id.

125. See Carl Q. Christol, *Space Stations: Political, Practical and Legal Considerations*, in 7 HASTINGS INT'L COMP. L. REV. (1984), reprinted in SPACE LAW: PAST, PRESENT AND FUTURE 195 (1991) (noting that the current system of allocation is on a first-come, first-served basis). In the view of lesser-developed countries,

this formula has been used by the space resource states to assure exclusive use of geostationary orbital positions and the radio spectra employed by space objects using such orbital positions and patterns. Several states, including the United States, have taken considerable pains to deny the legal significance of the formula and at the same time to oppose an alternative approach put forward by the [lesser developed countries] which would immobilize the 'first-come, first-served' proposition.

Id.

rate and light pollution emanating from outer space activities is interfering with the ability to peer into the deep universe.¹²⁶

Much in the same way that modern archaeologists preserve ancient ruins for future historians to uncover with their superior techniques, space developers are well-advised to maintain areas of outer space, including near-Earth space and the moon, for future generations to utilize, by better methods and with more understanding of the fragile environment of outer space.¹²⁷

III. CONCLUSION

One country alone could not build the ISS. Such a tremendous undertaking required the resources, expertise, and efforts of many individuals from different states throughout the world.¹²⁸ In the long term, the positive aspects of this model for investment and cooperation will hopefully be emulated on Earth. As a scholar for the United Nations Institute for Disarmament Research has observed:

the dominant implication of exploitation of space resources is parallel to the international cooperation implications described above, in that the state's representatives are unavoidably required to work together for common purposes, often sharing commonly owned facilities. Internationalism reinforces interdependence, mutual concerns and interests multiply, and the inevitable increase in international cooperation has a positive, reinforcing effect on international political stability and states' political relations.

An opposite result can occur when states' leaders choose not to participate in international cooperative ventures for the exploitation of space resources. The denial of participation can generate attitudes of hostility, and comparative imbalances in the quality, costs, and reliability of services available in a particular State compared to similar services

126. See Lee, *supra* note 14, at 227-9 (evaluating the hazard of space debris on space travel).

127. See Edith Brown Weiss, *The Planetary Trust: Conservation and Intergenerational Equity*, 11 *ECOLOGY L.Q.* 495 (1984) (introducing the concept of international equity); see also Edith Brown Weiss, *Our Rights and Obligations to Future Generations*, 84 *AM. J. INT'L L.* 198 (1990) (discussing the inherent right of each generation to leave the planet safe for the next generation).

128. See Space Station Treaty, *supra* note 4 (listing all of the members who came together to cooperate on the Space Station).

available in neighbouring states. Local dissatisfaction with particular decisions could lead to internal stress and to local or regional interstate political tension.¹²⁹

These comments are clearly realized in the context of the ISS. Former political enemies, the United States and Russia (the former U.S.S.R.), worked hand-in-hand to make the concept of an international space station capable of supporting human life and conducting scientific research into a reality. Countries from diverse parts of the globe put aside their differences in the hopes of attaining a greater goal – that of being able to explore outer space from the ISS. No matter how admirably these fifteen states are working together, the great majority of people on Earth are precluded from living this dream. The ISS is a very limited resource and not a panacea for the world's problems. It may be, however, a good first step toward gaining an increased respect for the result of mutual cooperation. If this principle spreads to activities on Earth, the ISS will have been the best investment ever made.

129. DOYLE, *supra* note 19, at 105.