

2013

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Recommended Citation

Claudia Pastorius (2013) "Law and Policy in the Global Space Industry's Lift-Off," *Barry Law Review*: Vol. 19 : Iss. 1 , Article 7.
Available at: <https://lawpublications.barry.edu/barryrev/vol19/iss1/7>

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LAW AND POLICY IN THE GLOBAL SPACE INDUSTRY'S LIFT-OFF

Claudia Pastorius*

PART I: INTRODUCTION—WHO OWNS SPACE?

Would Hugo Grotius¹ call for freedom of space? Would John Locke² postulate that man will create value by the work of his hands in space and on celestial bodies and that this value carries with it an inherent right of ownership? When we look up with cosmic wonder, do we see *spatium liberum*,³ *spatium nullius*,⁴ or *spatium communis*⁵?

Locke's influential writings and labor theory of property have been used to justify colonization and property laws for centuries.⁶ Although he refers to the Earth,⁷ the heart of his principles is highly applicable to an inquiry of what space property law should be. In the excerpt below from his writing on property rights, we can see applicability to commercial space development projects of today.

Though the earth and all inferior creatures be common to all men, yet every man has a property in his own person: this nobody has any right to but himself. The labour of his body and the work of his hands we may say are properly his. Whatsoever then he removes out of the state that nature hath provided and left it in, he hath mixed his labour with, and joined to it something that is his

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1. HUGO GROTIUS, MARE LIBERUM [THE FREEDOM OF THE SEAS] (James Brown Scott ed., Ralph van Deman Magoffin trans., 1916).

2. JOHN LOCKE, THE SECOND TREATISE OF GOVERNMENT AND A LETTER CONCERNING TOLERATION 12–13 (Tom Crawford ed., Dover Thrift 2002) (1689). Occupancy and value-added are significant elements of Locke's labor theory of the acquisition of real property rights. *See generally id.*

3. Here, *spatium liberum*—freedom of space—references Grotius' *mare liberum* principle known as the freedom of the seas. *See* Grotius, *supra* note 1. Under *mare liberum* the right to the high seas remains the province of all humanity, to be appropriated or limited by none. *See id.*

4. *Spatium nullius*—space zero—references the concept of *res nullius*. “*Res nullius* are things belonging to no one. In the Roman sources they are discussed in the context of modes of acquisition of ownership (*dominium*). Things that belong to no one are susceptible to being acquired by taking (*occupatio*).” Lauren Benton & Benjamin Straumann, *Acquiring Empire by Law: From Roman Doctrine to Early Modern European Practice*, 28 LAW & HIST. REV. 1, 14 (2010) (charting the development of the legal phrase *terra nullius* from *res nullius* in legal writings justifying colonization).

5. *Spatium communis*—community space—refers to the concept of *res communis* (property subject to community use and enjoyment, but that may not be appropriated). Nowlan, *infra* note 86, at 122; Baslar, *infra* note 255, at 39–40.

6. *See* LOCKE, *supra* note 2 and accompanying text.

7. *See generally id.*

own, and thereby makes it his property. It being by him removed from the common state nature hath placed it in, *it hath by this labour something annexed to it, that excludes the common right of other men.* For this labour being the unquestionable property of the labourer, no man but he can have a right to what that is once joined to, *at least where there is enough, and as good, left in common for others.*⁸

The first emphasized phrase, “*removes out of the state that nature hath provided,*” can be applied to space mining rights of minerals and elements on asteroids and the moon.⁹ In the second emphasized phrase, “*it hath by this labour something annexed to it, that excludes the common right of other men,*” what is annexed could be modular housing developments on the surface of Mars,¹⁰ additions to Earth’s geostationary orbit like satellites,¹¹ or outer space hotels.¹² The third emphasized phrase, “*at least where there is enough, and as good, left in common for others*” introduces a caveat of Locke’s labor theory that modifies the idea that property rights are inherently acquired through labor in situations where the scarcity of property and the impact of appropriation on others is an issue.¹³ We each gaze at the same moon at night, there being only one—is its appropriation limited to the extent that it can remain viable for the common use and enjoyment of mankind?

The global space industry’s development has a critical stake in the timeless question—*Who owns space?* A proactive answer to the question of property rights in space could set a course that optimizes the development of humanity and our expansion into outer space. There is no generally accepted regime for the acknowledgement or conferment of property rights in space.¹⁴ Whether property rights in space exist in international law is a subject of scholarly debate.¹⁵ Today, the commercial viability of the appropriation of space property is rapidly bringing these issues to a head.¹⁶ Resolution of legal rights in space property could come reactively from the outcome of controversies arising from ambiguous international

8. LOCKE, *supra* note 2, (emphasis added).

9. *Id.*; See also Klingler, *infra* note 145; see also *China Aims for Lunar Base After 2020*, *infra* note 61.

10. LOCKE, *supra* note 2; see also *About Mars One*, *infra* note 172.

11. See, e.g., *Which Countries Were First to Launch Satellites?*, *infra* note 26.

12. See, e.g., Malik, *infra* note 120.

13. LOCKE, *supra* note 2; see also Baslar, *infra* note 255 (analyzing the effect of scarcity on property rights).

14. See, e.g., Alan Wasser & Douglas Jobs, *Space Settlements, Property Rights, and International Law: Could A Lunar Settlement Claim the Lunar Real Estate It Needs to Survive?*, 73 J. AIR L. & COM. 37, 40 (2008); but see Kurt Anderson Baca, *Property Rights in Outer Space*, 58 J. AIR L. & COM. 1041, 1082 (1993) (examining the International Telecommunications Union’s (ITU) regime for regulating satellite orbit slots).

15. See, e.g., Blake Gilson, *Defending Your Client’s Property Rights in Space: A Practical Guide for the Lunar Litigator*, 80 FORDHAM L. REV. 1367 (2011) (giving an overview of the ambiguity regarding space property rights in the Outer Space Treaty, the different interpretations, examining property rights models around the world, and predicting lunar litigation outcomes in various jurisdictions).

16. See Gruner, *infra* note 210.

law on the matter,¹⁷ or proactively through unilateral actions¹⁸ or multilateral international agreement.¹⁹

Space law²⁰ and policy development, including the regulation of property rights in space, must take many issues into consideration: (1) how to ensure the safety and security of mankind as private access to outer space increases; (2) how to ensure economic justice for all in the regulation of commercial space enterprises; and (3) how to plan for interplanetary development and space property rights, anticipating that one day government, non-profit, and private space colonization efforts will become sustainable and independent from Earth.²¹

This article provides an overview of current developments in the commercial space industry and touches upon unsettled legal issues in space law and space property rights in particular. Grabbing the space bull²² by the horns, we depart from the ideas introduced in Part I into an analysis of the security risks, environmental hazards, and economic opportunities associated with the development of the commercial space industry. Part II gives an overview of past and present commercial and nation-state space development activities. Part III addresses the reasons underlying the ambiguity regarding space property rights in the major source of space law, the Outer Space Treaty of 1967, and proposes that the international community reconsider the benefits of a public trust concept. Part IV examines the policy considerations of (1) safety and security; (2) economic justice; and (3) interplanetary rights in global space law development—with an eye on *efficient* and *equitable*²³ outcomes. Part V briefly synthesizes the facts, laws, and policy considerations discussed in this article to highlight the common goals of nation-states, commercial actors, and humanity in the global space industry development. Part VI concludes with the observation that the choices we make in global space law development today can impact the future of the human race.

17. Gilson, *supra* note 15.

18. Wayne N. White, Jr., *Implications of a Proposal for Real Property Rights in Outer Space*, PROC. 42ND COLLOQUIUM ON L. OUTER SPACE 366, 370 (1999), available at http://www.spacefuture.com/archive/implications_of_a_proposal_for_real_property_rights_in_outer_space.shtml (last visited Oct. 14, 2013) (among other proposals, stating that nation-states should each take the initiative to legislate space property rights on a national level).

19. Gilson, *supra* note 15, at 1402–05 (proposing an “International Moon Authority” to regulate lunar property rights).

20. “[S]pace law is a substantive area of the law that consists of a discrete set of international treaties, resolutions, statutes, regulations, and court opinions that address aerospace activities, among other contexts, in terms of contract, tort, property, patent, and even tax law.” Timothy M. Ravich, 2010: *Space Law in the Sunshine State*, FLA. B.J., Sept./Oct. 2010, at 24; see also Benjamin Perlman, *Grounding U.S. Commercial Space Regulation in the Constitution*, 100 GEO. L. J. 929, 934 (2012).

21. See Ravich, *supra* note 20; see also Perlman, *supra* note 20.

22. See Alex Knapp, *The Technology Behind Red Bull's Space Jump*, FORBES (Oct. 10, 2012), <http://www.forbes.com/sites/alexknapp/2012/10/16/the-technology-behind-red-bulls-space-jump/> (last visited Oct. 13, 2013). Here, we are not referring to Red Bull's particular sponsorship of a space jump—but a small leap necessary to address the imminent legal needs of the commercial space industry (and not legal fictions).

23. See Baca, *supra* note 14 (on the ITU regulatory principles).

PART II: CONTEMPORARY DEVELOPMENTS IN OUTER SPACE EXPLORATION

Inspired by a conference dedicated to applying the principles of the United States Constitution to the colonization of outer space, retired Supreme Court Justice William Brennan proclaimed in 1991 that “[w]e have technology today that can deliver millions of people to space Hundreds of millions of people will eventually live and work there from every part of the Earth.”²⁴ Currently, the technological and economic feasibility of mankind’s engagement with outer space and celestial bodies is experiencing what some call a “space renaissance.”²⁵

A. The Progress of Spacefaring Nations

Spacefaring nations are defined as those countries that have built rockets powerful enough for launches into space and have deployed their own satellites into orbit.²⁶ Included on the list of spacefaring nations are: Russia, the United States, France, Japan, China, Great Britain, India, Israel, Iran, North Korea, South Korea, and Europe (as the twenty-nation cooperative European Space Agency).²⁷ Spacefaring nations are all signatories to the Outer Space Treaty,²⁸ and are invited to report their activities to the United Nations.²⁹ Spacefaring nations who have successfully completed crewed (formerly known as “manned”) flights into outer space are Russia, China, and the United States.³⁰

Russian space development builds on the impressive history of sending the first satellite, first animal, first man, and first woman into space during the Soviet Space Program.³¹ Today, the Russian government continues crewed space flights.³² In the past, Russia’s support for the International Space Station (ISS) has been considerable and it allocated half of its space budget to the ISS.³³ The Russian space development budget from 2013 to 2020 has received an enormous boost to \$67.8 billion, a radical increase from the \$3.3 billion spent annually in 2010 and

24. William J. Brennan, *Space Law in the Next Century*, N.Y. ST. B. J., May/June 1991, at 42 (retired Supreme Court Justice, first addressing the viability of space colonization, then the ensuing necessity of legal regimes for space colonies).

25. See generally ADRIANO V. AUTINO, *THREE THESES FOR THE SPACE RENAISSANCE* (2011).

26. *Which Countries Were First to Launch Satellites?*, SPACE TODAY ONLINE, <http://www.spacetoday.org/Questions/FirstSats.html> (last visited Oct. 13, 2013).

27. *Id.*

28. See UNITED NATIONS COMMITTEE ON THE PEACEFUL USES OF OUTER SPACE, STATUS OF INTERNATIONAL AGREEMENTS RELATING TO ACTIVITIES IN OUTER SPACE AS OF 1 JANUARY 2012 (Mar. 12, 2012), http://www.oosa.unvienna.org/pdf/limited/c2/AC105_C2_2012_CRP03E.pdf.

29. *International and National Activities of Member States and International Organizations, INTERNATIONAL COOPERATION IN THE PEACEFUL USES OF OUTER SPACE*, <http://www.oosa.unvienna.org/oosa/en/natact/natact/index.html> (last visited Oct. 13, 2013). See Outer Space Treaty, *infra* note 199, at Art. XI.

30. *Countries Capable of Manned Space Flight*, CHARTS BIN, <http://chartsbin.com/view/1231> (last visited Oct. 14, 2013).

31. *This Day in History: April 12, 1957*, HISTORY.COM, <http://ahscoldwarb.wikispaces.com/Soviet+Space+Program> (last visited Mar. 19, 2014).

32. *Building on Sand?*, ATO.RU (Jan. 11, 2009), <http://www.ato.ru/content/building-sand> (last visited Oct. 13, 2013).

33. *Id.*

2011.³⁴ In addition to its Earth monitoring systems and advanced satellite technologies,³⁵ the Russian space program is performing important research to establish the safety of human spaceflight to Mars, estimated to take 520 days.³⁶

The Chinese space program operates under the China National Space Agency,³⁷ which oversees a nationally owned corporation, the China Aerospace Corporation.³⁸ China has plans to build its own space station, built with sustainable living technologies, by the year 2020.³⁹ China first sent crewed vehicles into space in 2003.⁴⁰ In 2012, the Chinese successfully docked with a space capsule in orbit, laying the technological groundwork for their space station development.⁴¹ The accelerated pace of the “sleeping giant’s” space program development is astounding many analysts.⁴² China claims to have spent \$6 billion on its crewed spaceflight program, but some question the accuracy of these figures.⁴³

United States government officials monitoring Chinese space development have found clear indications that China’s interest in space development is not solely scientific, and its use of outer space technology is expanding its military capabilities.⁴⁴ China’s reporting on its space⁴⁵ and collaborative space activities with other Asian nations is heavily infused with language affirming the principle of

34. Samantha Stainburn, *Russia to Increase Space Program Budget to Nearly \$70B For 2013-2020*, GLOBAL POST (Dec. 30, 2012), <http://www.globalpost.com/dispatch/news/regions/europe/russia/121230/russia-increase-space-program-budget-nearly-70b-2013-2020> (last visited Oct. 13, 2013); Lee Rannals, *Russian Space Agency Spending \$68 Billion In Next 7 Years*, RED ORBIT (Dec. 28, 2012), <http://www.redorbit.com/news/space/1112754896/russian-space-agency-roskosmos-budget-increase-122812/>.

35. See, e.g., Russian Federal Space Agency, *An Operator of Russian Space Systems of the Earth Remote Sensing, Capabilities of Russian Orbital Constellation of Remote-Sensing Systems in 2011-2012*, UNITED NATIONS OFFICE FOR OUTER SPACE AFFAIRS (2012), available at <http://www.oosa.unvienna.org/pdf/pres/stsc2012/2012ind-06E.pdf>.

36. Jonathan Amos, *Simulated Mars Mission ‘Lands’ Back on Earth*, BBC.CO.UK (Nov. 4, 2011), <http://www.bbc.co.uk/news/science-environment-15574646>. Russia may repeat what is known as the Mars500 research experiment, originally conducted in collaboration with the European Union and China, by simulating the zero-gravity conditions of spaceflight on humans on a portion of the International Space Station. Lee Rannals, *Russia Wants to Repeat Mars500 Experiment in Space*, RED ORBIT (May 2, 2012), <http://www.redorbit.com/news/space/1112526846/russia-wants-to-repeat-mars500-experiment-in-space/>.

37. *Organization and Function*, CHINA NAT’L SPACE ADMIN., <http://www.cnsa.gov.cn/n615709/n620681/n771918/index.html> (last visited Oct. 13, 2013).

38. *Company Profile*, CHINA AEROSPACE SCI. & TECH. CORP., <http://english.spacechina.com/n16421/n17138/n17229/c127066/content.html> (last visited Oct. 13, 2013).

39. *China’s Space Station Will Be Energy-Efficient*, SPACE DAILY (Mar. 4, 2013), http://www.spacedaily.com/reports/Chinas_space_station_will_be_energysufficient_999.html.

40. *China Claims Its Place in Space*, CNN NEWS (Oct. 15, 2003), http://articles.cnn.com/2003-10-14/tech/china.launch_1_yang-liwei-jiuquan-first-astronaut?_s=PM:TECH.

41. Clara Moskowitz, *China Successfully Docks Manned Space Capsule*, CBS NEWS (June 18, 2012), http://www.cbsnews.com/8301-205_162-57455123/china-successfully-docks-manned-space-capsule/.

42. Morris Jones, *China’s Space Program Accelerates*, SPACE DAILY (Jun. 29, 2012), http://www.spacedaily.com/reports/Chinas_Space_Program_Accelerates_999.html.

43. *Id.*

44. Andrea Shalal-Esa, *RPT-China’s Space Activities Raising U.S. Satellite Security Concerns*, REUTERS (Jan. 14, 2013), <http://www.reuters.com/article/2013/01/14/china-usa-satellites-idUSL2N0AJ10620130114>.

45. United Nations General Assembly, Committee on the Peaceful Uses of Outer Space, *International Cooperation in the Peaceful Uses of Outer Space: Activities of Member States*, A/AC.105/1008/Add.1, UNITED NATIONS OFFICE FOR OUTER SPACE AFFAIRS (Jan. 16, 2012) [hereinafter *Peaceful Uses of Outer Space*], http://www.oosa.unvienna.org/pdf/reports/ac105/AC105_1008Add1E.pdf.

supporting the peaceable uses of space as the common heritage of mankind.⁴⁶ Some analysts consider these statements to be pure rhetoric,⁴⁷ belying the evidence of China's military technological development and its assertive anti-satellite test in 2007,⁴⁸ which has been confirmed as the cause of damage to a Russian satellite.⁴⁹ Chinese space development occurs entirely under its military forces⁵⁰ in the General Armament Department of the People's Liberation Army's Central Military Commission. One difference between Chinese and American space development programs is that the United States has kept its military space technology development a degree separated from its scientific and civilian space program.⁵¹

The United States National Aeronautics and Space Administration (NASA) boasts a rich history of propelling man to his first steps on the moon, taking "[o]ne small step for man, one giant leap for mankind."⁵² While the Bush administration renewed vows to return to the moon, a different course has been set by the Obama administration,⁵³ planning to reach asteroids by 2025 and Mars in the 2030s.⁵⁴ In 2010, NASA discontinued its human spaceflight program and instead turned towards the private space industry for space innovation.⁵⁵ The United States currently invests in the development of crewed space vehicles from private space corporations.⁵⁶ NASA's budget estimate for 2015 is \$17.5 billion.⁵⁷

Although commercial space prospects have radically "lifted off" in the past few years, the United States policy imperative to propel NASA towards the advancement of commercial activity in space began in the late 1970s and was formally enunciated in the Reagan administration's 1984 National Policy on the Commercial Use of Space.⁵⁸ The Commercial Space Launch Amendments Act of

46. Joseph Kahn, *China Shows Assertiveness in Weapons Test*, N.Y. TIMES (Jan. 20, 2007), http://www.nytimes.com/2007/01/20/world/asia/20china.html?_r=0&pagewanted=all.

47. *Id.*

48. Mike Wall, *China's Space Advances Worry US Military*, SPACE.COM (Feb. 28, 2012), <http://www.space.com/14697-china-space-program-military-threat.html>.

49. Leonard David, *Russian Satellite Hit by Debris from Chinese Anti-Satellite Test*, SPACE.COM (Mar. 8, 2013), <http://www.space.com/20138-russian-satellite-chinese-space-junk.html>. This occurrence, recent at the time of writing of this article, could potentially activate provisions on nation-state liability for its space activities agreed to in both the Outer Space Treaty and the Convention on Liability. See Gilson, *supra* note 15, at 1378–79.

50. China's crewed space program operates under the General Armament Department of the People's Liberation Army's Central Military Commission. SUSAN V. LAWRENCE & MICHAEL F. MARTIN, CONG. RESEARCH SERV., R41007, UNDERSTANDING CHINA'S POLITICAL SYSTEM 25–26, (Jan. 31, 2013), available at FEDERATION OF AMERICAN SCIENTISTS, <http://www.fas.org/sgp/crs/row/R41007.pdf>.

51. Wall, *supra* note 48.

52. Ned Potter, *Neil Armstrong: How 'One Small Step' Became First Words on Moon*, ABC NEWS (Jan. 2, 2013), <http://abcnews.go.com/Technology/neil-armstrong-small-step-words-moon-apollo-11/story?id=18115402>.

53. Kenneth Chang, *Obama Calls for End to NASA's Moon Program*, N.Y. TIMES (Feb. 1, 2010), http://www.nytimes.com/2010/02/02/science/02nasa.html?_r=0.

54. Nancy Atkinson, *Obama Wants Mission to Asteroid by 2025, Mars by Mid-2030's*, UNIVERSE TODAY (Apr. 15, 2010), <http://www.universetoday.com/62766/obama-wants-mission-to-asteroid-by-2025-mars-by-mid-2030s/#ixzz2NSHL2BWB>.

55. *Id.*

56. NASA Awards Contracts, *infra* note 102.

57. NASA FY 2015 BUDGET REQUEST, NASA (2014), available at [http://www.nasa.gov/sites/default/files/files/FY_15_agency_fact_sheet\(1\).pdf](http://www.nasa.gov/sites/default/files/files/FY_15_agency_fact_sheet(1).pdf)

58. See generally NASA HISTORICAL DATA BOOK VOL. VI: NASA SPACE APPLICATIONS, AERONAUTICS AND SPACE RESEARCH AND TECHNOLOGY, TRACKING AND DATA ACQUISITION/SUPPORT OPERATIONS, COMMERCIAL PROGRAMS, AND RESOURCES, 1979–88, at 355–62, NASA (Judy A. Rumerman ed.,

2004 codified the United States' policy for commercial space development, stating "the goal of safely opening space to the American people and their private commercial, scientific, and cultural enterprises should guide Federal space investments, policies, and regulations."⁵⁹ In the 2010 release of the Space Policy of the United States, President Barack Obama further articulated the importance of the commercial sector to our space industry,

[a] robust and competitive commercial space sector is vital to continued progress in space. The United States is committed to encouraging and facilitating the growth of a U.S. commercial space sector that supports U.S. needs, is globally competitive, and advances U.S. leadership in the generation of new markets and innovation-driven entrepreneurship.⁶⁰

The national governments of the United States, Russia, China, Japan India, and the European Space Agency have expressed plans to take the next step in human outer space development by establishing Lunar colonies.⁶¹ The Bush administration's Vision for Space Exploration included returning to the moon and establishing "an extended human presence."⁶² However, the initiative was not sufficiently funded by Congress and the moon-oriented Constellation program was cancelled during the Obama administration.⁶³ The NASA budget for 2014 does not include funding for the United States to reach for the moon,⁶⁴ but leaders in Congress continue to assert the strategic importance of establishing a lunar base in proposed legislation RE-asserting American Leadership in Space Act (the REAL Space Act).⁶⁵ Furthermore, in the proposed Apollo Lunar Landing Legacy Act,

1999), available at <http://history.nasa.gov/SP-4012/vol6/ch5.pdf>. See also President and Fellows of Harvard College, *Commercialization of Space Commercial Space Launch Amendments Act of 2004*, 17 HARV. J. L. & TECH. 619, 622 (2004).

59. Commercial Space Launch Amendments Act of 2004, 51 U.S.C.A. § 50901(a)(10) (West 2010).

60. Barack Obama, Office of the President of the United States, NAT'L SPACE POLICY OF THE U.S. OF AM. 3 (June 28, 2010) [hereinafter U.S. SPACE POLICY],

http://www.whitehouse.gov/sites/default/files/national_space_policy_6-28-10.pdf.

61. *China Aims for Lunar Base After 2020*, MOON DAILY (Sept. 26, 2007) [hereinafter *China Aims for Lunar Base*], http://www.moondaily.com/reports/China_aims_for_lunar_base_after_2020_999.html (citing China's reasons for establishing a lunar base, including low maintenance costs as a satellite platform orbiting the Earth, the possibility of tapping into the moon's thermal energy potential, and the mining of helium to fulfill energy needs); see also *Japan Plans Moon Base By 2030*, MOON DAILY (Aug. 3, 2006), http://www.moondaily.com/reports/Japan_Plans_Moon_Base_By_2030_999.html; Keith Veronese, *Could Helium-3 Really Solve the Earth's Energy Problems?*, io9.com (May 11, 2012), <http://io9.com/5908499/could-helium-3-really-solve-earths-energy-problems>; John Lasker, *Race to the Moon for Nuclear Fuel*, WIRED.COM (Dec. 15, 2006), <http://www.wired.com/science/space/news/2006/12/72276>.

62. George W. Bush, President Bush Announces New Vision for Space Exploration Program, Remarks by the President on U.S. Space Policy, Jan. 14, 2004, available at <http://history.nasa.gov/Bush%20SEP.htm>.

63. Tarik Maliq, *NASA Grieves Over Canceled Program*, NBC NEWS (Feb. 20, 2010), http://www.nbcnews.com/id/35209628/ns/technology_and_science-space/t/nasa-grieves-over-canceled-program/#.UX2RqStVQz0.

64. See generally FISCAL YEAR 2014 BUDGET PRESENTATION, NASA, http://www.nasa.gov/pdf/740427main_NASAFY2014SummaryBriefFinal.pdf.

65. News Release, *U.S. Congressman Bill Posey, Bipartisan Legislation Sets NASA's Focus on the Moon*, H.R. (Apr. 10, 2013), <http://posey.house.gov/news/documentsingle.aspx?DocumentID=327243>; see also Eric Giunta, *Bill Posey Shoots for the Moon*, SUNSHINE STATE NEWS (Apr. 10, 2013),

members of Congress are calling for the creation of a national park on the moon to commemorate the first footprints on the lunar surface.⁶⁶

China's lunar exploration plan is detailed in three phases: "[A]n orbital reconnaissance phase, now completed (Chang'E 1 and Chang'E 2), a soft-landing phase (Chang'E 3 and likely Chang'E 4), and a sample-return phase (likely Chang'E 5 and Chang'E 6)."⁶⁷ As part of the Chang'E 3 phase, the deployment of a sophisticated rover was completed on December 14, 2013 when the "Yutu" lunar rover delivered the robotic cover the "Jade Rabbit."⁶⁸ The diligent progression of the program and its continued funding indicate that China may achieve the goal of a sustained lunar presence before the United States or Russia, despite their head start.⁶⁹ The European Space Agency has formed the International Lunar Exploration Working Group to develop a "world strategy for the exploration and utilization of the Moon."⁷⁰ The feasibility of lunar exploration plans is greater than ever before with the discovery of water and other elements important for sustaining life on the moon.⁷¹

The presence of Helium-3 on the moon provides a strong economic incentive to enter the "race" for lunar mining rights.⁷² Helium-3, rare on Earth, can be used in a clean nuclear fusion process without the hazardous byproducts of current nuclear reactors, and has the potential to meet the energy needs of the world.⁷³ Twenty-five tons of Helium-3 could power the United States for one year.⁷⁴ Furthermore, just three space shuttles filled with Helium-3 could fulfill the annual

<http://www.sunshinestatenews.com/story/bill-poseys-real-space-act-would-shoot-for-moon-set-nasa-alight-again>; Mike Wall, *Moon Base Over Asteroid?*, SPACE.COM (Apr. 11, 2013), <http://www.space.com/20600-nasa-manned-moon-mission-congress.html>. The REAL Space Act (H.R. 1446) was re-introduced by Representative Bill Posey on April 9, 2013 and supercedes H.R. 1641, proposed in 2011. H.R. 1446, 103d Cong. (2013), <http://www.govtrack.us/congress/bills/113/hr1446#related> (last visited Oct. 13, 2013).

66. Apollo Lunar Landing Legacy Act, H.R. 2617, 113th Cong. (2013), <http://www.govtrack.us/congress/bills/113/hr2617/text> (last visited Oct. 13, 2013); see Jeffrey Kluger, *National Parks on the Moon? It's an Excellent Idea* (July 20, 2013), <http://science.time.com/2013/07/20/national-parks-on-the-moon-its-an-excellent-idea/>.

67. Emily Lakdawalla, *The Chang'e 3 Lunar Lander and Rover, Expected to Launch Late This Year*, PLANETARY SOCIETY (Jan. 9, 2013), <http://www.planetary.org/blogs/emily-lakdawalla/2013/01091341-change-3-lunar-lander.html> (last visited Oct. 13, 2013).

68. Leonard David, *China Moon Landing: 'Jade Rabbit' Rover Basks in Lunar Bay of Rainbows*, SPACE.COM (Dec. 14, 2013), <http://www.space.com/23971-china-moon-rover-landing-change3-success.html>.

69. *Lunar Probe to Land on Moon*, CHINA DAILY (Apr. 4, 2013), http://www.chinadaily.com.cn/cndy/2013-03/04/content_16271699.htm; see also *China Announces Plans for Moon Landing in 2013*, FOX NEWS (July 31, 2012), <http://www.foxnews.com/scitech/2012/07/31/china-announces-plans-for-moon-landing-in-2013/>.

70. *International Lunar Exploration Working Group*, ESA, SCIENCE AND TECHNOLOGY [hereinafter EUROPEAN SPACE AGENCY], <http://sci.esa.int/science-e/www/object/index.cfm?fobjectid=34125> (last visited Oct. 13, 2013).

71. Elizabeth Howell and SPACE.com, *Apollo Moon Rocks Challenge Lunar Water Theory*, SCIENTIFIC AMERICAN (Feb. 19, 2013), <http://www.scientificamerican.com/article.cfm?id=apollo-moon-rocks-challenge>; but see *NASA Sidelining India's Moon Men?*, THE TIMES OF INDIA, (May 17, 2010), http://articles.timesofindia.indiatimes.com/2010-05-17/india/28305933_1_moon-impact-probe-mini-sar-indian-scientists (claiming the discovery of water should be credited to India).

72. Jeff Bonde & Anthony Tartorello, HELIUM-3: THE ENERGY SOURCE OF TOMORROW? 22 (2008), available at <http://mcdcampbell.com/Helium-3version2.pdf> (estimating Helium-3 annual revenue of \$300 billion).

73. *Id.* at 18.

74. *Id.* at 19. See also Julie Wakefield, *Moon's Helium-3 Could Power Earth*, SPACE.COM (June 30, 2000), http://fti.neep.wisc.edu/gallery/pdf/space_com063000.pdf.

energy needs of the world.⁷⁵ Although Helium-3 is plentiful on the lunar surface, certain lunar regions boast greater concentrations based on elevation and particle size,⁷⁶ increasing the significance of the legal issues between nations regarding property rights on the moon. There are two open questions in the race to return to the moon: (1) what exactly does the winner receive? and (2) who are the contestants?

The distinction between spacefaring and non-spacefaring nations may become moot because of space technology transfers,⁷⁷ partnerships between nation-states like the European Space Agency,⁷⁸ the commercialization of the space industry,⁷⁹ and public-private partnerships.⁸⁰ Nation-states with sufficient resources can quickly become spacefaring through technology transfers (authorized or unauthorized) and capitalize on the long, arduous, and expensive achievements of space pioneers⁸¹ or simply benefit from the efficiency of commercial space companies.⁸² Nation-states can outsource space program functions by contracting with other countries or commercial space service providers for the advantages of new space technology such as sending satellites into orbit, conducting scientific experiments, utilizing remote-sensing technology, deploying rovers, and even launching people into space.⁸³ Even the United States, while its human spaceflight program is on hiatus, has taken to paying Russia for space flights to the International Space Station (ISS), at \$50 million per passenger.⁸⁴ The ISS

75. Bonde, *supra* note 72, at 18.

76. A. M. Abdrakhimov & E. M. Galimov, *The Estimation Of Helium-3 Probable Reserves In Lunar Regolith*, LUNAR AND PLANETARY SCIENCE XXXVIII (2007), available at <http://www.lpi.usra.edu/meetings/lpsc2007/pdf/2175.pdf>.

77. See U.S. Dep'ts of Def. and State, Rep. to Cong. on §1248 of the Nat'l Def. Authorization Act for Fiscal Year 2010, *infra* note 81.

78. See Ansdell, *infra* note 80; see also EUROPEAN SPACE AGENCY, *supra* note 70.

79. See generally *infra* Part II, Section B.

80. See generally M. Ansdell, et. al., *Analyzing the Development Paths of Emerging Spacefaring Nations Opportunities or Challenges for Space Sustainability?*, IAFF 6159: CAPSTONE RESEARCH (Apr. 2011), available at http://www.gwu.edu/~spi/assets/docs/Ansdell%20Delgado%20Hendrickson_Final.pdf (analyzing the space development paths of six emerging space actors in three regions of the world: Nigeria and South Africa in Africa, Malaysia and India in Asia-Pacific, and Venezuela and Brazil in South America, noting the Ethics of European Space Development, difficulty with United States dual-use technology transfers, and collaborative solutions with Russian Space Program).

81. U.S. Dep'ts of Def. and State, Rep. to Cong. on §1248 of the Nat'l Def. Authorization Act for Fiscal Year 2010, (Pub. L. No. 111-84), RISK ASSESSMENT OF UNITED STATES SPACE EXPORT CONTROL POLICY (2010), at 3-4, App.4, 4-4, available at <http://www.globalsecurity.org/space/library/report/2012/1248-space-exports.pdf> (assessing risks of United States dual-use space technology exports, recommending the best policy is to allow export of items readily available in similar technological capacity markets and to guard dual-use technologies from reverse-engineering risks from other nations, specifically China).

82. See, e.g., Clark, *infra* note 114.

83. See News Release, *Government of Dubai, Emirates Institution for Advanced Science and Technology (EIAST), EIAST and Bigelow Aerospace Sign Agreement to Create Next-Generation Commercial Human Spaceflight Programme* (Jan. 2, 2011) [hereinafter *Government of Dubai*], <http://www.eiast.ae/default.aspx?options=%7B6c9456d6-36c1-4fa2-8f09-916d30089868%7D&view=Eiast&layout=Eiast&itemId=61&Id=234> (United Arab Emirates signed a Memorandum of Understanding with Bigelow Aerospace for the development of a human spaceflight program in 2011.); see generally Ansdell, *supra* note 80 and accompanying text.

84. Rachel Courtland, *U.S. Space Companies Present Soyuz-Busting Price Plans*, NEWSIDENTIST (Mar. 22, 2010), <http://www.newscientist.com/article/dn18688-us-space-companies-present-soyuzbusting-price-plans.html>.

collaborative effort, led by Europe, the United States, Russia, Japan, and Canada, provides scientific benefits to countries worldwide.⁸⁵

One implication for humanity of the blurring of boundaries—the globalization of outer space development—is that the nation-state will no longer be the best unit of measurement for the success of outer space development.⁸⁶ Another implication is that the nation-state will not be the most efficient entity for the production of space technology.⁸⁷ Furthermore, when it comes to the bottom line, nation-states will lose the ability to unilaterally reap the benefits of their state investments into space technology and infrastructure.⁸⁸ To continue to work in the old-world paradigm may cost nation-states the economic benefits of space exploration.⁸⁹ This does not mean that nation-states should openly disseminate technology and disregard the security issues.⁹⁰ However, it is critical that the level of collaboration between nation-states reaches new heights to strategically and successfully optimize the benefits of space exploration.⁹¹ The progress of spacefaring nations is truly becoming the progress of humanity—the international community has become a *spacefaring civilization* and we are developing a global space industry.⁹²

B. The Rise of the Commercial Space Industry

1. Government Contracting to Commercial Space Corporations

The dissolution of the Soviet space program resulted in new state agencies, prominently the Russian Federal Space Agency and the National Space Agency of Ukraine, as well as the privatization of design bureaus into over 100 commercial firms including MirCorp, RSC Energia, and Khartron Corp.⁹³ The private firms

85. *International Space Station Benefits for Humanity, Executive Summary*, EUROPEAN SPACE AGENCY, http://www.esa.int/Our_Activities/Human_Spaceflight/International_Space_Station_Benefits_for_Humanity/Executive_Summary (last visited Oct. 13, 2013); *see also International Space Station Legal Framework*, EUROPEAN SPACE AGENCY, http://www.esa.int/Our_Activities/Human_Spaceflight/International_Space_Station/International_Space_Station_Legal_Framework (last visited Oct. 13, 2013).

86. *See* Aileen E. Nowlan, *Stumbling Towards Distributive Justice*, 12 CHI.-KENT J. INT'L & COMP. L. 99, 102, 122 (2012) (“The challenge of space exploration has joined with the depletion and degradation of the world’s environment . . . to entice or compel individuals and governments to think in terms of our common destiny: to counter humanity as a single gifted but greedy species, sharing a common, finite, and endangered speck of the universe.”) (quoting Thomas Franck, *FAIRNESS IN INTERNATIONAL LAW AND INSTITUTIONS* 6 (1995)).

87. *See* Pappalardo, *Is This NASA Document Saving or Killing Manned Private Space Flight?*, *infra* note 104 and accompanying text.

88. *See generally* Ansdell, *supra* note 80 (documenting challenges in space technology transfers); *see also A Charter For Scientific And Technical Co-Operation And Technology Transfer*, *infra* note 391. *See, e.g.*, David, *Bigelow Aerospace Soars with Private Space Station Deals*, *infra* note 111; Clark, *infra* note 114 (examples of nation-state investments in space technology that later become international products).

89. Ansdell, *supra* note 80.

90. *Compare supra* note 88 and accompanying text, with RISK ASSESSMENT OF UNITED STATES SPACE EXPORT CONTROL POLICY, *supra* note 81.

91. *See, e.g.*, Nowlan, *supra* note 86, at 101.

92. *See, e.g.*, *Space Settlements Represent Hope for Mankind*, NATIONAL SPACE SOCIETY (Aug. 23, 2013), http://www.nss.org/news/releases/NSS_Release_20130823_Settlement.html.

93. *See Space Industry of Russia*, KOSMOS DIRECTIVES (May 5, 2012), <http://kosmosdirectives.com/news120512.html>; *see also* Jason C. Chavis, *Space Tourism Trips on the Russian Soyuz*, BRIGHT HUB (June 1, 2011), <http://www.brighthouse.com/science/space/articles/71569.aspx>.

both service the outer space needs of the national governments in Russia and Eastern Europe and provide services for commercial customers.⁹⁴ While the success of the privatization of parts of the Russian space program has had a rocky history,⁹⁵ the flexibility of the public-private ventures has resulted in outer space commercial firsts like the launching of the first space tourists in the Soviet-developed Soyuz capsule.⁹⁶

On May 25, 2012, SpaceX made history it considers “evolutionary, not revolutionary,” when it docked its commercial cargo spacecraft, the *Dragon*, on the International Space Station.⁹⁷ The cargo delivery mission was the first of at least twelve resupply missions it will fulfill under NASA’s Commercial Resupply Services contract—worth \$1.6 billion.⁹⁸ Two companies, SpaceX and Orbital Sciences, have contracts under NASA’s Commercial Orbital Transportation Services program to develop cargo delivery space vehicles, “space taxis,”⁹⁹ for the federal agency.¹⁰⁰ United Launch Alliance, a joint venture between Boeing and Lockheed Martin, received a fixed-price contract to launch NASA’s Cloud and Land Elevation Satellite-2 mission, whose total estimated cost to launch is \$96.6 million.¹⁰¹ NASA also plans to work with private companies to send astronauts into space under its Commercial Crew Program.¹⁰² Three companies—Boeing, SpaceX, and Sierra Nevada—have been awarded contracts worth about \$10 million each for the phase of the program known as Certification Products Contracts.¹⁰³

The pace and vigor that the United States has devoted to developing the commercial space industry since the Commercial Space Launch Amendments of 2004 reveals a true commitment to the policy of developing commercial space enterprise. NASA’s contracts directly compensate corporations for the work performed to meet NASA program goals, which supports the commercial space industry and also results in savings to the government.¹⁰⁴ Admiring NASA’s new

94. See Chavis, *supra* note 93. See generally *Space Industry of Russia*, *supra* note 93.

95. See generally *Space Industry of Russia*, *supra* note 93.

96. Chavis, *supra* note 93.

97. Kenneth Chang, *First Private Craft Docks with Space Station*, N.Y. TIMES at A12 (May 26, 2012), available at <http://www.nytimes.com/2012/05/26/science/space/space-x-capsule-docks-at-space-station.html>.

98. News Release, *First Contracted SpaceX Resupply Mission Launches with NASA Cargo to Space Station*, NASA (Oct. 7, 2012), http://www.nasa.gov/home/hqnews/2012/oct/HQ_12-355_SpaceX_CRS-1_Launch.html [hereinafter *First Resupply Mission*].

99. James Pura, *US’s Commercial Spaceflight Bargain*, SPACE FRONTIER FOUNDATION (Aug. 6, 2012), <http://spacefrontier.org/2012/08/uss-commercial-spaceflight-bargain/>.

100. *First Resupply Mission*, *supra* note 98.

101. News Release, *NASA Selects Launch Services for ICESat-2 Mission*, NASA (Feb. 22, 2013), <http://www.nasa.gov/centers/kennedy/news/releases/2013/release-20130222b.html>; see also News Release, *Boeing, Lockheed Martin to Form Launch Services Joint Venture*, BOEING (May 2, 2005), <http://boeing.mediaroom.com/2005-05-02-Boeing-Lockheed-Martin-to-Form-Launch-Services-Joint-Venture>.

102. News Release, *NASA Awards Contracts In Next Step Toward Safely Launching American Astronauts from U.S. Soil*, NASA (Dec. 10, 2012) [hereinafter *NASA Awards Contracts*], http://www.nasa.gov/home/hqnews/2012/dec/HQ_12-429_CCP_CPC_Contract.html.

103. *Id.*

104. See Stewart Money, *Why SpaceX is Setting the Pace in the Commercial Space Race*, NBC NEWS (July 30, 2012), http://www.nbcnews.com/id/48390277/ns/technology_and_science-space/t/why-spacex-setting-pace-commercial-space-race/#.UUFHDltVQz0 (“represents . . . a rare bargain for taxpayers”); see also Joe Pappalardo, *Is This NASA Document Saving or Killing Manned Private Spaceflight?*, POPULAR MECHANICS (Oct. 18, 2011), <http://www.popularmechanics.com/science/space/nasa/is-this-nasa-document-saving-or-killing-manned-private->

model of doing business, space technology journalist Stewart Money noted, “[t]he stunningly low-cost and expansive nature of the Falcon-Dragon system represents much more than a rare bargain for taxpayers It offers indisputable proof that a new approach to space transportation can work far more effectively than the old ways.”¹⁰⁵

Government contracting in the space industry is not only changing the model of space technology development, it is also contributing to its non-government applications as well. In the Commercial Crew Integrated Design Contracts with NASA, subcontractors retain the rights to their intellectual property even if government funds and oversight assist in its development.¹⁰⁶ In the United States, this means that taxpayer funds subsidize commercial space activities that may or may not contribute to the American economy in the end.¹⁰⁷ Nonetheless, the United States is optimistic that its investments will result in a “U.S. commercial space industry” that will produce job creation and American industrial and economic growth.¹⁰⁸

United States government investments support research and development activities of space technology companies, space launch infrastructure, new space systems technologies, and spaceports that can be used for commercial launches.¹⁰⁹ For example, Bigelow Aerospace contracted with NASA for \$17.6 million to provide an innovative modular addition to the International Space Station.¹¹⁰ However, the technology will not remain a domestic asset since Bigelow Aerospace has also signed Memoranda of Understanding for the sale of modular space buildings to several other nation-states, including Japan, the Netherlands, Singapore, Sweden, Australia, and the United Kingdom.¹¹¹ Although the International Traffic in Arms (ITAR) regulations may pose some limitations,

spaceflight-6518496 (noting greater efficiency and cost-savings is possible with private space vehicle development, but questioning the degree of efficiency possible with government contracts oversight requirements).

105. Money, *supra* note 104.

106. Pappalardo, *Is This NASA Document Saving or Killing Manned Private Space Flight?*, *supra* note 104.

107. See Joe Pappalardo, *Interview: NASA's New Rules for Manned Private Spaceflight*, POPULAR MECHANICS (Oct. 18, 2011), <http://www.popularmechanics.com/science/space/nasa/interview-nasas-new-rules-for-private-companies-and-their-human-carrying-spacecraft> (“[Contractors are] going to own these systems; they’re going to be able to sell the capability not just to NASA but to other customers as well.” (quoting NASA’s director of commercial spaceflights, Phil McAlister)); see also Pappalardo, *Is This NASA Document Saving or Killing Manned Private Space Flight?*, *supra* note 104.

108. Commerce, Justice, Science, and Related Agencies Appropriations for Fiscal Year 2011: *Hearing on S. 3636 Before the Commerce, Justice, Sci. Subcomm. on Appropriations & the Comm. of Appropriations of the U.S. S.*, 111th Cong., 2d Sess. 132–33 (2010) (Statement of Hon. Charles F. Bolden, Jr., Adm’r of NASA) available at <http://www.gpo.gov/fdsys/pkg/CHRG-111shrg54959/pdf/CHRG-111shrg54959.pdf>; see also Pappalardo, *Is This NASA Document Saving or Killing*, *supra* note 104. NASA’s director of commercial spaceflights, Phil McAlister, said that they are “hoping that this will spur the development of a new industry for the United States.” *Id.*

109. See *supra* notes 97–104 and accompanying text. See generally Elkind, *infra* note 127.

110. See, e.g., Kenneth Chang, *For Space Station, a Pod That Folds Like a Shirt and Inflates Like a Balloon*, N. Y. TIMES, (Jan. 17, 2013 at A15), available at <http://www.nytimes.com/2013/01/17/science/space/for-nasa-bigelow-aerospace-balloonlike-module-is-innovative-and-a-bargain-too.html>; see also Jon Card, *The First Space Settlement is Growing Thanks to NewSpace*, SPACE FRONTIER FOUNDATION (Jan. 16, 2013), <http://spacefrontier.org/2013/01/first-private-building-in-space/>.

111. Leonard David, *Bigelow Aerospace Soars with Private Space Station Deals*, SPACE.COM (Oct. 19, 2010), <http://www.space.com/9358-bigelow-aerospace-soars-private-space-station-deals.html>.

commercial space technology innovations developed in the United States can become commodities in the international market.¹¹²

Many national governments are increasingly utilizing the services of commercial space corporations, which increase the access of non-spacefaring nations to the benefits of outer space.¹¹³ For example, SpaceX launched a satellite for Malaysia containing a medium-aperture camera that could be used for environmental and land development purposes.¹¹⁴ The United Arab Emirates intend to hire Bigelow Aerospace for its human spaceflight program development.¹¹⁵ The savings to nation-state governments created by outsourcing their space technology development to private companies comes with the cost of acceding global access to the technology.¹¹⁶ Investing in commercial space technology may spur an exciting industry, but the benefits of the new technology and the return on investment to nation-states may not be fully captured within their borders.¹¹⁷

2. Space Tourism Industry Development

Private investors, including many of the world's billionaires, are investing heavily in "space tourism" and other commercial and potentially profitable applications of space exploration technologies.¹¹⁸ Bigelow plans to use the same expandable space module building technology that was first sold for government applications to develop the first space hotel in orbit.¹¹⁹ For this honor, Bigelow is competing with two Russian companies, Orbital Technologies and RSC Energia, who plan to develop a space hotel named the Commercial Space Station for space tourists.¹²⁰ MirCorp, the company that gained control of the Russian space station program, has partnered with Space Adventures, an American company, in their space tourism venture to sell space flights aboard the Soyuz.¹²¹ Space Adventures

112. See Jeff Foust, *Bigelow Aerospace's big day at the rodeo*, THE SPACE REVIEW.COM (July 24, 2006), <http://www.thespacereview.com/article/667/1>; See, e.g., Card, *supra* note 110.

113. See, e.g., Clark, *infra* note 114; see also News Release, *Government of Dubai*, *supra* note 83.

114. Stephen Clark, *Commercial Launch of SpaceX Falcon 1 Socket a Success*, SPACEFLIGHT NOW (July 14, 2009), <http://spaceflightnow.com/falcon/005/index.html>.

115. News Release, *Government of Dubai*, *supra* note 83.

116. See, e.g., *supra* notes 110–14.

117. See, e.g., *supra* notes 110–14; see also *supra* note 88 and accompanying text.

118. Dan Vergano, *Billionaires Back Ambitious Space Projects*, USA TODAY (May 13, 2012), <http://usatoday30.usatoday.com/tech/science/space/story/2012-04-25/space-exploration-billionaires/54866272/1>; see also Paur, *infra* note 323. Another proposed source of commercial space industry revenue is outer space advertising, which Congress passed a law to generally prohibit. Frank J. Balsamello, *When You Wish Upon a Falling Billboard: Advertising in an Age of Space Tourism*, 98 GEO. L.J. 1769, 1821–22 (2010).

119. 'Space Hotel' Test Craft Launched, BBC News (June 29, 2007), <http://news.bbc.co.uk/2/hi/science/nature/6253054.stm>. But see Chang, *supra* note 110 (Bigelow planning to build space station to surpass the size of International Space Station to rent space to countries and tourists).

120. Tariq Malik, *Russian Companies Plan Commercial Space Station*, NBC NEWS (Sept. 29, 2010), http://www.nbcnews.com/id/39418605/ns/technology_and_science-space/#.UT1oTtFVQz0; Tiffany Lam, *Russians Unveil Space Hotel*, CNN TRAVEL (Aug. 18, 2011), <http://travel.cnn.com/explorations/life/russians-unveil-space-hotel-678591> ("Plans to open the first-ever space hotel in 2016. But what's there to do up there?").

121. Chavis, *supra* note 93; see also *Orbital Spaceflight Program*, SPACE ADVENTURES, <http://www.spaceadventures.com/index.cfm?fuseaction=orbital.orbital> (last visited Mar. 14, 2013); To date, Space Adventures has sold passages and delivered seven private citizens into outer space. *Clients—Completed Missions*,

has also entered into a contract with Boeing to sell seats on its upcoming space vehicle, the CST-100.¹²² At \$150 million per seat, Space Adventures is marketing for passengers to try a commercial first—a privately financed circumlunar voyage it anticipates will launch before 2017.¹²³

SpaceX founder Elon Musk has his sights set higher than becoming NASA's favorite contractor.¹²⁴ The company's long-term plans include entering the space tourism industry and transporting crewed space missions to Mars, with an estimated cost per passenger of \$500,000.¹²⁵ The space industry has plans in the works to drastically reduce the ticket price for space tourists.¹²⁶ Richard Branson's Virgin Galactic builds upon the \$10 million X-Prize winning SpaceShipOne, the first commercial space vehicle to enter space.¹²⁷ Virgin Galactic has announced ticket prices of \$200,000,¹²⁸ which is affordable compared to the \$20 million seats that have been sold by Space Adventures on the Soyuz.¹²⁹ XCOR, a company run by an ambitious group of rocket scientists, plans to charge space tourists a more "reasonable" ticket price of \$95,000 for trips into outer space by developing a shuttle-like reusable vehicle that could launch with forty-eight hours notice.¹³⁰ The State of Texas is also granting XCOR a \$10 million economic incentive "prize" to relocate their operations to Texan soil.¹³¹

Commercial space tourism operations have concrete plans to launch from spaceports in Abu Dhabi and Curacao, among other currently non-spacefaring countries.¹³² After investing \$390 million, Aabar Investments of Abu Dhabi now owns 37.8 percent of Branson's Virgin Galactic Corp.¹³³ Additionally, "Virgin

SPACE ADVENTURES, <http://www.spaceadventures.com/index.cfm?fuseaction=orbital.clients> (last visited Mar. 14, 2013).

122. *Orbital Spaceflight Program*, *supra* note 121.

123. Eric Anderson—Eric Anderson on Space Adventures Circumlunar Mission, YOUTUBE (Feb. 1, 2012), <http://youtu.be/vVdw5m9dgDc>.

124. See Mann, *infra* note 137; see also Karin Diepgrond, *Is SA Billionaire Elon Musk Living Up To His 'Tony Stark' Title?*, MONEYWEB (Feb. 14, 2013), <http://www.moneyweb.co.za/moneyweb-technology-news/is-sa-billionaire-elon-musk-living-up-to-his-tony->. In an interview lauding Musk's accomplishments and plans, "Jon Stewart noted (perhaps incorrectly): four entities have launched rockets into space: the U[nited] S[tates], China, the Soviet Union (Russia) and Elon Musk. To which [Musk] humbly replied, 'Well, it wasn't just me.'" *Id.*

125. Rob Coppinger, *Pack Your Bags: Pioneer Wants 80,000 of Us to Colonize Mars*, NBC NEWS, http://www.nbcnews.com/id/49967348/ns/technology_and_science-space/#.UT1xbdFVQz1 (last updated Nov. 26, 2012, 1:09 PM).

126. See *id.*

127. See Peter Elkind, *Space-travel Startups Take Off*, CNN MONEY (Jan. 16, 2013), <http://tech.fortune.cnn.com/2013/01/16/xcor-virgin-galactic/>; see also *Spaceships: Virgin Galactic's Vehicles*, VIRGIN GALACTIC, <http://www.virgingalactic.com/overview/spaceships/> (last visited Mar. 14 2013); see also Alan Boyle, *SpaceShipOne Wins \$10 Million X Prize*, NBC NEWS (Oct. 5 2004), http://www.nbcnews.com/id/6167761/ns/technology_and_science-space/t/spaceshipone-wins-million-x-prize/.

128. Elkind, *supra* note 127.

129. *Tourists Visit the International Space Station*, SPACE TODAY ONLINE, <http://www.spacetoday.org/Astronauts/SpaceTourists.html> (last visited Mar. 14, 2013).

130. Elkind, *supra* note 127.

131. *Id.*

132. Federal Aviation Authority (FAA) Office of Commercial Space Transportation (AST) & Space Policy Institute, George Washington University, *Introduction to FAA Office of Commercial Space Transportation (AST) and International Outreach*, Oct. 18, 2012, at 20, available at <http://www.gwu.edu/~spi/assets/docs/John%20Sloan%20charts.pdf> [hereinafter *AST International Outreach*].

133. Nour Malas, *Abu Dhabi's Aabar Boosts Virgin Galactic Stake*, MARKETWATCH (Oct. 19, 2011, 12:22 AM), <http://www.marketwatch.com/story/abu-dhabis-aabar-boosts-virgin-galactic-stake-2011-10-19>.

plans to fly tourists out of a \$209 million spaceport that Branson persuaded New Mexico officials to build with taxpayer funds.”¹³⁴ When Virgin Galactic takes off, over one-third of the company profits will belong to Aabar Investments of Abu Dhabi.¹³⁵ While New Mexico will likely benefit economically from its spaceport investment, the economic benefits and profits of Virgin Galactic’s space tourism business will be spread around the world.¹³⁶

3. The Outer Space Mining Industry

The most ambitious attempts to launch the new space industry may be the prospecting of asteroids for mining metals and minerals.¹³⁷ Some think the cost to capture these resources seems outlandish and prohibitive, but many of the world’s wealthiest businessmen see it differently.¹³⁸ While many companies and countries, including the United States,¹³⁹ have expressed plans to tap into asteroid mining, the company with the most progress and promise is Planetary Resources.¹⁴⁰

Founded by Eric Anderson and Dr. Peter H. Diamandis, Planetary Resources’ financial backers include brave prospectors “Google tycoons Larry Page and Eric Schmidt, film director James Cameron (*Titanic*, *Avatar*), and Ross Perot Jr.”¹⁴¹ Famed astrophysicist Michio Kaku, commenting on the venture, said

If you put two Google billionaires with Microsoft billionaires with some astronauts together, you can’t go wrong. I think private enterprise will boldly go where governments fear to tread. And I think the space program has been in purgatory in the last few years. NASA is an agency to nowhere. So, we need private enterprise, especially people with deep pockets to help jump start the program and maybe mining the heavens is just the ticket.¹⁴²

134. Elkind, *supra* note 127.

135. See Malas, *supra* note 133.

136. See *id.*; see also Elkind, *supra* note 127.

137. Vergano, *supra* note 118; see also Adam Mann, *The Year’s Most Audacious Private Space Exploration Plans*, WIRED (Dec. 27, 2012, 6:30 AM), <http://www.wired.com/wiredscience/2012/12/audacious-space-companies-2012/>.

138. Compare Vergano, *supra* note 118, with Duff McDonald, *The World Needs More Crazy Billionaires*, CNN MONEY (Dec. 15, 2011, 2:18 PM), <http://finance.fortune.cnn.com/2011/12/15/paul-allen-billionaires/>. See also Jon Stewart, Video: *Space Innovators*, THE DAILY SHOW (Apr. 25, 2012), <http://www.thedailyshow.com/watch/wed-april-25-2012/space-innovators>.

139. See Klingler, *infra* note 145; see also Matt Smith, *NASA Shoots for Asteroid, New Manned Missions*, CNN (Apr. 11, 2013, 12:14 PM), <http://www.cnn.com/2013/04/10/politics/budget-nasa>.

140. See, e.g., Damon Poeter, *Planetary Resources Aims to Mine Asteroids for Water, Platinum*, PCMAG.COM (Apr. 24, 2012, 4:24 PM), <http://www.pcmag.com/article2/0,2817,2403469,00.asp>. See generally Klingler, *infra* note 145.

141. Vergano, *supra* note 118; see also Poeter, *supra* note 140.

142. James Cameron, *Google Executives, Billionaires to Mine for Asteroids?*, MICHIO KAKU (Apr. 28, 2012), <http://mkaku.org/home/?p=1328> (citing Yungi De Nies, *James Cameron, Google Executives, Billionaires to Mine for Asteroids?*, ABC NEWS (Apr. 21, 2012), <http://abcnews.go.com/Technology/james-cameron-google-founder-billionaires-mine-asteroids/story?id=16186817#.T5t3Xav2a8A>).

Planetary Resources is not shy about the profit potential of mining asteroids, estimating that it will become a “trillion dollar industry,” with an eye on platinum and water extraction from select asteroids.¹⁴³ The water extraction systems and minerals from asteroids could be used to benefit other space exploration missions, like Mars colonization, by meeting water and fuel needs of voyagers in space.¹⁴⁴

The company is developing a mini-telescope spacecraft, the Arkyd-100 Series that will launch into space and begin studying the asteroids to identify the most viable candidates for mining.¹⁴⁵ Planetary Resources has contracted with Virgin Galactic for payload services.¹⁴⁶ In 2013, Virgin Galactic’s Richard Branson also became a key investor in Planetary Resources’ highly publicized Kickstarter crowdfunding campaign for the first public-use orbiting space telescope.¹⁴⁷

Reports in 2012 indicated that the commercial venture was completely independent from the NASA program.¹⁴⁸ However, NASA did contract with Chris Lewicki, the chief engineer of Planetary Resources, for telescope technology development in 2011.¹⁴⁹ Planetary Resources’ plans to “capture” asteroids and deliver them to Earth are disconcerting to some critics who raise security concerns about unintended asteroids impacting the Earth, or even being used as weapons.¹⁵⁰ Despite the risks, NASA has aligned itself with the same goals.¹⁵¹ In the summer of 2013, NASA proposed the Asteroid Redirect Mission to capture an asteroid and transport it back to Earth for study and it also issued the Grand Asteroid challenge to collect ideas for observation, capture, and deflection of near-Earth asteroids.¹⁵² After completing feasibility studies and developing the necessary technology,

143. News Release, *The Space Economy: A Modern Day Gold Rush*, PLANETARY RESOURCES, <http://www.planetaryresources.com/2012/04/the-space-economy-a-modern-day-gold-rush-2/> (last visited Mar. 14, 2013); see also *Asteroid Usage*, PLANETARY RESOURCES, <http://www.planetaryresources.com/asteroids/usage/> (last visited Mar. 14, 2012).

144. *Asteroid Usage*, *supra* note 143.

145. Dave Klingler, *Planetary Resources Set to Begin Hunt for Asteroids to Mine in 18-24 Months*, ARS TECHNICA (Apr. 24, 2012, 5:50 PM), <http://arstechnica.com/science/2012/04/good-morning-everyone-im-chris-lewicki-and-im-an-asteroid-miner-planetary-resources-announces-aste/>.

146. News Release, *Planetary Resources, Inc. Announces Agreement with Virgin Galactic for Payload Services*, PLANETARY RESOURCES (July 11, 2012), <http://www.planetaryresources.com/2012/07/planetary-resources-inc-announces-contract-with-virgin-galactic-for-payload-services/>.

147. News Release, *Planetary Resources Surpasses US \$1.5 Million to Launch World’s First Crowdfunded Space Telescope*, PLANETARY RESOURCES (July 1, 2013), <http://www.planetaryresources.com/2013/07/planetary-resources-surpasses-us-1-5-million-to-launch-worlds-first-crowdfunded-space-telescope/>.

148. Klingler, *supra* note 145.

149. Vergano, *supra* note 118.

150. Klingler, *supra* note 145.

151. See *id.*; see generally Advanced Exploration Systems, *infra* note 152.

152. NASA, Advanced Exploration Systems, Asteroid Initiative Request for Information, Synopsis (Jan. 18, 2013), [hereinafter Advanced Exploration Systems], <http://prod.nais.nasa.gov/cgi-bin/eps/synopsis.cgi?acqid=156731>; see also Elizabeth Howell, *What’s the Asteroid Capture Mission Going to Look Like? NASA’s Starting Its Review*, UNIVERSE TODAY (Aug. 1, 2013), <http://www.universetoday.com/103893/whats-the-asteroid-capture-mission-going-to-look-like-nasas-starting-its-review/>; Nancy Atkinson, *NASA Explains Their New Asteroid Retrieval Mission*, UNIVERSE TODAY (Apr. 10, 2013), <http://www.universetoday.com/101378/nasa-explains-their-new-asteroid-retrieval-mission/>; see also Asteroid Redirect Mission Concept Reference, NASA, available at http://www.nasa.gov/pdf/756122main_Asteroid%20Redirect%20Mission%20Reference%20Concept%20Description.pdf (last visited Aug. 3, 2012); *Asteroid and Comet Watch*, NASA (Sept. 17, 2013), <http://www.nasa.gov/press/2013/september/nasa-highlights-asteroid-grand-challenge-at-world-maker-faire/#.UmROaXPj90>.

Planetary Resources plans to reach the asteroids by 2025—which is also the year the United States government projects that NASA will reach the asteroids.¹⁵³

C. Non-Profit Organizations in Outer Space Development

The International Astronautical Federation's (IAF) slogan is “A space-faring world cooperating for the benefit of humanity.”¹⁵⁴ The organization is comprised of 246 members from sixty-two countries, including all major government space agencies, companies, and associations in the outer space industry.¹⁵⁵ It hosts the annual International Astronautical Congress with over thirty symposia presenting approximately 1,800 space technology research and policy papers.¹⁵⁶ The IAF also has a Global Networking Forum to promote cooperation, collaboration, and to connect members of the global space community.¹⁵⁷

One of the pioneering outer space development non-profit organizations was the Space Studies Institute.¹⁵⁸ From the grounds of Princeton University to the halls of NASA, Dr. Gerard K. O'Neill performed fundamental research on the lunar surface and the technology required for the development of a lunar colony.¹⁵⁹ The Space Studies Institute funds scientific research such as the Mass-Drivers developed at Massachusetts Institute of Technology (MIT), which can propel asteroids into different orbits, and also made possible the development of “beneficiation”—a process to extract useful resources from lunar soil.¹⁶⁰ Today, the Space Studies Institute continues Dr. O'Neill's legacy and imperative that: “Our mission is not complete until people are living and working in space.”¹⁶¹ Two of Dr. O'Neill's protégés have since become prominent commercial space industry leaders, Dr. Peter Diamandis of Planetary Resources and Jeff Bezos of Amazon, who founded Blue Origins (a company developing space vehicles).¹⁶²

The Space Frontier Foundation supports education, research, policy, and advocacy specifically focused on supporting the private space industry.¹⁶³ Its mission statement states that its “purpose is to unleash the power of free enterprise and lead a united humanity permanently into the Solar System.”¹⁶⁴ NASA provides

153. Klingler, *supra* note 145.

154. *About*, IAF, <http://www.iafastro.org/index.php/about> (last visited Mar. 15, 2013).

155. *Id.*

156. *The International Astronautical Congress*, IAF, <http://www.iafastro.org/index.php/events> (last visited Mar. 14, 2013).

157. *IAF Global Networking Forum (GNF)*, IAF, <http://www.iafastro.org/index.php/activities/gnf> (last visited Mar. 14, 2013).

158. *Space Studies Institute (SSI)*, PERMANENT, <http://www.permanent.com/space-studies-institute-ssi.html> (last visited Mar. 14, 2013).

159. *See History*, SSI, <http://ssi.org/about/history/> (last visited Mar. 14, 2013). *See generally* GERARD K. O'NEILL, *THE HIGH FRONTIER: HUMAN COLONIES IN SPACE* (1977) (the pioneering book for space colony development).

160. *About the Foundation*, SSI, <http://ssi.org/about/> (last visited Mar. 14, 2013).

161. *Our History*, *supra* note 159.

162. *Space Studies Institute (SSI)*, *supra* note 158.

163. *See About the Foundation*, SPACE FRONTIER FOUNDATION, <http://spacefrontier.org/about-us/> (last visited Mar. 14, 2013).

164. *Id.*

funding for some of the Space Frontier Foundation's activities.¹⁶⁵ To fulfill its mission, the Space Frontier Foundation has developed tests to analyze whether space technology is "Frontier Enabling" and whether government programs are "Settlement Enabling."¹⁶⁶

The Planetary Society, founded by Carl Sagan, Bruce Murray, and Louis Friedman, is the largest outer space advocacy organization with more than 40,000 members from over 100 countries.¹⁶⁷ Bill Nye is the current Chief Executive Officer.¹⁶⁸ One significant piece of space technology the Planetary Society is developing through its LightSail program is "Lightsail" vehicles—ultra-light spacecrafts that can be propelled by sunlight.¹⁶⁹ The organization sponsors many projects including microrover technology, extrasolar planetary exploration, SETI (search for extraterrestrial intelligence), and Mars exploration.¹⁷⁰

Of the many Mars colonization organizations, the work of Mars One is currently gaining significant speed, attention, and funding.¹⁷¹ Mars One is a Netherlands-based non-profit organization planning to begin a Martian colony to benefit the whole of humanity.¹⁷² The non-profit intends to fund the mission to Mars through a reality television show.¹⁷³ Its detailed colonization plan includes using existing technology to send humans to Mars on one-way voyages as emigrants to the red planet.¹⁷⁴ ParagonOne is the first supplier to receive a Mars One contract,¹⁷⁵ but the organization also plans to procure technology through companies around the world including SpaceX, British company Surrey Satellite Technology, and French company Thales Alenia Space.¹⁷⁶

165. See *Our History*, SPACE FRONTIER FOUNDATION, <http://spacefrontier.org/our-history/> (last visited Mar. 14, 2013).

166. *About the Foundation*, *supra* note 163.

167. *About Us*, THE PLANETARY SOCIETY, <http://www.planetary.org/about/> (last visited Mar. 14, 2013); *Volunteer Code of Conduct*, THE PLANETARY SOCIETY, <http://www.planetary.org/get-involved/volunteer/volunteer-code-of-conduct.html> (last visited Mar. 14, 2013).

168. *Our Experts*, THE PLANETARY SOCIETY, <http://www.planetary.org/connect/our-experts/> (last visited Mar. 14, 2013).

169. LIGHTSAIL-1, THE PLANETARY SOCIETY, <http://www.planetary.org/explore/projects/lightsail-solar-sailing/> (last visited Mar. 14, 2013).

170. *Space Projects*, THE PLANETARY SOCIETY, <http://www.planetary.org/explore/projects/> (last visited Mar. 14, 2013).

171. See, e.g., Nicola Clark, *Reality TV for the Red Planet*, N.Y. TIMES, Mar. 8, 2013, at B1, available at http://www.nytimes.com/2013/03/09/business/global/reality-tv-for-the-red-planet.html?pagewanted=all&_r=0

172. See, e.g., *About Mars One*, MARS ONE, <http://www.mars-one.com/en/about-mars-one/about-mars-one> (last visited Feb. 19, 2013).

173. Wall, *infra* note 175; see also Clark, *supra* note 171.

174. *About Mars One*, *supra* note 172; see also Wall, *infra* note 175 ("There are no plans at the moment to bring any of these interplanetary adventurers back to Earth.").

175. Mark Hoffman, *Mars Colonization Project Awards First Supplier Contract*, SCIENCE WORLD REPORT (Mar. 12, 2013, 4:52 PM), <http://www.scienceworldreport.com/articles/5513/20130312/mars-colonization-project-awards-first-supplier-contract.htm>; see also Mike Wall, *Mars Colony Project Signs Deal to Study Spacesuits, Life Support*, SPACE.COM (Mar. 11, 2013, 3:57 PM), <http://www.space.com/20164-mars-colony-life-support-systems.html>.

176. *About the Suppliers*, MARS ONE, <http://mars-one.com/en/partners/suppliers> (last visited Mar. 14, 2013).

D. The Global Space Industry

The work of government space programs, commercial space ventures, and non-profit organizations are inextricably intertwined in the big picture of the accelerating global space industry. Commercial space corporations receive contracts and funds for development from nation-state space programs, non-profit organizations, and wealthy individuals.¹⁷⁷ The colonization plans for the Earth's orbit, the Moon, and Mars include: nation-state bases, non-profit colonies, for-profit colonies, and space tourism hotels.¹⁷⁸ The commercial space industry's success ultimately depends on its ability to efficiently and profitably fulfill its missions. For nation-states, there are high stakes in security issues and economic growth from outer space development.

Although the *fait accompli* of the government, commercial, and non-profit space exploration programs outlined above is yet to be seen,¹⁷⁹ it is important to analyze space law relative to current developments and actual possibilities at different points in time. Quixotic dreams of space utopia are easier to sign on to when space colonization does not seem feasible. After space explorers have sustainable access to the Moon and Mars, outer space property rights must become more than just theories because the role of actual use and occupation will take on new meanings.¹⁸⁰ Now that space exploration has become feasible, financially viable, and the fervent mission of space industry pioneers, we should take a proactive approach to establishing the rules of space development that balances the needs of humanity, nation-states, and the commercial space industry.¹⁸¹

The space industry is a multi-billion dollar industry¹⁸² and, for the time being, is forced to operate within the confines of current space law. These confines restrict it to launching, satellite systems, and scant space manufacturing. The existing legal regime will not permit it to grow any further. Unless space law alters its course, there is little incentive to invest in outer space. Minor legal change could create the needed legal incentive to invest in an industry requiring enormous investments of capital and substantial risk. The rewards are infinite, including economic gain, infinite resources, humanitarian progress, and solutions to future crises.¹⁸³

177. See *supra* discussion and examples in Part II, Section B and Part II, Section C.

178. See *supra* the examples in Part II.

179. See *supra* discussion in Part II.

180. See, e.g., Baca, *supra* note 14; see also, e.g., LOCKE, *supra* note 2.

181. See Twibell, *infra* note 183.

182. *Space Foundation's 2012 Report Reveals 12.2 Percent Global Space Industry Growth in 2011*, SPACE FOUND. (Apr. 5, 2012), <http://www.spacefoundation.org/media/press-releases/space-foundations-2012-report-reveals-122-percent-global-space-industry-growth>.

183. Ty S. Twibell, *Space Law: Legal Restraints on Commercialization and Development of Outer Space*, 65 UMKC L. REV. 589, 641 (1997).

Ty S. Twibell's admonitions in the above passage from 1997 express a point frequently critiqued in space law analysis.¹⁸⁴ The uncertainty regarding space law, the lack of governmental support, and the lack of international consensus establishing reliable rules of development are cited as the reasons for the slow-pace of growth in outer space exploration for the past few decades.¹⁸⁵

The commercial space industry has nonetheless emerged—perhaps fueled by nation-state investments, but more likely fired-up by the pioneering spirit of the emerging captains of space industry.¹⁸⁶ Described as “visionaries with deep pockets,” the role of leading commercial space entrepreneurs has been compared to that of Howard Hughes with the airline industry, J.D. Rockefeller with oil, and Henry Ford with the automobile.¹⁸⁷ The global space industry is experiencing significant growth and momentum.¹⁸⁸ It was estimated to be worth \$289.77 billion in 2011, growing 12.2 percent from 2010.¹⁸⁹ Significant global space industry developments are: the shift of commercial space technology development from public to private actors;¹⁹⁰ the imminent launch of more “affordable” commercial space tourism flights;¹⁹¹ and, the fact that people around the world are now willing and *able* to settle in outer space territories.¹⁹² No single nation-state can claim the space industry as its own.¹⁹³ Outer space exploration and development has become the work of the emerging global space industry—built through the efforts of commercial space corporations, non-profit organizations, and nation-states.¹⁹⁴

PART III: SPACE PROPERTY LAW

In addressing the space law of property rights, scholars and government actors currently advocate, among other approaches: (1) acquiescence to the non-appropriation principle of space property present in the “common heritage of mankind” doctrine;¹⁹⁵ (2) interpreting ambiguity regarding space property rights in favor of the existence of a private, but not a sovereign, right to own space property;¹⁹⁶ and (3) rejecting the validity of the non-appropriation principle by unilaterally establishing a nationally-based regulatory framework for space

184. *See id.*

185. *Id.*

186. Vergano, *supra* note 118.

187. *Id.*

188. *Space Foundation 2012 Report*, *supra* note 182.

189. *Id.*

190. *See supra* the discussion in Part II, Section B.

191. Zhao Yun, *A Legal Regime for Space Tourism: Creating Legal Certainty in Outer Space*, 74 J. AIR L. & COM. 959, 960–61 (2009) (“[M]arket research has clearly demonstrated that many people have strong interest in space travel if it were more affordable. These wishes can be met with the development of reusable launch vehicle (RLV) technology, which could reduce space launch costs from \$10,000 per pound to \$1,000 per pound.”).

192. *See Is this really possible?*, *infra* note 418; *see also* HUMAN SETTLEMENT ON MARS IN 2023, *supra* note 172.

193. *See supra* the history and developments of spacefaring countries in Part II, Section A.

194. *See supra* Part II, Sections A–C.

195. *See, e.g.*, Rana, *infra* note 266, at 229.

196. *See, e.g.*, White Jr., *Implications of a Proposal for Real Property Rights in Outer Space*, *supra* note 18.

property rights.¹⁹⁷ Complex political and economic consequences accompany every approach to the issue of space property ownership.¹⁹⁸

A. The Outer Space Treaty is Intentionally Ambiguous About Property Rights

Article II of the Outer Space Treaty states 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.”¹⁹⁹ Some scholars and space lawyers interpret the plain meaning of the term “national appropriation” to indicate that only the exertion of national sovereignty is prohibited, and thus, private property rights in space are permitted under the terms of the Outer Space Treaty.²⁰⁰ Other schools of thought read this article of the treaty *in pari materia*, ascertaining that the phrase appropriation “by any other means” would include appropriations by private parties under the jurisdiction of a nation-state, in light of the obligations expressed in the text of Outer Space Treaty Articles IV, VI, VIII, XI, VII, and the corollary United Nations Convention on Outer Space Liability.²⁰¹

In traditional treaty interpretation, the conflicting views of the meaning of Article II of the Outer Space Treaty would be resolved by looking to the plain meaning of the text, the intention of the parties, the treaty as a whole, and the legislative history (or *travaux préparatoires*).²⁰² On the issue of space property rights, the ambiguity will likely not be resolved by the words of the text. The words are ambiguous because they are the result of a compromise between the conflicting intentions of the parties.²⁰³ At the time of drafting the Outer Space Treaty, the tension of the Cold War’s competing political ideologies and economic models dominated the negotiations.²⁰⁴ The conflicts regarding space property rights were largely premised on the difference between the socialist and capitalist conceptions of property rights.²⁰⁵ Because the ambiguity of Article II is actually the expression of different camps wanting different things, analyses of the multiple intentions of

197. See Landry, *infra* note 232 (proposing a two-tier property rights regime).

198. See, e.g., Collins, *infra* note 386 (discussing the economic potential of space industry); see also, e.g., *supra* notes 195–97.

199. Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205, available at http://www.oosa.unvienna.org/pdf/publications/st_space_61E.pdf [hereinafter Outer Space Treaty].

200. See, e.g., Wayne N. White, Jr., *Real Property Rights in Outer Space*, PROC. 40TH COLLOQUIUM ON L. OUTER SPACE 370, 379 (1998), available at http://www.spacefuture.com/archive/real_property_rights_in_outer_space.shtml.

“International lawyers differ in their interpretation of the term ‘national appropriation.’ Some interpret Article II narrowly to prohibit only national appropriation. Many others interpret the clause broadly to prohibit all forms of appropriation, including private and international appropriation.” *Id.* (favoring narrow interpretation allowing private property rights). See also Gilson, *supra* note 15, at 1388–89.

201. See, e.g., Gilson, *supra* note 15, at 1388.

202. *Id.* at 1388–89.

203. Wasser, *supra* note 14, at 41; Baslar, *infra* note 255, at 32–35.

204. See, e.g., Gilson, *supra* note 15, at 1389; Wasser, *supra* note 14, at 57.

205. See Wasser, *supra* note 14, at 56–58.

the parties does not result in a clear, singular legal meaning.²⁰⁶ Thus, the resulting international law remains largely unsettled.²⁰⁷ In the absence of further international treaty negotiations and accords, it can be expected that the resolution will be made in terms of actions.²⁰⁸

President Obama's release of the official National Space Policy of the United States in 2010 sheds some light on how the United States plans to further the commercial space industry and adhere to the principles of the Outer Space Treaty.²⁰⁹ Though some advocates of the commercial space industry have suggested that withdrawal from the treaty would be the best course for the United States,²¹⁰ President Obama seems to have adopted the middle path of affirming the central tenets of the Outer Space Treaty *and* declaring the intent to protect and defend commercial activities in space under its jurisdiction.²¹¹

As established in international law, there shall be *no national claims of sovereignty* over outer space or any celestial bodies. The United States considers the space systems of all nations to have the rights of passage through, and conduct of operations in, space without interference. Purposeful interference with space systems, including supporting infrastructure, will be considered an infringement of a *nation's rights*.

The United States will employ a variety of measures to help *assure the use of space for all responsible parties*, and, consistent with the inherent right of self-defense, deter others from interference and attack, defend our space systems and contribute to the defense of allied space systems, and, if deterrence fails, defeat efforts to attack them.²¹²

While the United States' policy affirms the principle of national non-appropriation and the "freedom of space,"²¹³ the use of the term "responsible parties," could indicate parties other than nation-states.²¹⁴ Otherwise, the term "nations" would be used as in the remainder of the policy paper,²¹⁵ here emphasized as "nation's rights." Likewise, to be free from "interference" denotes

206. See *supra* notes 200–05 and accompanying text.

207. *Id.*

208. See, e.g., Gilson, *supra* note 15 (analyzing the applicable law to outer space controversies for the benefit of the "lunar litigator").

209. See generally U.S. SPACE POLICY, *supra* note 60.

210. See, e.g., Brandon Gruner, Comment, *A New Hope for International Space Law: Incorporating Nineteenth Century First Possession Principles Into the 1967 Space Treaty for the Colonization of Outer Space in the Twenty-First Century*, 35 SETON HALL L. REV. 299, 351 (2004).

211. See U.S. SPACE POLICY, *supra* note 60, at 3 (emphasis added).

212. U.S. SPACE POLICY, *supra* note 60, at 3 (emphasis added).

213. U.S. SPACE POLICY, *supra* note 60, at 1–2.

214. *Id.* at 3.

215. See U.S. SPACE POLICY, *supra* note 60.

the right to exclude others.²¹⁶ This language could be used to further treaty interpretation theories that insist private property rights, just not national property rights, exist in outer space.²¹⁷

However, looking only at the language of the space policy could be misleading. The cautionary language in the policy principles and directives might be more related to anti-satellite tests and space warfare systems potentially being developed by China²¹⁸ than the United States' stance on the treaty interpretation. For example, one leader in the People's Liberation Army made some revealing statements about China's military space applications.²¹⁹

China's Air Force will begin to develop "offensive operations" in space . . . People's Liberation Army (PLA) Air Force Commander Xu Qiliang said on Sunday that space militarisation, or the development of weapons and defensive technology in outer space, was a "historic inevitability" and that "competition between military forces is moving towards outer space." He said "some developing countries," in addition to "major air force powers", were changing their military strategies to improve their space capabilities, a remark analysts said was likely directed at India and the United States.²²⁰

The security concerns regarding China's anti-satellite technology and other military space applications present political concerns about how the United States should approach the issue of property rights in space.²²¹ These concerns are reminiscent of the intent of the parties in the negotiations of the Outer Space Treaty under the influence of the Cold War.²²²

Despite security concerns and legal ambiguity in space property rights, the global space industry continues on a rapid development trajectory.²²³ Nation-states should endeavor to proactively address the issues regarding property rights in outer space rather than attempt to establish rules once controversies arise.

B. Models of Property Ownership for Outer Space

The natural law and labor-work theory of property ownership rests upon the concept of property in an unappropriated state as *res nullius*, "territory under no one's control, but amenable to appropriation."²²⁴ As aforementioned, the Outer

216. U.S. SPACE POLICY, *supra* note 60, at 3.

217. *See generally id.*

218. *See* U.S. Statement on Peaceful Use of Outer Space—Thematic Debate of UNGA First Committee, *infra* note 359; *see also* Wall, *supra* note 48.

219. Ananth Krishnan, *China to Develop Space Military Capabilities*, THE HINDU (Nov. 3, 2009, 00:59 IST), <http://www.thehindu.com/news/international/article42382.ece>.

220. *Id.*

221. *See* Wall, *supra* note 48.

222. *See, e.g.,* Gilson, *supra* note 15, at 1389.

223. *See Space Foundation 2012 Report*, *supra* note 182.

224. Nowlan, *supra* note 86, at 125.

Space Treaty expressly prohibits appropriation by sovereign nation-states.²²⁵ Whether this non-appropriation principle extends to private entities and individuals exploring outer space under the jurisdiction of a nation-state is highly debated.²²⁶

Some analysts think the true value of outer space exploration cannot come to fruition without the incentive and guarantee of private property ownership.²²⁷ However, the general principle of natural rights is not recognized by all nations, and it has not been agreed to in the international treaty for outer space laws.²²⁸ Proponents of private outer space property rights argue that a nation-state would not violate the Outer Space Treaty by merely *recognizing* private property rights established through use or occupation as opposed to the case of a sovereign *conferring* property rights in outer space.²²⁹ Opponents of this theory argue that this is a false distinction because recognizing or conferring private ownership rights in outer space “presupposes a sovereign competent to confer title” and, thus, violates the Outer Space Treaty.²³⁰

No matter which position is adopted, if property rights that are fully alienable and transferrable in outer space are acknowledged without regulatory conditions, the results would have several foreseeable consequences.²³¹ Appropriation of outer space property through the “first in time”²³² principle would raise controversies and consequences analogous to the colonization of *res nullius* lands on Earth by the colonial powers.²³³ Without concerted international agreement on the first in time property rights, great controversies may arise over the outer space property claims as inequitable imperialistic acts.²³⁴

A recent proposal that America should declare a national park around the lunar landing site artifacts sets aside the Outer Space Treaty rules and revives the hegemonic approach to the appropriation of property.²³⁵ Comments on the proposal have largely ridiculed the idea of a national park on the moon as preposterous.²³⁶ One comment on BigThink.com raised the issue of legal entitlement with a dose of common sense— “[t]hat’s the moon . . . America doesn’t own the moon . . . are we

225. Outer Space Treaty, *supra* note 199.

226. *See, e.g.*, Gilson, *supra* note 15, at 1388.

227. Twibell, *supra* note 183, at 641.

228. *See, e.g.*, Gilson, *supra* note 15.

229. *Id.* at 1389–90.

230. *Id.*

231. *See generally* Baca, *supra* note 14. *See also* Gruner, *supra* note 210, at 344–57.

232. Baca, *supra* note 14, at 1054–55; *see also* Benjamin David Landry, *A Tragedy of the Anticommons: The Economic Inefficiencies of Space Law*, 38 BROOK. J. INT’L L. 523 (2013). *See* Landry’s article for a more detailed account of the space law treaty provisions on property rights and the space property rights models proposed by other scholars. *See id.* He ultimately proposes a two-tiered *res nullius*-based model that disregards the Outer Space Treaty provisions and rejects the common heritage of mankind concept. *Id.* at 567–76. While his point—that the common heritage of mankind is imbued with the unlikely presumption that mankind owns the universe—is well-taken, the result of its application is different when the idea of entitlement to *equal* benefits is replaced by the goal of *equitable* outcomes.

233. *See* Gruner, *supra* note 210, at 344–57.

234. *See id.* at 344.

235. Kecia Lynn, *Would You Visit a National Park on the Moon?*, BIG THINK (July 31, 2013, 5:30 PM), <http://bigthink.com/ideafeed/would-you-visit-a-national-park-on-the-moon>.

236. *The Bull Report: A National Park Idea from Outer Space*, CONG. W. CAUCUS (July 24, 2013), <http://www.westerncaucus.pearce.house.gov/press-releases/the-bull-report-a-national-park-idea-from-outer-space>.

just giving up on that whole ‘we came in peace for all mankind’ business? Can the USA just declare ownership of the heavens?”²³⁷ In the media, the Outer Space Treaty’s non-appropriation principle has been viewed as a legal bar to the bill’s enactment and also dismissed as just another pesky non-binding rule from the United Nations:²³⁸

Michael Listner, founder of New Hampshire-based Space Law and Policy Solutions, says the creation of national parks “requires sovereign control over the real property . . . Since the Outer Space Treaty prohibits sovereign claims over the moon, any attempt to create a National Park . . . will fail.” However, novelist Homer Hickam, whose latest book includes lunar tourism, is all for the idea. “To hell with any past agreements we’ve had . . . they are passé. That’s sacred American soil as far as I’m concerned.”²³⁹

While the idea of a lunar national park seems groundless to those who note that Congress already has trouble funding the national parks on Earth, there could be more reason behind the proposal than meets the eye.²⁴⁰ If the first in time principle begins to establish property rights on the moon, America benefits by proactively staking its claim and sets a precedent for other space pioneers.²⁴¹ It may not be the most strategic approach, however, because the precedent could pave the way for other plans like China’s lunar base or space hotel enterprises to appropriate lunar land and encourage development without order.²⁴² The conservation aspect of the national park proposal may seem appealing, but the effect would be overshadowed by America’s implicit ratification of the legality of unilaterally establishing outer space property rights.²⁴³

Eliminating legal uncertainties would increase the incentives to push for technological innovation and expeditious outer space exploration because the reward would be greater and more reliable.²⁴⁴ The right to exclude others in property, among other rights, might also encourage space pioneers to take greater risks to claim the most advantageous outer space properties first.²⁴⁵ Without a regulatory regime to ensure fairness and order, controversies may arise between competing parties for particular outer space property claims.²⁴⁶ The nearby resources of asteroids, Lunar, and Martian surfaces may seem vast at this point in

237. JKB, Comment to *Would You Visit a National Park on the Moon?*, BIG THINK (July 31, 2013, 5:30 PM) <http://bigthink.com/ideafeed/would-you-visit-a-national-park-on-the-moon>.

238. See Lynn, *supra* note 235.

239. *Id.*

240. See *The Bull Report*, *supra* note 236.

241. Lynn, *supra* note 235.

242. See *China Aims for Lunar Base after 2020*, *supra* note 61.

243. Lynn, *supra* note 235.

244. See Gruner, *supra* note 210, at 331–46.

245. See generally LOCKE, *supra* note 2.

246. See generally Peaceful Uses of Outer Space, *supra* note 45.

time, but the resources are not actually limitless.²⁴⁷ Where there are limits on the availability of a *res nullius* resource, even John Locke articulated that the principle of free appropriation through the use and improvement of a property would also be limited.²⁴⁸

When a property is designated as “commons,” the property of all, a tragedy or a comedy could ensue.²⁴⁹ The social *and* economic benefits could be maximized by common usage,²⁵⁰ or the over-exploitation and externalities²⁵¹ resulting from common usage could “tragically” detract from the optimal use of the property.²⁵² In the *res communis* property concept, property may not be appropriated, although the resources of the property will be available to all (or a designated community).²⁵³ Theoretically, the resources are a common property that anyone could use.²⁵⁴ However, *res communis* is also subject to the dilemma of inequitable access, whether through scarcity or a lack of access to the technology necessary to use the resource.²⁵⁵ In outer space property, the accessibility dilemma is even more pronounced because of the distinction between spacefaring and non-spacefaring nations and individuals.²⁵⁶

An inverse consideration is the idea of an “anticommons” tragedy in property law, where the under-utilization of resources can be a result of the “unfair” dispersion of the benefits.²⁵⁷ As mentioned above, in discussing Twibell’s point of view, the stagnation in the space industry’s growth was attributed to the deterring factors of inadequate incentives, regulation, and uncertainty in space property rights.²⁵⁸ However, as the burgeoning global space industry demonstrates, the commercial benefits have come to outweigh the legal risks of the application of the common heritage of mankind doctrine or the uncertainty in outer space property rights.²⁵⁹ At this point, the “anticommons” concern that development is inhibited by international space law is not as great as the concern that where outer space is becoming developed, humanity will repeat the same tragic mistakes of development on Earth.²⁶⁰

One example of where the tragedy of the commons concept is becoming evident in outer space is in the untempered uses of the Earth’s orbit.²⁶¹ The

247. See, e.g., Abdrakhimov, *supra* note 76 (analysis of availability of Helium-3 in relation to lunar regolith properties and location on the Moon).

248. See generally LOCKE, *supra* note 2, at ch. V.

249. Compare Garrett Hardin, *The Tragedy of the Commons*, 162 SCI. 1243, 1244 (1968), with Carol Rose, *The Comedy of the Commons: Custom, Commerce, and Inherently Public Property*, 53 U. CHI. L. REV. 711, 723 (1986).

250. See generally Rose, *supra* note 249.

251. Ronald H. Coase, *The Problem of Social Cost*, 3 J. L. & ECON. 1, 1–2 (1960).

252. Hardin, *supra* note 249, at 1244.

253. Nowlan, *supra* note 86, at 125–26.

254. *Id.*

255. Kemal Baslar, *THE CONCEPT OF THE COMMON HERITAGE OF MANKIND IN INTERNATIONAL LAW*, 42–45 (1998).

256. See *id.* at 45.

257. Landry, *supra* note 232, at 527–28.

258. See generally Twibell, *supra* note 183.

259. See Baslar, *supra* note 255. See, e.g., Twibell, *supra* note 183; see, e.g., *supra* notes 120, 142.

260. See, e.g., Hardin, *supra* note 249, at 1244.

261. *Id.* (illustrating the tragedy of the commons concept).

problem of space debris reveals an externality of outer space use, namely pollution.²⁶² The space debris pollution problem is compounded by two phenomena: (1) the “Kessler effect,” where once “debris reaches a sufficient density, collisions between objects will create more debris particles, which will undergo still more collisions, until the process becomes self-sustaining”; and (2) the effect of human-generated space junk on the composition of the Van Allen radiation belts.²⁶³ Missions to retrieve old satellites, debris from collisions, and to “pick up after our launches” that result in rocket fragments involve significant costs.²⁶⁴ Additionally, the debris from anti-satellite testing, such as China’s 2007 test, persists in Earth’s orbit and can damage the space technology of others in the shared space.²⁶⁵

Related to whether space property could be considered “commons” property is the scholarly discussion regarding whether the Outer Space Treaty or general principles of international law truly render outer space “the common heritage of mankind.”²⁶⁶ The common heritage of mankind doctrine asserts that “property not yet appropriated by nations belongs to the whole of humanity, who should thus always share in the benefits of those properties.”²⁶⁷ The central tenets of the common heritage of mankind doctrine are:

- (1) the areas designated as common heritage shall not be appropriated;
- (2) the use of the areas and their resources which fall under the common heritage regime will be governed and managed by an international authority;
- (3) there will be active and equitable sharing of benefits derived from the exploitation of the common heritage area and its resources;
- (4) the peaceful use of areas and resources concerned;
- and (5) the protection and preservation of given resources for the benefit and interest of mankind.²⁶⁸

The common heritage of mankind doctrine has been proposed and applied with varying results in the context of Antarctica, the high-seas and deep-seabed, outer space, and the Moon.²⁶⁹ First proposed by Maltese representative Arvid Pardo at the Law of the Sea Convention, the common heritage of mankind doctrine was initially rejected by both the Soviet and American camps.²⁷⁰ Capitalism naturally

262. See Coase, *supra* note 251. For an overview of the problems and law, and lack thereof, regarding space debris, see Irene Atney-Yuridin, *Space Debris Legal Research Guide*, 3 PACE Y. B. INT’L L. 167, 167–68 (1991).

263. Glenn Harlan Reynolds, *International Space Law: Into the Twenty-First Century*, 25 VAND. J. TRANSNAT’L L. 225, 227 (1992).

264. Michael Listner, *Legal Issues Surrounding Space Debris Remediation*, THE SPACE REVIEW (Aug. 6, 2012), <http://www.thespacereview.com/article/2130/1>; Reynolds, *supra* note 263, at 277.

265. See David, *supra* note 49.

266. See generally Harminderpal Singh Rana, *The “Common Heritage of Mankind” & the Final Frontier: A Reevaluation of Values Constituting the International Legal Regime for Outer Space Activities*, 26 RUTGERS L. J. 225 (1994).

267. *Id.* at 228–29.

268. BASLAR, *supra* note 255, at xx–xxi.

269. See generally Rana, *supra* note 266, at 239–50 (analyzing the common heritage of mankind inception and application in the Law of the Sea Convention, Outer Space Treaty, Moon Treaty, and Antarctica).

270. Baslar, *supra* note 255, at 32–33.

ran counter to the idea of non-appropriation because it offended *laissez-faire* economic market conceptions.²⁷¹ In turn, socialists declared that “obtaining profit without working for it is against socialism. It is just like an absentee-landlord theory.”²⁷² Although the United States eventually signed the Law of the Sea Treaty of 1956, the Senate has still not ratified the Treaty, largely because this principle limits the rights of American companies on the high seas.²⁷³ Furthermore, the rejection of the Moon Treaty of 1982 by a majority of the international community, including all spacefaring nations, is viewed as a rejection of the application of the common heritage of mankind doctrine to space property rights.²⁷⁴ However, in new perspectives, such as in the context of environmental and resource management efforts, the common heritage of mankind is frequently regarded as a general principle of international law.²⁷⁵

China openly recognized outer space as the common heritage of mankind in its 2011 report to the United Nations Committee on the Peaceful Uses of Outer Space, stating that “China has always maintained that outer space is the *common heritage of humankind*, has supported activities for the peaceful uses of outer space and has continued to contribute to human space endeavor by engaging in active exploration and use of outer space.”²⁷⁶ In the 2010 United States Space Policy, President Obama recognized the freedom of space, stating that

[t]he United States, therefore, calls on all nations to work together to adopt approaches for responsible activity in space to preserve this right for the benefit of future generations.

From the outset of humanity’s ascent into space, *this Nation declared its commitment to enhance the welfare of humankind by cooperating with others to maintain the freedom of space.*

The United States hereby renews its pledge of cooperation in the belief that with strengthened international collaboration and reinvigorated U.S. leadership, all nations and peoples—spacefaring and space-benefiting—will find their horizons broadened, their knowledge enhanced, and their lives greatly improved.²⁷⁷

Viewed together, the United States Space Policy and China’s declarations in the United Nations report establish that, at a minimum, both nations affirm the

271. *Id.* at 33–34.

272. *Id.* at 32.

273. *See, e.g.,* Kristina Wong & Sean Langdell, *DeMint: Law of the Sea Treaty Now Dead*, WASHINGTON TIMES (July 16, 2012), <http://www.washingtontimes.com/news/2012/jul/16/demint-says-law-sea-treaty-now-dead/?page=all>.

274. Baca, *supra* note 14, at 1068–69.

275. *See, e.g.,* Rana, *supra* note 266, at 228–29.

276. Peaceful Uses of Outer Space, *supra* note 45 (emphasis added).

277. U.S. SPACE POLICY, *supra* note 60, at 1–2 (emphasis added).

Outer Space Treaty's principles, including the national non-appropriation rule.²⁷⁸ This makes the theorized and proposed unilateral conferment of private property rights to provide incentives and consistent property rights for private enterprise unlikely, even if ideologically or economically desirable.²⁷⁹

C. The Public Trust Doctrine

Rooted in Roman law, the public trust doctrine, whereby a state actor holds and manages property in trust for the benefit of the public, is now regularly applied through common law and statutory regulations around the world.²⁸⁰ The origins of the public trust doctrine are found in the Justinian Institute's declaration that the air, running water, and the seas (and seashores) were common to mankind, and as such, are resources to be protected by the sovereign.²⁸¹ Virgiliu Pop, a Romanian Space Agency researcher, postulates that the Outer Space Treaty essentially creates a public trust in the agreement by stating: "for the benefit of and in the interest of all countries" in Article I.²⁸² The missing piece of the puzzle, he claims, is the undesignated trustee(s).²⁸³ The sovereign or state is traditionally the trustee in a public trust.²⁸⁴

In a public trust holding property ownership rights, the bundle of property rights²⁸⁵ is thus divided between the trustee (the State) and the beneficiaries (the Public).²⁸⁶

There are two co-existing interests to trust lands: the *jus publicum* which is the public's right to use and enjoy trust lands; and the *jus privatum* which is the private property rights that may exist in the use and possession of trust lands. The State may convey the *jus privatum* to private owners, but this private interest is subservient to the *jus publicum*, which is the State's inalienable interest that it continues to hold in the trust land or water.²⁸⁷

The ownership of the property thus remains with the trustee; but, the rights to exclude, use, and enjoy could be allocated to a group, an individual, or an entity.²⁸⁸

278. See generally Peaceful Uses of Outer Space, *supra* note 45.

279. See generally *supra* notes 45, 60.

280. Paul M. Bray, LLC, *Public Trust Doctrine (PTD)*, BRAYPAPERS, BrayPapers.com/PTD.html (last visited Mar. 15, 2013).

281. *Id.*

282. VIRGILIU POP, WHO OWNS THE MOON? EXTRATERRESTRIAL ASPECTS OF LAND AND MINERAL RESOURCES OWNERSHIP 89 (2008).

283. *Id.*

284. Bray, *supra* note 280.

285. See Gilson, *supra* note 15, at 1373.

286. Bray, *supra* note 280.

287. *Id.*

288. See *id.* See generally Lee Anne Fennell, *Adjusting Alienability*, 122 HARV. L. REV. 1403, 1404 (2009) (calling for attention and creativity to the importance of designing "inalienability" rights in resource management).

The United Nations created a Trusteeship Council in the hopes of applying the common heritage of mankind doctrine, but its operations centered on work with post-war decolonization territories and were suspended in 1994.²⁸⁹ In its inception, it was conceived that the Trusteeship Council would operate as the “trustee of the common heritage of humankind to ensure the necessary coordinated approach to this concern” and manage the *jus privatum* rights of common heritage properties.²⁹⁰ The board of trustees consisted of: China, France, Russia, the United Kingdom and the United States—the five permanent members of the Security Council.²⁹¹ Proposals to utilize the Trusteeship Council to address management of “global commons” have made little progress.²⁹² One contributing factor to the ineffectiveness of the Trusteeship Council may be that the political differences between Security Council members often leads to a stalemate in decision-making.²⁹³

Despite the dissolution of the Trusteeship Council, there are utilitarian reasons why the formation of a trust for outer space resources would minimize economic detriments to all nation-states and optimize economic benefits of outer space development for all, particularly for spacefaring pioneer nations.²⁹⁴ The common heritage of mankind and public trust doctrine’s proposals and applications have been met with resistance due to the tension between the “haves” and the “have-nots,” or the developed and developing nations.²⁹⁵ However, the successful application of public trusts to environmental resource management could be changing perspectives on the utility of the doctrine.²⁹⁶ Where there are common preservation and conservation goals for a given resource, the public trust is more likely to succeed as the means for managing the benefits and responsibilities relative to the resource.²⁹⁷

Two successful applications of the public trust principles that could influence the management of outer space resources are the International Telecommunications Union (ITU) and the United States Bureau of Land Management (BLM).²⁹⁸ The ITU issues licenses for orbital allocations of satellites and the use of radio frequencies.²⁹⁹ By necessity, the nation-states of the world have peaceably participated in the licensing regime.³⁰⁰ A true tragedy of the commons would result if our telecommunications channel appropriations were chaotic, and, if entities

289. POP, *supra* note 282, at 93.

290. *Id.*

291. *Trusteeship Council*, UNITED NATIONS, <http://www.un.org/en/mainbodies/trusteeship/> (last visited Mar. 15, 2013).

292. *See supra* note 289 and accompanying text.

293. Babbac Sabahi, *The ICJ’s Authority to Invalidate the Security Council’s Decisions Under Chapter VII: Legal Romanticism or the Rule of Law?*, 17 N.Y. INT’L L. REV. 1, 6, n.23 (2004).

294. *See* Nowlan, *supra* note 86, at 2–3.

295. *Id.* at 103.

296. Steven C. Forrest, *Creating New Opportunities for Ecosystem Restoration on Public Lands: An Analysis of the Potential for Bureau of Land Management Lands*, 23 PUB. LAND & RESOURCES L. REV. 21, 73 (2002).

297. *See generally id.*

298. *Id.*; *see infra* notes 303, 305. *See generally* Baca, *supra* note 14.

299. *See* Baca, *supra* note 14, at 1075–77.

300. *See generally* Baca, *supra* note 14, at 1076–80.

placed satellites into orbit unilaterally with no precautionary coordination.³⁰¹ Without coordination and commitment to the rules, the overlapping noises would prevent people from hearing each other on the radio, and millions of dollars of satellite equipment, as well as our communication systems, would be at risk.³⁰²

The BLM raises an incredible amount of revenue for the government by selling leases of publicly managed lands for oil and natural gas exploration and exploitation to the United States.³⁰³ The BLM raised \$233 million through leases of public lands in 2012 alone.³⁰⁴ Methods the BLM employs that could be adopted for use with outer space leaseholds are: (1) the auctioning of leases; (2) relative pricing per acre of lease payments depending on whether or not the land is producing; (3) imposing environmental resource management limits on resource exploitation, and (4) issuing fixed term leases with conditions for renewal.³⁰⁵ Some space law academics have noted that United Nations' treaties and other space law accords will need to distinguish surface property rights on celestial bodies and extraction rights.³⁰⁶ Some even argue that asteroids should be treated as chattel and not land.³⁰⁷ The BLM legal property rights management is an excellent model to look to for establishing the legal property rights that will be needed in outer space for mining minerals, extracting water, and harvesting Helium-3.

If leasehold estates held in trust were conferred in outer space, then measures could be taken to ensure optimal and equitable allocation of outer space leaseholds, and rules could be imposed to manage the *sustainable* exploitation of space resources.³⁰⁸ Problems such as space debris pollution could be avoided by reviewing development plans to ensure measures to prevent pollution, exit strategies of endeavors, or plans of relative permanence are in place before the projects take-off.³⁰⁹ Controversies regarding planned celestial land use and

301. See Baca, *supra* note 14, at 1072–75 (stating the geostationary orbit is a “limited natural resource,” and indicating that optimizing the allocations of orbital slots is important for reducing radio interference).

302. See Baca, *supra* note 14, at 1073.

303. News Release, *Salazar Announces BLM Onshore Oil & Gas Lease Sales Garnered \$233 Million for Taxpayers in 2012*, DOI.GOV, http://www.blm.gov/wo/st/en/info/newsroom/2012/december/nr_12_17_2012.html (last updated Dec. 17, 2012).

304. *Id.*

305. See *id.* See also PRESALE: PLANNING AND ENVIRONMENTAL ASSESSMENT, U.S. DEP'T OF THE INTERIOR, BUREAU OF LAND MANAGEMENT, *available at* http://www.blm.gov/co/st/en/BLM_Programs/oilandgas/Frequently_Asked_Questions_Leasing.html (last visited Mar. 9, 2014).

306. See David Johnson, *Limits on the Giant Leap for Mankind: Legal Ambiguities of Extraterrestrial Resource Extraction*, 26 AM. U. INT'L L. REV. 1477, 1515 (2011) (distinguishing outer space “vacuum” rights from rights regarding celestial bodies).

307. “[A]n evolution in *corpus juris spatialis* that recognizes the unique physical form of asteroids, and designates asteroids as chattels, would simplify outer space property law and help spur the development of asteroid use and exploitation.” Andrew Tingkang, *These Aren't the Asteroids You Are Looking for: Classifying Asteroids in Space as Chattels, Not Land*, 35 SEATTLE U. L. REV. 559, 563 (2012) (“Chattels are personal property, characterized as moveable objects, and are accordingly free of many of the idiosyncrasies of real property.”).

308. See discussion above on the BLM model of conferring leases with regulatory conditions. See *Salazar Announces BLM Onshore Oil & Gas Lease Sales Garnered \$233 Million for Taxpayers in 2012*, *supra* note 303.

309. James Finch, *Sustainability and the National Security Space Strategy: An Approval to the Congested Environment*, DEP'T OF DEF. (Mar. 1, 2012), *available at* http://www.defense.gov/home/features/2011/0111_nsss/docs/International%20Symposium%20on%20Sustainable%20Space%20Development%20and%20Utilization%20for%20Humankind.pdf.

competing claims to more lucrative territories could be arbitrated and resolved on Earth. From an economic perspective, even though the possibility of “free” appropriation of outer space resources might encourage more space exploration initiatives, development with consistent and reliable rules would provide the stronger incentive of protecting the commercial investments in space exploration.³¹⁰

An outer space public trust can also be more economically beneficial for nation-states and the people within them. Lease payments for outer space exploration, exploitation, and building rights could be very lucrative for spacefaring nation-states.³¹¹ A different form of income from the global space industry may help re-capture lost economic benefits of space program investments that may occur because of the transferability of financial benefits within the globalized economy.³¹² Beneficiaries do not have to benefit equally in a trust; in fact, the principles of the common heritage of mankind doctrine assert that the benefits should be shared “equitably.”³¹³ Distributions could be made equitably by establishing *pro rata* criteria for nation-state “shares” in the trust such as space program budget investments, the value of nationally incorporated space technology firms, and a nation-state’s stake in a given venture. Non-spacefaring nations could have nominal shares in the trust with the option of increasing their number of shares when they invest in the global space industry. Spacefaring nations could economically benefit in proportion to their investments in the global space industry and in particular ventures. In this manner, the benefits of space activities could be commonly shared by nation-states in a more equitable manner while also encouraging investments in infrastructure and funding to benefit the commercial space corporations.

PART IV: SPACE LAW DEVELOPMENT & POLICY CONSIDERATIONS

“The now ubiquitous and interconnected nature of space capabilities and the world’s growing dependence on them mean that irresponsible acts in space can have damaging consequences for all of us.”³¹⁴

A. Security of Humanity

Innovations in space technology³¹⁵ make it increasingly possible for any private or nation-state venture to gain access to outer space,³¹⁶ which presents

310. See, e.g., Twibell, *supra* note 183.

311. See the discussion above on the analogous profitability of the BLM model. See Salazar *Announces BLM Onshore Oil & Gas Lease Sales Garnered \$233 Million for Taxpayers in 2012*, *supra* note 303.

312. See the discussion above regarding how the investments of the United States government in commercial space technology development later results in internationally marketable products. See Clark, *supra* note 114.

313. Baslar, *supra* note 255, at xx–xxi.

314. U.S. SPACE POLICY, *supra* note 60, at 1.

315. See generally discussion Part II.

316. See, e.g., *Government of Dubai*, *supra* note 83.

grave security risks for mankind.³¹⁷ Different nation-states have varying systems of governance, ideals and goals, financial resources, judicial authority, and military capacity to contribute to the full exercise of jurisdiction over a commercial space enterprise.³¹⁸ Safety concerns arise in both the context of ensuring the safety of commercial space flight passengers and preventing the militant and violent use of outer space development.³¹⁹ The development of an outer space insurance industry will require proven safety standards for commercial outer space travel, reliable international regulations regarding liability, and the mitigation of concerns regarding the militant or violent use of outer space.³²⁰

Both the Outer Space Treaty and the Convention on Liability impose state obligations for jurisdiction through “launching state” status as espoused in Articles VI–VIII.³²¹ Commercial space ventures, however, could be based out of virtually any nation-state.³²² In fact, there is a super-plane in development that would allow space vehicles to launch and ascend into outer space from 30,000 feet above ground.³²³ In addition to raising jurisdictional issues for want of a “launching state,” such ventures create real risks of security breaches and inadequate safety regulation enforcement.³²⁴ Without a global regulatory framework, private space ventures may proceed with limited oversight and accountability for their space activities within individual nation-states.³²⁵ Space ventures deployed by newer nation-state government programs or private space ventures based out of nation-states without space programs pose particular risks because the governments may

317. See, e.g., *North Korea Threatens Nuclear Strike, U.N. Expands Sanctions*, Kim, *infra* note 346; see also, e.g., Krishnan, *China to Develop Space Military Capabilities*, *supra* note 219 (discussing information on the military applications of China’s outer space development program).

318. See generally White Jr., *Implications of a Proposal for Real Property Rights in Outer Space*, *supra* note 18.

319. Dr. Zhao Yun, *A Legal Regime for Space Tourism: Creating Legal Certainty in Outer Space*, 74 J. AIR L. & COM. 959, 972–73 (2009).

320. See generally *id.* at 964–82 (discussing the needs of the commercial space industry, including space insurance, commercial liability, and space law criminal jurisdiction).

321. See Gilson, *supra* note 15, at 1378–79. For a more detailed account of the liability provisions in the international space treaties, jurisdictional rules for space law claims, and actual space law cases in involving satellites that did not reach their orbits; see Joel Stroud, *Space Law Provides Insights on How the Existing Liability Framework Responds to Damages Caused by Artificial Outer Space Objects*, 37 REAL PROP. PROB. & TR. J. 363, 371–72, 381 (2002); see also Julie C. Easter, *Spring Break 2023 - Sea of Tranquility: The Effect of Space Tourism on Outer Space Law and World Policy in the New Millennium*, 26 SUFFOLK TRANSNAT’L L. REV. 349, 377–78 (2003) (discussing space law inadequacy for supporting space tourism, specifically noting that civilians do not qualify as astronauts under the Rescue Agreement, and also noting the Liability Convention applies to nations and not private space participants and investors).

322. For example, consider that spaceport development is occurring in Curacao, the Netherlands, and Abu Dhabi—two currently non-spacefaring nations. *AST International Outreach*, *supra* note 132.

323. Jason Paur, *Microsoft Billionaire Paul Allen Launches New Space Venture*, WIRED (Dec. 13, 2011), <http://www.wired.com/autopia/2011/12/rutan-allen-musk-team-up-for-orbit/>.

324. *Id.* It might be presumed that the nation of incorporation for the super-plane would still assume liability as the “launching state” of the spacecraft that depart from a launch site above any territorial bounds, but technically the launch could happen anywhere above the Earth’s surface, virtually free from regulation.

325. United Nations Convention on the Law of the Sea art. 94, Dec. 10, 1982, 1833 U.N.T.S. 397 (explaining that Launching state liability is analogous to “Flag State” liability imposed by UNCLOS); see also William Tetley, Q.C., *The Law of the Flag, “Flag Shopping,” and Choice of Law*, 17 TUL. MAR. L. J. 139, 183 (1993) (“Flag shopping”; that is, the use of flags of convenience and double registries under bareboat charters, may have tolled the death knell of the law of the flag as a logical solution to conflicts of law.”).

lack the experience, expertise, resources, technology, or regulatory infrastructure to properly mitigate safety and security risks.³²⁶

In the United States, the Commercial Space Launch Amendments Act of 2004 addressed the security concerns in space technology development stating, “[t]he regulatory standards governing human space flight must evolve as the industry matures so that regulations neither stifle technology development nor expose crew or space flight participants to avoidable risks as the public comes to expect greater safety for crew and space flight participants from the industry.”³²⁷ The United States’ Space Policy principles and directives issued by President Obama in 2010 reaffirm the nation’s commitment to “strengthened international collaboration.”³²⁸ However, the practical guidance documents of the Office of Commercial Space Transportation (FAA-AST) in 2012, affirmed that, “[a]t this time, the U.S. Government does not support creating an international space organization such as for space safety.”³²⁹ What the policy directive effectively declares are the principles and practices the United States will unilaterally adhere to in its space industry development, and it encourages other nations to also adopt those principles.³³⁰

The Federal Aviation Administration currently follows a different policy than other countries on the certification of space flight vehicles.³³¹ The agency recently opposed the European Aviation Safety Agency’s (EASA) proposed certification of space flight vehicles, asserting that the cost is too great at this time and the industry is too new to have established best practices.³³² The United States instead requested that the EASA consider using the “lighter” process of FAA-AST licensing of launches for commercial space flights, without safety certifications of vehicles.³³³ Waiting for “best practices” in the global space industry to emerge through trial and error may be a grave mistake. A precautionary principle should be applied to ensure the safety of space travelers and the security of nation-states and mankind.

326. Cf. Tetley, *supra* note 325, at 172–76 (analogous developments have occurred with flag state jurisdiction in the law of the sea).

327. Commercial Space Launch Amendments Act of 2004, 51 U.S.C.S. § 50901(a)(15) (West 2010) [hereinafter CSLA]; see also Joanne Irene Gabrynowicz, *One Half Century and Counting: The Evolution of U.S. National Space Law and Three Long-Term Emerging Issues*, 4 HARV. L. & POL’Y REV. 405, 418 (2010) (quoting Timothy Robert Hughes & Esta Rosenberg, *Space Travel Law (and Politics): The Evolution of the Commercial Space Launch Amendments Act of 2004*, 31 J. SPACE L. 1, 59 (2005)) (explaining that commercial space flights are associated with increased risk and liability that the CSLA mandates must be disclosed to participants).

Federal regulations written after the passage of the Commercial Space Launch Act Amendments of 2004 require commercial suborbital flight operators to make several written informational disclosures in order to obtain the informed consent of customers, called “space flight participants” (SFPs). “[SFPs] are excluded from indemnification eligibility under the 2004 Space Act and are not entitled to the benefits of liability insurance coverage.”

Id.

328. U.S. SPACE POLICY, *supra* note 60, at 1–3.

329. *AST International Outreach*, *supra* note 132.

330. U.S. SPACE POLICY, *supra* note 60, at 3.

331. *AST International Outreach*, *supra* note 132.

332. *Id.* at 17; but see Gabrynowicz, *supra* note 327.

333. *AST International Outreach*, *supra* note 132, at 17–18.

Commercial space companies have a strong incentive to ensure passenger safety because it is essential to their success and future profitability.³³⁴ The motivation of commercial ventures and the experience and resources of spacefaring nation-states could be combined to most efficiently and effectively increase the stability and safety of commercial spaceflight.³³⁵ The standards and testing requirements the government agencies of spacefaring nation-states have employed to determine the level of risk involved in new spacecraft technology can be adapted to the commercial environment.³³⁶ Developing confidence in the safety of commercial spaceflight and certainty in the regulations will encourage insurance companies to support the outer space industry and aid in its growth.³³⁷

The Outer Space Treaty expressly prohibits states from placing nuclear weapons, or other weapons of mass destruction, into orbit or on other celestial bodies.³³⁸ However, the Outer Space Treaty does not prohibit sending ballistic missiles or other weapons that are not considered weapons of mass destruction into space.³³⁹ When outer space colonies come to exist, security measures in the deployment of materials to outer space will be necessary. Raw materials that can create weapons of mass destruction should be interplanetary contraband; but an authority to ensure contraband does not enter outer space is not yet in place.³⁴⁰ Additionally, there are plans to use nuclear power for spacecraft.³⁴¹ If this is permitted, then an additional layer of security measures would be required to ensure the means of energy production are truly intended to facilitate the peaceful use of nuclear energy and the peaceable uses of outer space.³⁴²

The enforcement measures for preventing the deployment of nuclear weapons into space will vary for each nation-state depending on the availability and allocation of resources to the task.³⁴³ Because private ventures are empowered to choose the nation-state in which to base their commercial space activities, a regulatory “race to the bottom” could ensue for lack of minimum uniform security

334. Catherine E. Parsons, Comment, *Space Tourism: Regulating Passage to the Happiest Place off Earth*, 9 CHAP. L. REV. 493, 521 (2006).

335. See e.g., News Release, *Orbital's Cygnus Spacecraft Selected by NASA to Host Experimental Fire Safety Payload*, ORBITAL (Aug. 8, 2013), <http://www.orbital.com/NewsInfo/release.asp?prid=862>.

336. See *id.*; see also Maxime Faget, *The Spacecraft's Safety System, Source Files on Project Mercury, 1952-1968*, NASA, available at <http://research.archives.gov/description/278168> (last updated May 5, 2013); *Spacecraft Fire Safety*, USRA (Jan. 24, 2011), <http://www.usra.edu/news/features/2011/fire/>.

337. Compare Yun, *supra* note 320 (regarding certainty in the space industry and the need for insurance), with Beck, *infra* note 344 (more regulated spacefaring nations will require liability insurance; however, companies could relocate to the least restrictive legal regimes).

338. Outer Space Treaty, *supra* note 199, at Art. IV (“States Parties to the Treaty undertake not to place in orbit around the Earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner.”).

339. *Id.*

340. See Caselli, *infra* note 341, 656–58.

341. See Leonardo P. Caselli, *Space Demilitarization Treaties in a New Era of Manned Nuclear Spaceflights*, 77 J. AIR L. & COM. 641, 656 (2012).

342. *Id.* Caselli also gives a detailed overview of the Partial Test Ban Treaty and other international disarmament agreements. *Id.* at 645.

343. *Cf.*, *supra* notes 293, 295 (analogous to law of the sea development).

measures.³⁴⁴ If nation-state actors, who have no interest in compliance with the Outer Space Treaty, choose to send weapons of mass destruction into space, the risk is graver still.³⁴⁵ Regime changes and brewing conflicts in the world indicate the possibility of nations or individuals who would choose to engage in warfare³⁴⁶ and could do so from space.³⁴⁷

The security issues in international flights pose similar risks; however, each nation-state is able to regulate its own perceived risks at the points of departure and arrival at its discretion.³⁴⁸ The risks of flights into space involve all of humanity and not solely those considered within the dominion of the point of departure. Therefore, the commercial and nation-state “right” to travel in space should be subjected to international regulatory standards with enforcement measures agreed upon by sovereign nations—in a manner similar to nuclear weapons development treaties and program inspection accommodations.³⁴⁹

Adopting the ambiguous terms in the Outer Space Treaty of 1967 as a compromise between nations in the midst of the Cold War, although legally confusing, served an important political purpose.³⁵⁰ The Outer Space Treaty, among other efforts between nations, helped prevent a nuclear space war.³⁵¹ The tensions between the United States, some western nations, and the Middle Eastern countries have been ongoing for decades.³⁵² The outright threats of “preemptive” missile launches from North Korea are not easily dismissed.³⁵³ Security concerns should thus be a salient feature and driving force towards establishing international

344. See Brian Beck, *The Next, Small, Step for Mankind: Fixing the Inadequacies of the International Space Law Treaty Regime to Accommodate the Modern Space Flight Industry*, 19 ALB. L.J. SCI. & TECH. 1, 32 (2009).

The CSLA imposes many requirements on space launch activities in the United States, including: sufficient liability insurance, any requirement necessary to protect public health and safety, any requirement necessary to protect the safety of crew or space flight participants, and government monitoring of all commercial space launches. United States domestic law allows the Secretary of Transportation to issue a variety of regulations to protect the safety of space tourists and properly regulate the industry. However, without an international regulatory regime, the net effect may end up being that commercial space ventures just move outside of the United States or other nations with strong restrictions.

Id.

345. See generally Outer Space Treaty, *supra* note 199.

346. See, e.g., Jack Kim & Louis Charbonneau, *North Korea Threatens Nuclear Strike, U.N. Expands Sanctions*, REUTERS (Mar. 7, 2013), <http://www.reuters.com/article/2013/03/07/us-korea-north-attack-idUSBRE9260BR20130307>.

347. See, e.g., Krishnan, *supra* note 219.

348. See generally *International Travel*, <http://www.travel.state.gov/travel> (last visited Oct. 20, 2013); see Gabi Logan, *Int'l Flight Rules & Regulations*, USA TODAY, <http://traveltips.usatoday.com/international-flight-rules-regulations-100658.html> (last visited Oct. 20, 2013).

349. See generally Donald K. Anton, *Is the Use of Nuclear Weapons Against the Law?*, 39 ADVOCATE 12 (1996).

350. Twibell, *supra* note 183, at 611–15.

351. *Id.* at 594.

352. National Public Radio, *1098-2004 The Middle East and the West: A Troubled History*, NPR, http://www.npr.org/news/specials/mideast/the_west/ (last visited Oct. 11, 2013) (a six-part series).

353. See, e.g., Kim, *supra* note 346.

agreement on the rules of space development, just as they were a significant aspect of the Outer Space Treaty negotiations.³⁵⁴

The United States does not shy away from the possibility of combative activity in space by manipulating the inverse significance of the term “peaceful purposes” and declaring,

‘peaceful purposes’ allows for space to be used for national and homeland security activities . . . and, consistent with the inherent right of self-defense, [the United States will] deter others from interference and attack, defend our space systems and contribute to the defense of allied space systems, and, if deterrence fails, defeat efforts to attack them.³⁵⁵

The Outer Space Treaty stipulates that nations have the right to “consultation” when concerned about non-peaceable uses of outer space and the right to seek observation of each other’s space activities.³⁵⁶ However, the precedential application of these provisions in a state of conflict is not reassuring, nor is the United Nations presently equipped to proactively handle such controversies between nation-states.³⁵⁷ Spacefaring nations have not yet established an entity to arbitrate and adjudicate disputes regarding the use of outer space.³⁵⁸ Without an international body to regulate the safety of the global space industry’s security measures, diverging perspectives of what constitutes peaceable uses and what constitutes interference could lead to controversy.³⁵⁹ Furthermore, blatant

354. Michel Bourbonniere, *National-Security Law in Outer Space: The Interface of Exploration and Security*, 70 AIR L. & COM. 3, 60–63 (2005).

355. U.S. SPACE POLICY, *supra* note 60, at 3.

356. See Outer Space Treaty, *supra* note 199, at Art. IX; see also Michael Mineiro, *Principles of Peaceful Purposes and the Obligation to Undertake Appropriate International Consultations in Accordance with Article IX of the Outer Space Treaty*, 5th Eilene Galloway Symposium on Critical Issues in Space Law (Dec. 2, 2010), available at <http://www.spacelaw.olemiss.edu/events/pdfs/2010/galloway-mineiro-paper-2010.pdf> (quoting Michael Mineiro, *FY-1C and USA-197 ASAT Intercepts: An Assessment of Legal Obligations under Article 9 of the Outer Space Treaty*, 34 J. SPACE L. 321, 338–39 (2008)).

357. Mineiro, *FY-1C and USA-197 ASAT Intercepts: An Assessment of Legal Obligations under Article 9 of the Outer Space Treaty*, *supra* note 356, at 8. See *AST International Outreach*, *supra* note 132, at 17. But see Gabrynowicz, *supra* note 327.

358. See generally Mineiro, *supra* note 357.

359. For example, see the official international response on the part of the United States to China’s anti-satellite testing activity and other military activity in outer space. Garold Larson, *U.S. Statement on Peaceful Use of Outer Space –Thematic Debate of UNGA First Committee*, GENEVA (Oct. 19, 2009), <http://geneva.usmission.gov/2009/10/19/outerspace/>.

China’s increasing counter-space capabilities—including continued development of direct-ascent anti-satellite (ASAT) interceptors, lasers, high-powered microwaves and particle beam weapons—contrasts sharply with Chinese President Hu’s desire to pursue a path of peaceful development and ‘win-win progress.’ The resumption of high-level military-to-military dialogues between the United States and China is a positive step, but expanding this relationship to include focused discussions on space activities would increase transparency and help clarify China’s intentions, strategy, and doctrine regarding the use of space for military purposes.

Id.

disregard for the principles of peaceable uses,³⁶⁰ and willingness to engage in violent warfare as “preemptive” measures,³⁶¹ could tragically lead to space wars and/or war on Earth conducted from space.

Whether an international consensus could be reached to confer jurisdiction over security issues in space to a multinational body is a matter that can only be resolved by a sincere attempt among nations. The Outer Space Treaty was born in the midst of the Cold War, and perhaps its history reveals that it is better for nations to agree to a baseline of ambiguous principles than to unilaterally choose unfavorable courses of action.³⁶² By choosing a forum to air international space concerns and disputes, nations could, at the least, create an opportunity for transparency and dialogue before action.³⁶³ The global community could ensure the peaceable use of outer space by actually agreeing to global space law and empowering an entity to monitor and regulate outer space flights. To mitigate the safety risks, there should be an effective monitoring, certification, inspection, and licensing framework established through multi-national coordination.³⁶⁴

In the absence of a reliable international agreement, the traditional balance of power theory would advocate an equal distribution of military capacity in outer space.³⁶⁵ If the world were truly a peaceful global community, duplicative efforts in space technology development would not be necessary because the technology would be shared, as advocated in the aspirational aspects of international treaties.³⁶⁶ However, the Earth does not operate on a “brother’s keeper” economy. In the balance of power approach to security, advanced military capabilities can ironically serve to ensure peace.³⁶⁷ The United States has clearly delineated guidelines for what space technology it can share with other nations and what technology should be carefully guarded because of its military applications.³⁶⁸ The commercialization of space technology has the potential to shift outer space military capabilities and the balance of power among nation-states.³⁶⁹ On the upside, the blurring of boundaries of power and the globalization of the economy can create overlapping self-interests that lead to peace, even if for no other reason than self-preservation and the exploitation of the maximum potential of the space industry.³⁷⁰ To this end,

360. *Id.*; see also Wall, *supra* note 48, at 1.

361. See Kim, *supra* note 346.

362. See Twibell, *supra* note 183, at 611–22.

363. See Mineiro, *supra* note 356, at 9–10.

364. *But see AST International Outreach*, *supra* note 132, at 14 (United States does not consider that it is necessary to establish a regulating body at this time.).

365. See VESNA DANILOVIC, WHEN THE STAKES ARE HIGH: DETERRENCE AND CONFLICT AMONG MAJOR POWERS 71 (2002).

366. See, e.g., Ansdell, *supra* note 80, at 29 and accompanying text.

367. See DANILOVIC, *supra* note 365.

368. RISK ASSESSMENT OF UNITED STATES SPACE EXPORT CONTROL POLICY, *supra* note 8, at i.

369. See, e.g., dialogue in the United States’ Statement on the Peaceful Use of Outer Space—Thematic Debate of UNGA First Committee, *supra* note 359.

370. See generally Erik Gartzke & Quan Li, *Globalization and Peace: How Economic Integration Can Reduce the Incidence of International Conflict* (2003), available at http://people.tamu.edu/~quanli/research_papers/glob_chapter.pdf.

continuing to create strategic partnerships and collaboratively developing outer space will lead to more positive outcomes.³⁷¹

B. Global Economic Justice

*“[F]or the benefit and in the interests of all countries.”*³⁷²

The role of the “common heritage of mankind” in the Outer Space Treaty is the subject of scholarly debate,³⁷³ but in reality that “common heritage” is only currently accessible to a handful of nation-state and private actors.³⁷⁴ As space technology development shifts from the public to the private realm, the transferability of technology by private actors between nation-states and corporate entities will pose economic and security risks that can be most efficiently and equitably addressed by a proactive unified front of spacefaring nations now.³⁷⁵

In the history of colonialism, countries with strong, healthy economies invested in exploring and conquering “new” lands.³⁷⁶ The return on investment fueled industrial development for many, yet initiated a global slave trade for others.³⁷⁷ After a period of direct ownership of new states by older ones, emerging post-colonial nation-states face unique structural economic challenges (and dependencies) of varying degrees that affect their ability to sustain populations (even basic human needs—18,000 children starve to death everyday),³⁷⁸ access and control resources, and create industries to compete or participate in the global economy.³⁷⁹ Recognition of this state of affairs resulted in the principle of state sovereignty that is fundamental to the operations of the United Nations.³⁸⁰

Principles of state sovereignty, fairness, and reparations for historical “wrongs” are deeply embedded in the United Nations Convention on the Law of the Sea and the Outer Space Treaty of 1967.³⁸¹ These treaties consider the high seas and outer space as the province of all of humanity, to be appropriated by no sovereign nation at the expense of another.³⁸² Article I of the Outer Space Treaty states, “[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

371. *Id.*

372. Outer Space Treaty, *supra* note 199, at Art. I.

373. *See, e.g.,* Gilson, *supra* note 15, at 1378–79.

374. *See Which Countries Were First to Launch Satellites?*, *supra* note 26. *See generally supra* note 80 and accompanying text.

375. *See, e.g.,* Ansdell, *supra* note 80, at 35.

376. Thomas W. Donovan, *Jurisdictional Relationships between Nations and Their Former Colonies*, 6 GONZ. J. INT’L L. 1, 3 (2003) (Donovan explains the relationship between early colonialism’s prosperity and conquistadorial activity).

377. *Id.*

378. United Nations AP, *18,000 Children Die Every Day of Hunger*, U.N. Says, USA TODAY (Feb. 17, 2007), http://usatoday30.usatoday.com/news/world/2007-02-17-un-hunger_x.htm.

379. Donovan, *supra* note 376, at 1.

380. Rana, *supra* note 266.

381. *Id.*

382. *Id.*

of their degree of economic or scientific development, and shall be the province of all mankind.”³⁸³

The economic impact of commercial space development on nation-state units and humanity as a whole can be optimized, and unintended consequences can be avoided, by ensuring humanity learns from history and considers more sustainable models of development.³⁸⁴ Many groups advocate that successful missions of humans into space can fill humanity with hope and change the world for the better as the true potential of humankind emerges.³⁸⁵ Without directly correlated social and/or economic benefits, however, it is hard to see how the activities of humans in space could result in the pacification of political unrest, religious wars, the dangers of the illegal drug trade, and violence in the streets.

The economic benefits of the emerging commercial space industry include job creation and taxation income to a corporation’s country of origin (depending on the nation-state’s corporate income tax laws).³⁸⁶ Economic benefits of mining asteroids will also include job creation and taxation benefits, and *if* captured asteroids are brought to Earth, there will also be the potential of job creation in new industrial applications involving the processing, extraction, and production of new products from the resources.³⁸⁷ The creation of space colonies, on the other hand, will actually create new economies.³⁸⁸

383. Outer Space Treaty, *supra* note 199, at Art. I. The concern for respecting the “rights” of sovereign states is clearly pronounced with principles of nondiscrimination, equality, and cooperation adopted in the first article:

Outer space, including the Moon and other celestial bodies, shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law, and there shall be free access to all areas of celestial bodies. There shall be freedom of scientific investigation in outer space, including the Moon and other celestial bodies, and States shall facilitate and encourage international cooperation in such investigation.

Id.

384. For a critical examination of what “sustainable development” means, *see generally* MICHAEL REDCLIFT, SUSTAINABLE DEVELOPMENT: EXPLORING THE CONTRADICTIONS 4 (2002) (looking at the inherent contradiction between sustainability and the Western conception of what development entails). “Sustainable development, if it is to be different than unsustainable development, should imply a break with the linear model of growth and accumulation that ultimately serves to undermine the planet’s life support systems.” *Id.* These ideas can be analogously applied to outer space development where its resources are limited (like in the geostationary orbit) and the use and enjoyment of it (even from afar) can become limited by development. *See* Baca, *supra* note 14, at 1072–75. *See generally* Balsamello, *supra* note 118 (on advertising restrictions in outer space one example of a limit on common enjoyment).

385. MARS ONE, *supra* note 172.

386. One economic forecast anticipates a time where taxpayer investments in the commercial space industry could return to taxpayers with \$25 billion in tax revenue. Patrick Collins, *The Space Tourism Industry in 2030*, ASCE (Mar. 13, 2013), *available at* http://www.spacefuture.com/archive/the_space_tourism_industry_in_2030.shtml. *See generally* Globe Newswire, Photo/News Release, Photo Release—Commercial Space Industry Works With NASA and Creates Tech Jobs in Silicon Valley, NASDAQ OMX, GLOBE NEWS WIRE (Aug. 1 2011), *available at* <http://globenewswire.com/news-release/2011/08/01/452677/228079/en/Photo-Release-Commercial-Space-Industry-Works-With-NASA-and-Creates-Tech-Jobs-in-Silicon-Valley.html>.

387. *See* Leonard David, *Is Asteroid Mining Possible? Study Says Yes, for \$2.6 Billion*, SPACE.COM (Apr. 24, 2012), <http://www.space.com/15405-asteroid-mining-feasibility-study.html>. On the other hand, Planetary Resources on Earth may extract and utilize the fruits of asteroid mining in outer space with the help of robots.

Granting space property rights must be a process infused with fairness to the innovative and financial investments of entrepreneurs, the sponsoring nation-states, and humanity.³⁸⁹ The momentum in the development of private, commercial space industry is encouraging for the economic forecasts of the invested nation-states.³⁹⁰ However, there is also the risk of “economic blackmail”³⁹¹ by corporations offering their economic benefits to competing nation-state governments, which could decrease the potential revenue of nation-states.³⁹²

As discussed above, the building of spaceports in Curacao, Abu Dhabi, and in other nations could take on the difficult fate of sports stadium competition between states within the United States.³⁹³ Economic analysis of these huge expenditures by states indicates that the investments do not result in the degree of anticipated economic benefits of additional jobs and tourism in the local economies.³⁹⁴ However, investing in the sports industry and commercial space industry are not entirely analogous ventures. In 2013, Florida, Georgia, and Texas are understandably competing for the favor of developing SpaceX’s commercial launch site.³⁹⁵ Florida of course, has the unique advantages of the Kennedy Space Center’s infrastructure, history, an experienced space industry workforce, and industry support through the Space Florida agency and other initiatives.³⁹⁶ However, there are other incentives that can persuade commercial space companies to locate elsewhere, as evidenced by New Mexico’s spaceport venture.³⁹⁷ The benefits to each state or nation-state will vary according to the specific

Jeremy Hsu, *Robots Will Swing a Pickax For Asteroid Mining Venture* (Apr. 24, 2012), <http://www.mnn.com/earth-matters/space/stories/robots-will-swing-a-pickax-for-asteroid-mining-venture>.

388. For the idea that we must plan for space colonies, that will inevitably become independent from Earth, see Brennan, *supra* note 24, at 42. Furthermore, examine the emigration plans of Mars One, *Is This Really Possible?* *infra* note 418.

389. Compare Wasser, *supra* note 14, with Rana, *supra* note 226, and Nowlan, *supra* note 86.

390. See *About the Foundation*, *supra* note 163.

391. *A Charter for Scientific and Technical Co-Operation and Technology Transfer*, WORLD FEDERATION OF SCIENTIFIC WORKERS (Dec. 11, 2006) [hereinafter *A Charter For Scientific And Technical Co-Operation*], http://www.fmts-wfsw.org/article.php3?id_article=56.

The international exchange of scientific and technological findings appears hindered by the neocolonial dependence of developing countries: this dependence is used both by governments and by transnational corporations to exercise economic blackmail and political discrimination. Science and technology are an important aspect of the problem of restructuring international economic relations on a basis of equality and mutual benefit.

Id.

392. See generally Joel Slawotsky, *The Global Corporation as International Law Actor*, 52 VA. J. INT’L L. DIG. 79, 83 (2012) (“[T]he largest transnational corporations headquartered in the United States, Europe, and Japan, a single multinational firm today can wield as much economic power and influence as an entire nation.”).

393. See generally Marc Edelman, *Sports and the City: How to Curb Professional Sports Teams’ Demands for Free Public Stadiums*, 6 RUTGERS J.L. & URB. POL’Y 35, 38 (2008), available at <http://ssrn.com/abstract=1308254>.

394. *Id.*

395. James Dean, *3 States Vie For SpaceX’s Commercial Rocket Launches*, USA TODAY (May 7, 2013), <http://www.usatoday.com/story/tech/2013/05/07/commercial-cape-canaveral/2141499/>.

396. See Ravich, *supra* note 20, at 24–32 (providing an overview of Florida’s space industry and its potential, also comparing the development of the aviation industry to the emerging space industry, which also “took off” in Florida).

397. See Malas, *supra* note 133.

circumstances and agreements with commercial developers. The space technology field certainly has valuable job opportunities and associated work for support industries.³⁹⁸ Additionally, commercial space corporations are able to lower their costs and raise their profits by obtaining government incentives, subsidies, and grants.³⁹⁹ The development of the global space industry requires vision and collaboration among private and public actors, but both sides should be cautious in negotiating and fully understanding the benefits and risks of their agreements.

Increasing competition between states for government funding is one aspect of how an untempered space industry market could be detrimental for nation-states.⁴⁰⁰ The commercial space industry could also present the same taxation difficulties to nation-states that multinational corporations do in general.⁴⁰¹ Mitigating tax avoidance by multinational corporations on Earth is a present economic challenge for nation-states.⁴⁰² In general,

[t]ax avoidance is a global problem. It involves the abusive exploitation of gaps and loopholes in domestic and international tax law that allows multinational companies (MNCs) to shift profits from country to country, often to or via tax havens, with the intention of reducing the tax they pay on some or all of their profits. Tax avoidance on such a large scale is facilitated by a lack of transparency in the way MNCs report and publish their accounts. Making MNC accounts more transparent would help tackle tax avoidance at very low cost.⁴⁰³

The general problem could be avoided in the commercial space industry if, in addition to collecting payments for leasehold estates in space, the trustee nations also established a space industry income tax to be distributed in a *pro rata* manner.⁴⁰⁴ A uniform tax rate independent of location could help reduce the “forum shopping” of commercial space businesses allowing commercial space businesses to focus on more beneficial factors such as launch site suitability, existing market size, regional composition, infrastructure, and cultural benefits.⁴⁰⁵

Ultimately, the commercial space industry is taking on high-risk-investments that deserve government support on an international level because of the potential

398. See *supra* notes 330, 331, and accompanying text.

399. For example, see the incentives involved in the New Mexico spaceport, Texan relocation of XCOR, the bids for SpaceX operations, etc. See, e.g., Malas, *supra* note 133; see also Elkind, *supra* note 127; Dean, *supra* note 395.

400. Compare *id.*; with David, *supra* note 388; and Brennan, *supra* note 21 and accompanying text.

401. See Slawosky, *supra* note 392; see also *Issues: Country by Country Reporting*, *infra* note 403.

402. See Slawosky, *supra* note 392.

403. Task Force on Financial Integrity and Economic Development, *Issues: Country by Country Reporting*, FINANCIAL TRANSPARENCY CORP., <http://www.financialtaskforce.org/issues/country-by-country-reporting/> (last visited Mar. 10, 2013).

404. About the potential of the commercial space industry and taxation revenue see Collins, *supra* note 386.

405. About some location incentives, see *supra* note 399 and accompanying text. Regarding how regulations may affect how commercial space companies choose their locations, see Beck, *supra* note 344.

economic and other development benefits to humanity.⁴⁰⁶ Communication and coordination regarding the costs and benefits of the industry's expansion will increase the efficiency and transparency of its development.⁴⁰⁷ In a public trust model of managing the commercial space industry, nation-states would still have the incentive of investing in space programs and infrastructure because it would increase their *pro rata* trust shares and distributions from taxes and leasehold payments.⁴⁰⁸ The cost of uniform taxes and lease payments to commercial space corporations could be easily recovered through the benefits of enforceable legal rights for the return on their investments and greater government investments in outer space development.⁴⁰⁹

C. Interplanetary Rights Planning

Planning for interplanetary space property rights during the emergence of the global space industry is important because, at this point, it can reasonably be anticipated that government and private space colonization efforts may succeed in becoming sustainable and independent from Earth.⁴¹⁰ Justice Brennan envisioned such a possibility when he assisted in drafting the principles to guide new space colony development towards sovereign rights.⁴¹¹

A Declaration of First Principles for the Governance of Outer Space Societies

Bearing witness to the exploration and inevitable settlement of outer space; Recognizing the universal longing for life, liberty, equality, peace and security; Expressing our unshakable belief in the dignity of the individual; Placing our trust in societies that guarantee their members full protection of law, due process and equal protection under the law; Reaffirming our faith in fundamental freedoms;

Mindful, as were our nation's founders, of the self-evident truth that we are endowed by our Creator with certain inalienable rights; Recognizing the responsibility of a government to protect the rights of the governed to exist and to evolve; Do assert and declare in this petition the intrinsic value of a set of First Principles for the Governance of Outer Space Societies and, at the beginning of this third century of nationhood under our Constitution, resolutely urge

406. See, e.g., Twibell, *supra* note 183.

407. See, e.g., Mineiro, *FY-1C and USA-197 ASAT Intercepts: An Assessment of Legal Obligations under Article 9 of the Outer Space Treaty*, *supra* note 357, at 7–10.

408. POP, *supra* note 313.

409. See, e.g., Twibell, *supra* note 183 (on the importance of consistent legal rules for development). See, e.g., Collins, *supra* note 386 (on the potential of the commercial space industry and its taxation).

410. See generally Brennan, *supra* note 24.

411. *Id.* at 42–43.

all people of the United States of America to acknowledge, accept and apply such First Principles as hereinafter set forth.⁴¹²

Justice Brennan essentially advocates that America extend to space colonies the freedom it seized for itself in the Declaration of Independence and Revolutionary War.⁴¹³ He proposes that the United States should adopt the following commitment for the future of space colonies: “The United States shall provide for an orderly and peaceful transition to self-governance by outer space societies under its jurisdiction at such times as their inhabitants shall manifest clearly a belief that such a transition is both necessary and appropriate.”⁴¹⁴

The Mars One colonization non-profit project⁴¹⁵ has independence in mind as it makes “emigration” plans. Whether a property rights regime for space is established when the realization of the colony occurs—realistically, once a part of space has been developed—it will be owned.⁴¹⁶ Ejectment or any type of “taking” would be a difficult prospect in the initial stages of space colonization.⁴¹⁷ The colonization plans of Mars One involve sending an initial group of emigrants to create a colony, with more people and supplies arriving every two years, until a sustainable colony is thriving.⁴¹⁸ The space colony will grow in size with each arrival of settlers. Mars One anticipates that as the colony grows, they will eventually grow a forest of trees on Mars.⁴¹⁹ While the technology, transport, and timeline are well established in the non-profit venture—the decision-making process, resource distribution system, and division of labor have not been outlined or published.⁴²⁰

There are at least four other organizations planning to colonize Mars; one aims to do so within ten years.⁴²¹ While the initial Mars Drive colonization attempt is planned as a non-profit venture, the organization anticipates effectively developing real estate and free market enterprise on Mars.⁴²² There are several questions to consider as the organizations make their Mars colonization plans. First, how is site

412. *Id.* at 44.

413. *See generally id.*

414. *Id.*

415. *About Mars One*, MARS ONE, <http://mars-one.com/en/> (last visited Feb. 19, 2013).

The Mars One foundation will own the Mars settlement, the simulation outposts on Earth, and will be employer of the project management team of the mission, and the Mars astronauts. The Mars One foundation owns a majority share in the Interplanetary Media Group (IMG)—the company that manages the media associated with the human mission to Mars.

Id.

416. *See* the importance of “first in time” possession emphasized in Landry, *supra* note 232.

417. *See id.*

418. The Mars One astronauts will depart Earth with the assumption they will never return. Mars becomes their new home, where they will live and work for what will likely be the remainder of their lives. Mars One, *Is this really possible?*, MARS ONE, <http://mars-one.com/en/mission/is-this-really-possible> (last visited Feb. 19, 2013).

419. *Id.*

420. *Id.*

421. *About Us*, MARS DRIVE, <http://www.marsdrive.com/About.aspx> (last visited Feb. 19, 2013).

422. *Id.*

selection approved and by whom?⁴²³ Second, how would non-profit colonies, free enterprise colonies, and government based space colonies interact with one another?⁴²⁴ Finally, how will these colonies interact with Earth nation-states?⁴²⁵ These are open questions. While it might seem we have all the time in the world, the rules of development and governance on Mars should be planned before the time comes to pass.⁴²⁶ Addressing these possibilities, Justice Brennan said,

I refer to space law. I confidently predict that we'll soon have to grapple with the question: what law should govern, not only the relationship between earth (particularly the United States) and space societies, but perhaps more importantly, what law should govern within space societies themselves and among space inhabitants who will people space communities.⁴²⁷

PART V: THE COMMERCIAL SPACE INDUSTRY'S DEVELOPMENT IS A GLOBAL ENDEAVOR

Regulation of space activity stemming exclusively from national jurisdictions has inherent risks and benefits. Maintaining respect for the principle and reality of national sovereignty is important considering the great historical, cultural, and economic achievements of each nation-state.⁴²⁸ Establishing exclusivity in the economic benefits of commercial space enterprise may be an appealing proposition for nation-states because they strive to increase the prominence of their country and the prosperity of its citizens.⁴²⁹ Some even advocate that the creation of property rights in space and the jurisdiction and control over commercial enterprises should be the sole responsibility of the nation-state of origin for each venture.⁴³⁰ Space development based on national sovereignty, however, has many limitations.⁴³¹

423. See David Collins, *Efficient Allocation of Real Property Rights on the Planet Mars*, 14 B.U. J. SCI. & TECH. L. 201, 218 (2008) (advocating the allocation of Martian property rights by a "bounded," limited first in time regulation).

424. See, e.g., *About IAF*, *supra* note 154; *About the Foundation*, *supra* note 163; see *supra* notes 97–104 and accompanying text.

425. See, e.g., *Communicating in Space*, NASA (Aug. 26, 2010), <http://www.nasa.gov/topics/moonmans/features/hatsman-prt.htm>.

426. Brennan, *supra* note 24, at 42.

427. *Id.*

428. See *supra* discussion in Part II, Section A.

429. For example, consider the proposal for a national park on the moon, and the goal of developing a "U.S. commercial space industry." Apollo Lunar Landing Legacy Act, *supra* note 66; Pappalardo, *Is This NASA Document Saving or Killing Manned Private Spaceflight?*, *supra* note 104.

430. Wayne N. White, Jr., *Proposal for a Multilateral Treaty Regarding Jurisdiction and Real Property Rights in Outer Space*, PROC. 43RD COLLOQUIUM ON L. OF OUTER SPACE 245 (2000), available at http://www.spacefuture.com/archive/proposal_for_a_multilateral_treaty_regarding_jurisdiction_and_real_property_rights_in_outer_space.shtml.

431. Compare Beck, *supra* note 344 (on the possibility that space companies will relocate to less regulated nation-states), with Collins, *supra* note 386 and accompanying text (on the economic potential of the commercial space industry), and Ansdell, *supra* note 80 and accompanying text (on the progress of space technology transfers between countries).

The interconnectedness of the global economy,⁴³² the global nature of our security concerns, the political history, and the common interest in conserving the beauty and resources of outer space create a common vision and common interests for all of humanity in outer space development.⁴³³ Regulating the space industry in collaborative effort, like a joint venture between nations, can reap the greatest benefits of the commercial space activities.⁴³⁴ The safety concerns and security issues of space travel are best addressed by a multinational regulating entity.⁴³⁵ The economic benefits of the space industry's growth can be optimized for every country through the creation of leasehold estates for space property rights held in a trust for humanity.⁴³⁶ A *pro rata* distribution system⁴³⁷ of space industry revenues, such as lease payments, taxes, and other fees through a trust will ensure more equitable economic benefits than the alternatives.⁴³⁸ In turn, commercial space companies will benefit from consistent standards and legally protected rights in outer space development.⁴³⁹

There is no going back in a global economy.⁴⁴⁰ The political balance of power in the world is one consideration in the assessment of security concerns and the possibility of a “space race” between nations.⁴⁴¹ When it comes to economic power, however, it is often multinational corporations who hold the upper-hand, not individual nations.⁴⁴² To avoid a regulatory “race to the bottom” *and*

432. POP, *supra* note 282, at 118–19.

433. United Nations Conference, *The Space Millennium: Vienna Declarations on Space and Human Development*, UNISPACE III (Oct. 3, 2013), available at <http://www.oosa.unvienna.org/pdf/reports/unispace/viennadecLE.pdf>.

434. Fred Kosmo & James R. Dyer, *The Commercialization of Space: A Regulatory Scheme That Promotes Commercial Ventures and International Responsibility*, 61 S. CAL. L. REV. 1055, 1083–88 (1988) (identifying eight principles an international regulatory scheme should address for the development of the commercial space industry).

435. See, e.g., *id.*

436. See Salazar Announces BLM Onshore Oil & Gas Lease Sales Garnered \$233 Million for Taxpayers in 2012, *supra* note 303. See generally Nowlan, *supra* note 86.

437. Nowlan, *supra* note 86, at 112 (speaking of socio-economic factors and the role of units of measurement in a theory of distribution: “[T]he choice of categories to measure will be dispositive for decisions about how to distribute.”).

438. See, e.g., Collins, *supra* note 386. Collins encourages government investment in the commercial space industry and forecasts excellent returns on those investments. *Id.* It is also important to consider the challenges and inequities that individual nation-states will face in capturing the return on investment in the commercial space industry due to the globalized economy and technology transfers.

439. Twibell, *supra* note 183. But see White Jr., *Implications of a Proposal for Real Property Rights in Outer Space*, *supra* note 18. White’s perspective anticipates “competition between national legal systems” and that the “expected result would be a demand for the most economically efficient and least restrictive laws, with the laws of other space-faring nations serving as examples.” *Id.* While increasing competition between national regimes for commercial industry activity may seem like a benefit to the industry—it can also have a de-stabilizing effect on the industry because of the lack of consistency in the regulations and legal parity protecting rights and investments. See *id.*; see also Beck, *supra* note 344. For example, consider the transparency called for by the United States in addressing China’s anti-satellite testing before the United Nations. United States Statement on Peaceful Use of Outer Space – Thematic Debate of UNGA First Committee, *supra* note 359. When nation-states are not on the same page regarding the rules of development and the use of outer space, the risk of loss to commercial actors increases with the uncertainty regarding how these disputes will be resolved in the future. See *id.*

440. See, e.g., Gartzke, *supra* note 370.

441. See, e.g., Danilovic, *supra* note 365.

442. See, e.g., Slawotsky, *supra* note 392.

“economic blackmail” it is imperative that the nations of the world proceed with space development on a uniform platform by collaborating on the regulation of the commercial space industry and outer space property rights.⁴⁴³ To mitigate security concerns and encourage peaceable uses of space, there needs to be a forum for genuine communication about these concerns and commitments that can be relied on.⁴⁴⁴

A global economy, when it is mutually beneficial to all parties involved, gives us incentives to work together peaceably.⁴⁴⁵ The profitability of working together on outer space development would encourage nation-states to engage in the peaceable uses of space.⁴⁴⁶ Spacefaring nations may unwittingly lose the full economic benefits of space development by disregarding the common value to humanity of space property. The best course for spacefaring and non-spacefaring nations is to collaboratively and swiftly establish space rules of development and space property rights that will optimize the economic benefits of commercial space development for all.

PART VI: CONCLUSION

National policies on commercial space industry development must be calibrated to protect the legal rights of commercial actors and establish standards for global safety, security, and international economic development. Specifically, nation-states should collaborate because an untempered nation-state market competition for the economic benefits of space regulation could result in the diminution of the economic benefits of fostering commercial space enterprise. The economic impact of commercial space activities on the global and national levels can be optimized by adopting policies and regulations that encourage innovation, exploration, and competition, while at the same time establishing consistently applied measures for accountability. The development and acquisition of space technology by militant nation-states, and the influx of space technology into the global market from commercial space actors, has the potential to shift the balance of power in terms of both economic prowess and security concerns.

Finally, the poignant beauty of outer space should not be lost amidst the excitement over its economic potential. Principles of conservation should be infused in outer space development from the beginning so we can avoid some of the environmental catastrophes a lack of caring and foresight has created on Earth. The issues of the global space industry’s development delve deep into the principles and the foundation of our civilization and their resolution will establish the future fabric of the human race.

443. See, e.g., Beck, *supra* note 344; see also WORLD FEDERATION OF SCIENTIFIC WORKERS, *supra* note 391 and accompanying text.

444. See Mineiro, *FY-1C and USA-197 ASAT Intercepts: An Assessment of Legal Obligations under Article 9 of the Outer Space Treaty*, *supra* note 357, at 9–10.

445. See, e.g., Gartzke, *supra* note 370.

446. See *id.*