COMMENTS

The Need for Vertical Delineation of Air and Space: Can Google's Project Loon Survive Without It?

Michael Kyle Caswell*

"Law lags science; it does not lead it."

—Judge Richard Posner[1]

I. INTRODUCTION

Imagine thousands of giant, unmanned, high-altitude balloons skirting the edge of space, floating from country to country, beaming high-speed data signals down to the Earth below. These signals would provide Internet access to people in remote and isolated sections of the world where the Internet has never reached. Although virtually connecting all corners of the world may seem like an impossible feat, Google's Project Loon ("Loon") is an innovative endeavor that will

* © 2015 Michael Kyle Caswell. J.D. candidate 2016, Tulane University Law School; B.A. 2013, Davidson College.

1. Rosen v. Ciba-Geigy Corp., 78 F.3d 316, 319 (7th Cir. 1996).

achieve just that.[2] Loon is on the verge of full functionality, which test pilots have successfully proven. With consistent performance, Google's technological marvel will be a viable and practical solution for the lack of connectivity in remote, unconnected parts of the world.[3]

At first glance, Internet access may not seem like a prime concern for the developing world, but the Internet is widely recognized as providing major social and economic value because it unlocks information. Internet access helps reduce inequalities caused by the lack of information characteristic of the digital divide and can be a major asset in times of disaster.[4] For instance, Internet access can provide agricultural regions with accurate weather forecasts, allowing farmers to adjust production or planting schedules for more efficient crop yields.[5] Additionally, children without a formal education would be able to access information and may have an opportunity to utilize online classrooms.[6] Also, Internet access can forewarn large groups of people about forecasted natural disasters and enables government agencies and aid organizations to efficiently disseminate information to huge portions of the population.[7] Furthermore, the Internet serves as a connection to the outside world, allowing for the exchange of new and diverse ideas, ready access to information, and mediums for free expression.

Although Loon's technological progress may facilitate the equipment's functionality, external factors could determine whether its mission will be successful. The focus of this Article is one critical external factor—the current lack of demarcation or delimitation between "airspace" and "outer space" in international law. The regimes of air and space differ substantially from one another in that international *lex lata* grants subjacent states absolute sovereignty over the airspace above their territory but removes any notion of sovereignty altogether in outer space.[8]

---

2. *See How Loon Works*, PROJECT LOON, https://www.google.com/loon/how/ (last visited Nov. 15, 2015).

3. *Where Loon Is Going*, PROJECT LOON, http://www.google.com/loon/where/ (last visited Nov. 15, 2015); Tom Simonite, *Project Loon*, MIT TECH. REV., http://www.technologyreview.com/featuredstory/534986/project-loon/ (last visited Nov. 5, 2015).

4. *See* David Reed et al., *Technologies and Policies To Connect the Next Five Billion*, 29 BERKELEY TECH. L.J. 1205, 1207 (2014).

5. Project Loon, *Introducing Project Loon*, YOUTUBE (June 13, 2013), https://www.youtube.com/watch?v=m96tYpEk1Ao&feature=youtube.

6. *Id.*

7. Lucy Pearson, *Early Warning of Disasters: Facts and Figures*, SCIDEV.NET (Nov. 21, 2012), http://www.scidev.net/global/communication/feature/early-warning-of-disasters-facts-and-figures-1.html; Kristie Lu Stout, *Google's Balloon-Powered Internet: Coming to a Sky Near You?*, CNN (July 12, 2013), http://www.cnn.com/2013/07/tech/google-project-loon.

8. Convention on International Civil Aviation art. 1, Dec. 7, 1944, 61 Stat. 1180, 15 U.N.T.S. 295 [hereinafter Chicago Convention]; Treaty on Principles Governing the Activities of

Because Loon would operate in *near space*, the area between the limits of conventional civil aircraft operation and the point at which objects enter Earth's orbit, it is unclear which regime would apply.[9] Thus, the current state of international law leaves unanswered questions that may greatly influence the likelihood of Loon's success. For instance, should Google's equipment fall, causing injury below, it is unsettled whether the strict liability provisions of the outer space regime or the more complex liability regime of air law applies.[10] In such circumstances, this lack of certainty may breed unnecessary litigation and leave injured parties searching for a remedy. Furthermore, the absence of a declaration regarding whether Loon is operating in airspace or outer space leaves it uncertain which regulatory agency will have authority over Google's conduct and to whom Google may have to answer for alleged violations or necessary licensing.

An additional concern arises when considering Loon's international mission, which will require transit across national boundaries. Some subjacent states will likely attempt to exclude Loon's equipment by claim of sovereignty. For example, should Google's balloon network pass over an oppressive, reactionary state, such as North Korea, where Internet access is extremely limited, only permitted with special authorization, and primarily used for government purposes,[11] the lack of a settled international declaration that the balloons are operating beyond the bounds of sovereign airspace may prove problematic. Thus, regimes like North Korea may have a valid claim to the authority to exclude Loon under the unsettled state of international *lex lata*.

Nearly sixty years have elapsed since the dawn of the space age, but the international community has yet to reach a consensus on where airspace ends and outer space begins, and some have argued that such a distinction is not yet or may never be necessary.[12] However, this Article argues that the need for an internationally applicable distinction between airspace and outer space can no longer be overlooked. The rapid advancement of technology, like Loon, allowing for augmentation and

---

States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, Jan. 27, 1967, 183 U.S.T. 2410, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty].

9. *See* Jinyuan Su, *The Delimitation Between Airspace and Outer Space and the Emergence of Aerospace Objects*, 78 J. AIR L. & COM. 355, 361-62 (2013).

10. *See* Convention on the International Liability for Damage Caused by Space Objects art. 2, Mar. 29, 1972, 24 U.S.T. 2389, 961 U.N.T.S. 187.

11. *North Korea (Korea, Democratic People's Republic of)*, ASIA INTERNET HIST. PROJECT (May 21, 2015), https://sites.google.com/site/internethistoryasia/country-region-information/north-korea-korea-democratic-peoples-republic-of.

12. Su, *supra* note 9, at 356.

diversification of interests in near space, makes this an issue of prime concern. Part II of this Article will provide some background on Loon, its motivations, and its progress. Part III will offer a description of the stratosphere and the current activities conducted in near space. Part IV will discuss the international *lex lata* of air and space and the development of each regime. Part V will examine the gap left by both regimes in their failure to define their respective scope of applicability. Part VI will discuss a variety of proposals advanced to address this issue and some major criticisms of each, with an eye toward the implications that the various approaches might have on Loon and the future of near space activity. Finally, Part VI will conclude by offering a system for delimitation, which addresses the criticisms of existing proposals, lays the groundwork for clarification of significant gaps in the current regimes, and paves the way for future interests in near space.

II. PROJECT LOON—AN OVERVIEW

Currently, less than half of the world's households have access to the Internet.[13] In the developing world, two-thirds of households do not have Internet access.[14] In Africa, the poorest continent in the world, only one in ten households has access to the Internet.[15] One of the most prominent reasons these areas have not been reached is the high cost and degree of government cooperation necessary to install and maintain conventional telecommunication technology, such as fiber optic cables and data towers.[16] Although traditional means of providing Internet access to many of these "last mile" populations may be cost-prohibitive, Google believes Loon may provide a solution.[17]

Loon hopes to fill the connectivity void in these areas by unconventional means—from far above, in the Earth's stratosphere—by utilizing networks, comprised of potentially thousands of high-altitude balloons, each nearly 15 meters across, to beam high-speed data signals down to Earth's surface.[18] The balloons, which can ascend from a number of Google's launch stations around the world, will operate at

---

13. *ITU Releases 2014 ICT Figures*, INT'L TELECOMM. UNION, http://www.itu.int/net/pressoffice/press_releases/2014/23.aspx#.VP-OumTF8md (last visited Nov. 15, 2015).

14. *Id.*

15. Daron Acemoglu & James A. Robinson, *Why Is Africa Poor?*, 25 ECON. HIST. DEVELOPING REGIONS 21, 21 (2010), http://economics.mit.edu/files/7641; *ITU Releases 2014 ICT Figures*, *supra* note 13.

16. *See* Reed et al., *supra* note 4.

17. *See id.*

18. *See How Loon Works*, *supra* note 2; Simonite, *supra* note 3.

approximately 20 kilometers above Earth's surface, in the stratosphere.[19] The data signals will be used to provide Internet access to people in remote, undeveloped parts of the world, and each balloon is capable of providing connectivity to a region on the ground roughly 40 kilometers in diameter.[20] Solar batteries, powering the balloons' equipment, and a specially designed envelope[21] will enable the balloons to remain airborne for approximately 100 days without needing to descend for maintenance or replacement.[22] The balloons' movements will be controlled remotely by shifting their altitudes to catch the stratified winds that exist in the stratosphere.[23] Google hopes to use this setup to assemble huge networks of balloons that will be able to reach currently underserved or unserved markets that have proven impractical or impossible to reach by traditional telecommunication means.[24]

While this technology may seem far-fetched, Loon is well on its way to becoming operational. In fact, Google has been granted a patent for its ingenious means of controlling the balloons' altitude,[25] and since June 2013, Google has successfully conducted test pilots in several areas, including remote parts of New Zealand, California, and Brazil.[26] On March 2, 2015, Google announced that one of its balloons remained aloft for 187 days and circumnavigated the globe nine times, demonstrating a high degree of maneuverability through the difficult conditions found in the stratosphere.[27]

Additionally, Loon has taken steps to make its mission economically feasible. Google changed its original plan to buy space on the radio spectrum, which would allow Loon to operate independently of existing wireless networks, opting instead to "lease" the balloons to wireless carriers by allowing them to use ground antennas to link the balloons into preexisting networks.[28] This move saved Google billions of dollars in spectrum licenses and created alliances with those already in

---

19. *How Loon Works*, *supra* note 2.

20. *Id.*; Simonite, *supra* note 3.

21. The inflatable part of the balloon is called a balloon envelope. *How Loon Works*, *supra* note 2.

22. *Id.*

23. *Id.*

24. *Id.*

25. Balloon Power Sources with a Buoyancy Trade-Off, U.S. Patent No. 8,957,533 (filed Aug. 20, 2012).

26. Simonite, *supra* note 3; PROJECT LOON, *supra* note 5.

27. *Project Loon*, GOOGLE PLUS (Apr. 3, 2014), https://plus.google.com/+ProjectLoon/posts/1sWCpmsyj4H.

28. Simonite, *supra* note 3.

the telecommunications industry.[29] Mike Cassidy, Loon's project leader, recently stated that Loon has the potential to be a major revenue earner, predicting that it could take in tens of billions of dollars each year.[30] Thus, it seems that Loon is on the verge of economic and technological viability, and Google hopes to have enough balloons in operation to test nearly continuous service in several parts of the Southern Hemisphere by the end of 2015.[31]

III. THE STRATOSPHERE AND SUBORBITAL SPACE

The stratosphere, which lies in near space, is the second layer of Earth's atmosphere at an altitude of between 10 and 50 kilometers above Earth's surface.[32] Jet aircraft reach their operational limits in the lower extent of the stratosphere, and neither jets nor balloons can operate beyond the stratosphere because the air is approximately 1,000 times thinner than at sea level, making it insufficiently dense to support aircraft flight.[33] In this layer of the upper atmosphere, stratified winds, sometimes in excess of 300 kilometers per hour, create a maze that may prove difficult for Loon's balloons to navigate.[34]

Only a region of about 25 kilometers separates the upper extent of the stratosphere from the Kármán Line,[35] which many consider the scientific boundary between Earth's atmosphere and outer space.[36] In the stratosphere, Loon will remain above weather events, wildlife, and civilian aviation, but will remain far short of Earth's orbit.[37] Transatlantic commercial jetliners typically cruise at an altitude of 35,000-39,000 feet above sea level,[38] while the lowest satellite orbit would reach its perigee at about 100 miles above sea level.[39] At 20 kilometers (approximately 12.5

---

29. *Id.*

30. Jillian D'Onfro, *Google Thinks Its Internet Balloons Could Be a $10 Billion Business*, BUS. INSIDER (Mar. 2, 2015), http://www.businessinsider.com/google-project-loon-will-be-a-10-billion-business-2015-3.

31. *Where Loon Is Going*, *supra* note 3.

32. *The Stratosphere—Overview*, UCAR CTR. FOR SCI. EDUC., http://scied.ucar.edu/shortcontent/stratosphere-overview (last visited Nov. 5, 2015).

33. *Id.*

34. Simonite, *supra* note 3; Su, *supra* note 9, at 359.

35. The Kármán Line, scientifically speaking, is the point at which aerodynamics must give way to astronautics in order to enable flight. S. Sanz Fernández de Córdoba, *100 km Altitude Boundary for Astronautics*, Fédération Aéronautique Internationale, http://www.fai.org/icare-records/100km-altitude-boundary-for-astronautics (last visited Nov. 15, 2015).

36. *Id.*

37. *How Loon Works*, *supra* note 2.

38. D.R. Space et al., *The Airplane Cabin Environment: Past, Present and Future Research*, *in* AIR QUALITY AND COMFORT IN AIRLINER CABINS 189, 213 (2000).

39. JOHN VOGLER, THE GLOBAL COMMONS: A REGIME ANALYSIS 102 (1st ed. 1995).

miles or 66,000 feet) above sea level, Loon's balloons will not reach Earth's orbit or interfere with commercial aviation.[40]

Currently, several entities utilize high altitude vehicles (HAVs) in the stratosphere for a variety of purposes.[41] Meteorological balloons are utilized to gather weather and atmospheric data for organizations like the National Weather Service.[42] Additionally, some government and military agencies have expressed an interest in conducting operations using HAVs for more efficient movement of personnel and equipment and for intelligence gathering purposes.[43] Google's proposed activity in the stratosphere differs from the activities performed by weather balloons and other HAVs presently operating in suborbital space in several important respects.

Google is a private corporation seeking to profit from its activity, unlike a government or research agency that utilizes a weather balloon to obtain weather data. Furthermore, weather balloons typically float freely through the atmosphere until they eventually deflate, allowing their payloads to descend back to earth.[44] On the other hand, Google's balloons will be remotely navigated to target specific areas.[45] Because Loon will have an effect on terrestrial life, its presence will be known, unlike covert military intelligence operations or meteorological data-gathering equipment. States below, especially oppressive regimes, may object to Google's activity or even its passage through near space above their territory, as an intrusion into sovereign airspace. As the ensuing discussion will demonstrate, the current state of international law has left the door open to such claims, which may ground this technical marvel and muddy the waters for future use of suborbital space if the international community fails to take action.

IV. THE CURRENT INTERNATIONAL REGIMES

Aerospace—the totality of the area above Earth's surface—is divided into two regions for legal purposes: airspace and outer space.[46] However, there exists no natural or internationally agreed upon

---

40. *How Loon Works*, *supra* note 2; *see also* Fernádez de Córdoba, *supra* note 35.

41. Dean N. Reinhardt, *The Vertical Limit of State Sovereignty*, 72 J. AIR L. & COM. 65, 97 (2007).

42. *Id.*; *It's a Bird! It's a Plane! . . . No It's a NOAA Weather Balloon*, NAT'L OCEANIC & ATMOSPHERIC ADMIN., http://www.noaa.gov/features/02_monitoring/balloon.html (last visited Nov. 15, 2015).

43. Reinhardt, *supra* note 41, at 97.

44. *It's a Bird! It's a Plane! . . . No It's a NOAA Weather Balloon*, *supra* note 42.

45. *How Loon Works*, *supra* note 2.

46. Su, *supra* note 9, at 357.

delineation between them.[47] Thus, the *lex lata* of airspace and outer space has left each state to individually define the limit of its vertical sovereignty, but no state has explicitly done so.[48] This Part will examine the state of international law regarding airspace and outer space, with some discussion on the history of the two. The two regimes differ substantially, making the issue of delineation a prime concern for Google and others hoping to conduct activity in the stratosphere.

A. Airspace

The notion of sovereignty lies at the foundation of international air law.[49] Long before the first lighter-than-air aircraft freed man from his terrestrial bondage or Wilbur and Orville Wright carried out the first sustained mechanical flight, medieval courts contemplated private air rights through the legal maxim *cujus est solum eius est usque ad coelom*, "He who possesses the land possesses also that which is above it."[50] Thus, even from inception, airspace has been subject to the sovereignty of the possessor below. The events of World War I likely ushered in the modern conception of international air law, with its distinction between sovereign and international airspace. For the first time, aircraft were used to cross into enemy territory to support infantry and to perform strategic bombings, both in war zones and in civilian areas.[51] At the war's conclusion, Allied leaders met at the Paris Conference in 1919.[52] Drawing authority from the medieval principle of sovereign ownership of the air above one's land, Allied leaders formulated the first set of rules for regulating international aviation, with an eye to past events and national security.[53] These rules, titled the Convention Relating to the Regulation of Aerial Navigation (Paris Convention), granted full sovereignty and control to subjacent states of airspace above their territory, but it allowed a right of innocent passage through airspace in the course of international

47. Reinhardt, *supra* note 41, at 66.
48. *Id.* at 76.
49. *Id.* at 69.
50. Bury v. Pope (1586), 78 Eng. Rep. 375; Yehuda Abramovitch, *The Maxim "Cujust Est Solum Ejus Usque Ad Coelum" as Applied in Aviation*, 8 MCGILL L.J. 247, 247 (1962).
51. Dennis E. Showalter, *World War I 1914-1918*, ENCYCLOPEDIA BRITANNICA (Jan. 11, 2015), http://www.britannica.com/EBchecked/topic/648646/World-War-I/53158/Air-warfare.
52. Lisa Tomas, *Air Law*, MAX PLANCK ENCYCLOPEDIA PUB. INT'L L., para. 10 (2008), http://opil.ouplaw.com/view/10.1093/law:epil/9780199231690/law-9780199231690-e1134?rskey=4sq1ZA&result=3&prd=EPIL.
53. *Id.*

travel, known as overflight.[54] This doctrine of complete sovereignty is echoed in the current corpus of air law.

The Convention on International Civil Aviation (Chicago Convention) has since replaced the Paris Convention, but sovereignty has remained its prime consideration.[55] The Chicago Convention goes even further than its predecessor by granting no right of innocent passage and requiring the consent of the sovereign below for overflight during international transit.[56] As a result, states often negotiate bilateral or multilateral agreements, granting reciprocal traffic rights to airlines of states that are party to the particular agreement.[57] Thousands of such agreements are in existence today, and the negotiations involved are often a time-consuming, costly, and burdensome process.[58] Some countries have added additional costs to this already expensive system. For instance, Russia charges non-Russian airlines for overflight rights, arguably in violation of the Chicago Convention's non-discrimination provision.[59]

The Chicago Convention also establishes the International Civil Aviation Organization (ICAO) and charges the ICAO with setting standards for safety, regularity, and efficiency of international civil aviation.[60] The Chicago Convention and its progeny form a tort liability and regulatory enforcement regime, under which injured parties may pursue remedies in several forums, including the Council of the ICAO, the International Court of Justice, the European Court of Justice, or state arbitration courts, depending on the nature of the dispute and the membership of the parties in extra-Conventional bilateral or multilateral agreements.[61] The Chicago Convention forms the basis of international aviation law, and it has been almost unanimously adopted among major airfaring countries, with 191 state parties to the Convention as of 2013.[62]

---

54. Convention Relating to the Regulation of Aerial Navigation art. 1, Oct. 13, 1919, 11 L.N.T.S. 173.

55. *See* Chicago Convention, *supra* note 8.

56. *Id.*

57. Reinhardt, *supra* note 41, at 77.

58. *Id.*

59. Chicago Convention, *supra* note 8, art. 15; *see* Michael Milde, *Some Question Marks About the Price of "Russian Air,"* 49 GER. J. AIR & SPACE L. 147 (2000) (Ger.).

60. Chicago Convention, *supra* note 8, art. 15.

61. Tomas, *supra* note 52, paras. 46-51.

62. *List of Parties to the Chicago Convention*, INT'L CIV. AVIATION ORG. [ICAO], http://www.icao.int/secretariat/legal/List%20of%20Parties/Chicago_EN.pdf (last visited Nov. 15, 2015).

B. Outer Space

The law of outer space, like the law of airspace, developed out of concern for national security, in which space was simply another front in the Cold War.[63] In 1957, the Soviet Union's successful launch of *Sputnik I* sparked anxiety in the United States about a potential outer space nuclear attack from its Cold War enemy.[64] As a result, the United States Congress responded by passing the National Aeronautics and Space Act of 1958, which established NASA and made several very important decisions that would shape the course of international space law.[65] The Act declares, "[I]t is the policy of the United States that activities in space should be devoted to peaceful purposes for the benefit of all mankind."[66]

Nine years later, in January 1967, the United Nations General Assembly unanimously adopted the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies (Outer Space Treaty).[67] The Outer Space Treaty remains the regime's foundational legal document.[68] It stresses several points, most importantly, that the entirety of outer space, including the celestial bodies, cannot be appropriated by any state; instead, space is to be the "province of all mankind."[69] Furthermore, the Outer Space Treaty forbids the introduction of nuclear weapons or other

---

63. THOMAS GANGALE, THE DEVELOPMENT OF OUTER SPACE: SOVEREIGNTY AND PROPERTY RIGHTS IN INTERNATIONAL SPACE LAW 1 (2009).

64. Joanne 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, 406 (2010).

65. National Aeronautics and Space Act of 1958, Pub. L. No. 85-568, 72 Stat. 426 (1958) (codified as amended at 51 U.S.C. §§ 20101-20103, 20111-20117, 20131-20147, and 20161-20164 (2010)).

66. *Id.* § 102.

67. Outer Space Treaty, *supra* note 8.

68. MANFRED LACHS, INTERNATIONAL INSTITUTE OF SPACE LAW, THE LAW OF OUTER SPACE: AN EXPERIENCE IN CONTEMPORARY LAW-MAKING 30 (Tanja Masson-Zwaan & Stephan Hobe eds., reissued 2010) (1972).

69. Outer Space Treaty, *supra* note 8, arts. 1-2. It is noteworthy that the "province of all mankind" declaration seems to be an express rejection of the "common heritage" principle found in the U.N. Convention on the Law of the Sea article XI, in reference to "equitable sharing" of benefits from minerals below the deep seabed. Although it is not clear whether this is the case, this author believes that it is enough, for the purposes of this article, to say that the "province of all mankind" at least connotes free access to and use of space, beyond the jurisdiction of any single state. For further discussion, see Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, arts. 11.1, 11.7(d), Dec. 5, 1979, 1363 U.N.T.S. 3; VOGLER, *supra* note 39, at 102; John S. Lewis & Christopher F. Lewis, *A Proposed International Legal Regime for the Era of Private Commercial Utilization of Space*, 37 GEO. WASH. INT'L L. REV. 745, 755-58 (2005).

weapons of mass destruction and the establishment of military bases in outer space.[70] The Outer Space Treaty and the Convention on International Liability for Damage Caused by Space Objects also establish a strict liability regime for injuries caused by falling "space objects;"[71] and the Outer Space Treaty prohibits discriminatory restrictions on the freedom of exploration and use of outer space.[72] Thus, under the Outer Space Treaty, no state may claim sovereignty over an area, which would preclude another entity from entering or "using" outer space or the celestial bodies.

V. THE ABSENCE OF DEFINITION AND ITS IMPLICATIONS

As the preceding discussion illuminates, the regimes of outer space and airspace differ greatly in their respective approaches for addressing the security concerns of subjacent states. On one hand, the Chicago Convention confers absolute sovereignty to states, allowing them to ensure their own security via air space restrictions and control over sovereign airspace, to the exclusion of all others.[73] On the other hand, the Outer Space Treaty does away with the notion of sovereignty altogether.[74] Instead, it relies on separate provisions, which forbid nuclear weapons, weapons of mass destruction, and the establishment of military bases in space, in order to curb subjacent states' security concerns.[75] In light of these distinctions, there can be no overlap between the two regimes. Air must, at some point, give way to space. The two must be mutually exclusive, and no state or international body may exercise its jurisdiction within the airspace of another sovereign.

While the respective regimes governing outer space and airspace differ substantially, they do share one common characteristic. Neither the Chicago Convention nor the Outer Space Treaty defines its scope of application. Thus, each state has been left to determine the extent of its own vertical sovereignty, and there is no consensus today.[76] Various positions regarding the extent of sovereign airspace have developed among states. For example, the Soviet Union claimed vertical

---

70. Outer Space Treaty, *supra* note 8, art. 4.

71. *Id.* art. 7; *see also* Convention on the International Liability for Damage Caused by Space Objects, *supra* note 10.

72. Outer Space Treaty, *supra* note 8, art. 1.

73. Chicago Convention, *supra* note 8, art. 1.

74. Outer Space Treaty, *supra* note 8, arts. 1-2.

75. *Id.* art. 4.

76. Reinhardt, *supra* note 41, at 81.

sovereignty with no defined upper limit.[77] Australia defines the upper limit of Class A airspace at 60,000 feet and a "space object" as something being carried to or back from "an area beyond the distance of 100 kilometers above mean sea level."[78] However, Australia's codification does not expressly relinquish its potential claims to sovereignty above 60,000 feet.[79]

Several others have attempted to define "airspace" in connection with the term "aircraft." For instance, since 1961, Germany has included "spacecraft" and "rockets" in its definition of "aircraft."[80] In 1999, a member of the United Kingdom House of Lords stated that the United Kingdom has no working definition of such an upper limit, but that it is considered "to be at least as high as any aircraft can fly."[81] Currently, the United States claims "exclusive sovereignty of airspace of the United States," without expressly defining the term "airspace."[82] 49 U.S.C. § 40103(b) vests in the Administrator of the Federal Aviation Administration the authority to prescribe air traffic regulations on the flight of aircraft, thus linking the terms "airspace" and "aircraft."[83] However, the United States Code defines the term "aircraft" with extreme breadth, including "any contrivance invented, used, or designed to navigate, or fly in, the air."[84] Conceivably, this definition could include rockets or other spacecraft, and notably, lighter than air balloons operating beyond the typical bounds of commercial aviation. Additionally, federal law utilizes the term "outer space" numerous times but offers no definition.[85]

Surely, the *opinio generalis juris generalis* would deem the area customarily used for commercial aviation within the scope of airspace and subject to the control of the state below. Similarly, the space beyond the point at which objects reach Earth's orbit would fall under the regime of outer space. However, the gray area, created by the current absence of international consensus or codification of the division between airspace

---

77. *See* Air Code, Dec. 29, 1961, art. 1 (USSR), *reprinted in* STAFF OF S. COMM. ON COMMERCE, 89TH CONG., 2 AIR LAWS AND TREATIES OF THE WORLD 2545, 2545 (Comm. Print 1965).

78. Reinhardt, *supra* note 41, at 81-82.

79. *Id.* at 82.

80. Law Amending the Law Concerning Air Navigation (6th Amendment), July 25, 1964, art. 1(b), *reprinted in* STAFF OF S. COMM. ON COMMERCE, 89TH CONG., 1 Air Laws and Treaties of the World 777, 777 (Comm. Print 1965).

81. Reinhardt, *supra* note 41, at 83-84.

82. 49 U.S.C. § 40103(a)(1) (2012).

83. *Id.* § 40103(b)(1)-(2).

84. *Id.*

85. *See, e.g.*, 15 U.S.C. § 5802 (2012); 42 U.S.C. § 14701 (2012); 49 U.S.C. § 70102.

and outer space, may present serious issues for those hoping to conduct activity in near space because it is unclear whether they are operating in the territory of the subjacent state or the commons of outer space.

In the past, consideration of this issue may have been of only theoretical significance. In fact, the development of a solution for delimitation and definition of outer space has formally remained on the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS) agenda since 1967.[86] However, the introduction of new technology and economic motivation for activity above the confines of commercial aviation should bring renewed practical attention from the international community.

Failure to arrive at such a consensus may have negative consequences both for Google and for individuals. First of all, Loon's mission of providing Internet access to underserved and unserved markets and its limited degree of control over the equipment's movement make it likely that the balloons will end up crossing over the territory of states who do not want a corporation based in the United States providing unfettered Internet access for profit. Inevitably, these regimes will make claims of invasion of their sovereign airspace and attempt to interfere with Loon's operation.

Without a determination of whether Loon's activity is being conducted under the regime applicable to airspace or to outer space, it is unclear whether the strict liability standards for falling "space objects" found in the Outer Space Convention and its progeny will govern, or whether the more complex liability regime of air law will apply. Should Google's equipment fall to earth, causing injury, this lack of certainty may breed unnecessary litigation and leave injured parties searching for a remedy. Even in its short and relatively limited deployment, Loon has already encountered such an incident after one of its balloons went down unexpectedly in Veracruz, Mexico.[87] Although the balloon crashed in an unpopulated area and caused no physical damage,[88] one can easily imagine a less fortunate scenario. Furthermore, the absence of such a declaration leaves it uncertain which regulatory agency will have authority over Google's conduct in the stratosphere. And, because the Chicago Convention grants no right of innocent passage,[89] it leaves

---

86. Reinhardt, *supra* note 41, at 113.

87. *Google 'Project Loon' Wi-Fi Balloon Crash Alarms Mexican Town*, CBS S.F. (Mar. 13, 2015), http://sanfrancisco.cbslocal.com/2015/03/13/google-project-loon-wi-fi-balloon-crash-alarms-mexican-town/.

88. *Id.*

89. *See generally* Chicago Convention, *supra* note 8.

unanswered the question of whether Google's operations would be subject to the tangled web of reciprocal traffic agreements that allow airlines to cross the sovereign airspace of states that are party to the agreement. If the question whether near space is beyond the scope of airspace remains unanswered, this nonexhaustive list highlights several of the major issues that might arise.

VI. POSSIBLE SOLUTIONS

Over time, several approaches have emerged regarding the appropriate manner of categorizing activity in aerospace for legal purposes. Three of these approaches—the "wait and see" approach, spatialism, and functionalism—have risen to the forefront of academic discourse and practical application.[90] This Part examines each of these approaches by analyzing the property rights that each approach provides in the stratosphere and near space, their respective advantages and disadvantages, and the impact each might have on Loon and the future development of near space activity.

A. "Wait and See"

The "wait and see" or "no present need" approach may be more properly characterized as an "attitude" rather than an "approach."[91] Several states, including the United States, Canada, and the United Kingdom, have resisted the call for demarcation.[92] They argue that because the absence of a boundary has given rise to no significant problems thus far, the issue is not yet ripe for resolution.[93] Commentators on this perspective have expressed hope that science will resolve this issue in the future.[94] The fact that the issue of delimitation has occupied a spot on the UNCOPUOS agenda for more than 40 years without resolution evidences the current dominance of this position in international lawmaking.[95]

---

90. *See* Su, *supra* note 9; Reinhardt, *supra* note 41; Bin Cheng, *The Legal Regime of Airspace and Outer Space: The Boundary Problem Functionalism Versus Spatialism: The Major Premises*, 5 ANNALS AIR & SPACE L. 323, 324 (1980).

91. *See* Su, *supra* note 9, at 377; Gbenga Oduntan, *The Never Ending Dispute: Legal Theories on the Spatial Demarcation Boundary Plane Between Airspace and Outer Space*, 1 HERTFORDSHIRE L.J. 64, 66 (2003), https://www.herts.ac.uk/__data/assets/pdf_file/0010/38629/HLJ_V1I2_Oduntan.pdf.

92. Reinhardt, *supra* note 41, at 113.

93. *Id.*

94. BIN CHENG, THE LAW OF INTERNATIONAL AIR TRANSPORT 121 (1962).

95. Reinhardt, *supra* note 41, at 113.

The "wait and see" perspective recognizes several negative consequences that may result from any resolution at the current time. Delimitation opponents argue that attempts to reach an explicit agreement on an altitude boundary would lead some states to make excessively high claims of sovereignty, opening "Pandora's box."[96] There is a general understanding that a low airspace boundary will not alleviate some states' security concerns.[97] Therefore, "wait and see" advocates express concern that at present, a boundary would have to be set very high because "fear of the unknown" would lead states to argue for as much sovereignty as possible.[98] Such a high boundary may interfere with the free access to and use of outer space guaranteed by the Outer Space Treaty, and it may affect current and future activities, properly characterized as outer space activities.[99] If a higher boundary is set in order to address states' security concerns, few states will be willing to lower the boundary and limit their own sovereignty, making it virtually impossible to reduce any agreed upon altitude in the future.[100]

The most forceful calls for airspace demarcation have come from developing countries.[101] Space-faring countries, including the United States, have largely avoided opening the matter to multilateral treaty consideration.[102] This may be due to the prevailing assumption that any boundary established must be extremely high to garner sufficient international support.[103] Thus, space-faring countries likely fear such a boundary may infringe upon current and future space activities, especially because spacecraft are not launched straight up and often require passage through sovereign airspace to enter into orbit.[104] Furthermore, the argument that the international community should wait for a more pressing need to develop before pursuing demarcation serves the interest of states with ambitions of utilizing near space for military operations. The United States Air Force has developed technology that will enable it to conduct surveillance activity well above the current limit for conventional flight.[105] A high boundary may place these high-altitude vehicles within the limits of sovereign airspace.

---

96. Oduntan, *supra* note 91, at 66.
97. Reinhardt, *supra* note 41, at 113.
98. *Id.*; Oduntan, *supra* note 91, at 67.
99. Reinhardt, *supra* note 41, at 113.
100. *Id.*; Oduntan, *supra* note 91, at 66-67.
101. Oduntan, *supra* note 91, at 67.
102. *Id.*
103. Reinhardt, *supra* note 41, at 112.
104. *Id.* at 101.
105. *Id.*

The "wait and see" approach fails to take into account substantial technological advancements that have created a pressing need for demarcation. Lockheed Martin's SR-71 Blackbird, an aircraft used to gather intelligence during the Cold War era, blurs the line between conventional flight and space flight because the Blackbird has the capability to fly at 85,000 feet for short durations at Mach 3 speeds.[106] Such aircraft remain of little importance for much of the civilian world because their use is limited to military application. On the other hand, the advent of unmanned aerial vehicles (UAVs), including unmanned free balloons capable of controlled movement, enables states and private actors to conduct increasingly diverse activities in near space. "UAVs are dynamic. They are nano, micro, mini, short-range and tactical medium- and high-altitude combat aircraft whose diverse platforms complement a functional versatility."[107] The U.S. Air Force's RQ-4 Global Hawk can sustain flight for more than 34 hours at an altitude of 60,000 feet.[108] Furthermore, high-altitude balloons, like those employed by Loon, have the capability to stay aloft several months at altitudes of 100,000 feet or more, well above the upper limits of aviation.[109] Without the physical limitations of human pilotage, communication technology and the human imagination are the only limit on the operational heights and diverse uses for UAVs. Furthermore, private actors, like Google, who hope to utilize the area above conventional airspace, need some clarification on what regime will govern their activity, and because Loon will have a terrestrial impact by providing internet access, its presence will be known below, unlike covert military operations, making claims of sovereignty over that area even more likely.

As previously mentioned, the *lex lata* of international air and space law leaves stratosphere and near space use rights in a gray area, subject to either the control of the subjacent state or to the application of international treaties and conventions relative to outer space. However, because "[t]he constitutive principle of the modern international system has been the sovereign ownership of territory, coastal waters and more recently airspace,"[110] and because neither the airspace regime nor the

---

106. *Creating the Blackbird*, LOCKHEED MARTIN, http://www.lockheedmartin.com/us/100 years/stories/blackbird.html (last visited Nov. 15, 2015).

107. Timothy M. Ravich, *Complying and Flying: Legal and Technical Issues Relating to the Operation of Unmanned Aerial Systems: The Integration of Unmanned Aerial Vehicles into the National Airspace*, 85 N. DAK. L. REV. 597, 599 (2009).

108. *RQ-4 Global Hawk Fact Sheet*, U.S. AIR FORCE (Oct. 27, 2014), http://www.af.mil/ AboutUs/FactSheets/Display/tabid/224/Article/104516/rq-4-global-hawk.aspx.

109. *See* Reinhardt, *supra* note 41, at 101.

110. VOGLER, *supra* note 39, at 6.

outer space regime defines its scope of application, subjacent states would conceivably have a valid argument in claiming sovereignty over the near space region above their territory. Thus, if the "wait and see" approach persists, Google and other near space actors would likely be subject to the control of subjacent states. This control would be derived from the Chicago Convention, which affords subjacent states exclusive sovereignty over airspace.[111] Without an international declaration to the contrary, the categorization of near space activity within the bounds of airspace may stymie near space development and render Loon a doomed endeavor.

Two schools of thought have been cast in opposition to the "wait and see" approach. "[F]rom the dawn of the space age all those who deal with the question of defining outer space have been neatly divided into those who are spatialists and those who are functionalists."[112] Both spatialism and functionalism recognize the need for defining outer space, but their approaches differ.

B. Spatialism

Spatialism has long been considered a key tenet of international law.[113] Spatialism, at its most fundamental level, places territory into three distinct categories: national territory, in which a state, to the exclusion of all others, has territorial sovereignty; *territorium extra commercium*, which, like the high seas, is not subject to state sovereignty; and *territorium nullius*, which is not yet state territory but is capable of being acquired by any state in accordance with international law applicable to acquisition of territory.[114] As applied in international *lex lata*, spatialism "determine[s] and regulate[s] what [s]tates may or may not do in their own territory, in the territories of other [s]tates, in *territorium extra commercium*, in *territorium nullius* and in territories that constitute the common heritage of mankind."[115] This system confers upon states a definite set of jurisdictional capabilities that is understood with limited internal conflict or ambiguity.[116] It grants 3 types of jurisdiction, including territorial jurisdiction, quasi-territorial jurisdiction, and personal jurisdiction.[117] Within each of these types of jurisdiction the

111. Chicago Convention, *supra* note 8, art. 1.
112. Cheng, *supra* note 90, at 324.
113. *Id.* at 336.
114. *Id.* at 336-37.
115. *Id.* at 338.
116. *Id.* at 339.
117. *Id.* at 339-40.

state may enact and judicially interpret laws applicable to its territory, known as jurisfaction.[118] Furthermore, the state has the exclusive power to enforce those laws in its territory, a concept known as jurisaction.[119]

As applied to the context of a legal airspace-outer space distinction, the spatialist approach holds that a "definitive demarcation line should be drawn between air and space, which would impose a vertical limit on state sovereignty."[120] Subjacent states' vertical sovereignty would be limited to the area below such demarcation, and the area above would be *territorium extra commercium*: "the province of all mankind," comporting with the *lex lata* of outer space.[121] This approach echoes the principle of international law that has, in the past, provided an "unambiguous framework for the solution of all international legal disputes which may exist or arise" through the existence of an agreed starting point.[122] Spatialism relies on the adoption of some technical scientific criteria, such as Earth's gravitational pull and the lowest perigee of satellite orbits, in order to establish an agreed upon threshold of outer space.[123]

In 1978, the spatial approach received substantial support from at least one space-faring nation.[124] The Soviet Union, in its presentation and subsequent working paper outlining the proposal to UNCOPUOS, proposed that outer space should legally begin at an altitude of 100 to 110 kilometers above sea level.[125] This approach comports with current scientific notions in that the proposed altitude parallels the Kármán Line, and the application of astrodynamics.[126] Furthermore, the Soviet Union proposed that, in line with preexisting custom, space objects should be granted a right of innocent passage over state territory at lower altitudes to reach orbit or to return to Earth in the territory of the launching state.[127] Other states have claimed that this right of innocent passage was not preexisting custom, and the Soviet proposal ultimately failed.[128] Other arguments have been made for a limitation of vertical sovereignty at

118. *Id.* at 340.
119. *Id.*
120. Reinhardt, *supra* note 41, at 120.
121. Outer Space Treaty, *supra* note 8, art. 1.
122. Cheng, *supra* note 90, at 341.
123. Oduntan, *supra* note 91, at 70.
124. Reinhardt, *supra* note 41, at 115-16.
125. *Id.*
126. *Id.* at 116; *Layers of the Atmosphere*, NAT'L WEATHER SERV., http://www.srh.noaa.gov/srh/jetstream/atmos/layers.htm (last visited Nov. 15, 2015).
127. Reinhardt, *supra* note 41, at 116.
128. *Id.* at 117.

various arbitrary heights, ranging from 20 kilometers above sea level to 1.5 million kilometers above sea level.[129]

While the spatial approach would provide clarity and simplicity by unambiguously defining an internationally recognized limit on vertical sovereignty and neatly classifying the area below the delimitation as national territory while deeming the area above *territorium extra commercium*, it has several significant drawbacks. Obtaining the required level of international support for establishing such a bright-line demarcation has proven extremely problematic. The black-and-white distinction between subjacent states' rights in the airspace and outer space regions above their territory will likely present a major obstacle in obtaining the necessary consensus. By entering into such an agreement, a state is effectively signing over its rights to the area above the agreed upon boundary to an international organization—rights that the state may otherwise exercise in light of the *lex lata* of airspace. Such a bright-line rule may lead states to resist the formation of any physical demarcation or to seek an unnecessarily high delimitation.

As demonstrated by the preceding discussion and the Soviet Union's 1978 proposal, any settled demarcation would probably be extremely high, likely at the Kármán Line or higher.[130] National security concerns form the bedrock of air and space *lex lata*, and subjacent states will be reluctant in supporting a fixed limit on vertical sovereignty where danger exists from above such a point.[131] Further frustrating the process, states with substantial spacefaring interests or with interests in conducting other forms of activity in near space might prefer a lower delineation, which would render altitudes slightly above the limits of commercial aviation *territorium communis*.[132] This scenario would likely result in the inability to obtain the necessary consensus and would fail to remedy the complications explained in the prior discussion of the "wait and see" approach.

In any event, should consensus be obtained on a physical demarcation, the likely result would be a high demarcation.[133] This outcome would fail to protect the interests of near space actors like Google, who hope to conduct activity relatively near the limits of commercial aviation but far from the boundaries of outer space or the

---

129. Oduntan, *supra* note 91, at 81.
130. Reinhardt, *supra* note 41, at 114-15.
131. Martin Menter, *The Developing Law for Outer Space*, 53 A.B.A. J. 703, 705 (1967).
132. *See* Outer Space Treaty, *supra* note 8, art. 1.
133. Reinhardt, *supra* note 41, at 114-15.

scientific points of departure between air and space.[134] Thus, Loon, and likely all actors in the stratosphere, would be subject to the sovereignty of subjacent states, a problem to be discussed later in this Article.

The spatial approach has yet another weakness, which mirrors an aforementioned objection to demarcation made by "wait and see" advocates. Assuming any agreement that may be reached concerning demarcation would be extremely high, it would be very difficult to adjust in the future.[135] States will be reluctant to relinquish their own sovereignty and risk perceived security threats in order to lower the boundary line.[136] This scenario becomes more problematic as rapid technological advancements, which make the area above the limits of conventional flight more accessible, enable the emergence of increasingly diverse interests in near space. As financial incentives for near space activity become a reality, such technology will likely continue to advance, and the number of actors in the near space region will expand.

A similar pattern of development can be seen in the rise of the geostationary satellite industry and orbital space satellite deployment. Throughout the Cold War era and into the late 1980s, the United States and the Soviet Union were the sole possessors of the technology necessary to launch objects into outer space.[137] However, the rise of satellite technology and the realization of economic motivations for utilizing this technology to provide consumers with communication and global positioning services led to the advent of common-user organizations like Intelsat, Asiasat, Arabsat, and Eutelsat to provide access to Earth's orbit.[138] These organizations have allowed a host of new entities to develop interests in outer space by allowing orbital access without a dedicated space program.[139] Near space activity may very well follow a similar course, and it is likely that a diverse set of activities and interests will develop in the region. Thus, the failure of a spatial demarcation to provide adaptability during times of rapid technological advancement may prove its greatest sticking point, especially as increasing numbers of private parties become involved in shaping

---

134. Loon would operate at approximately 20 kilometers above Earth's surface; the effective ceiling of civilian aviation in the United States is around 40,000 feet (12.2 km); the Kármán Line lies at about 100 kilometers. Reinhardt, *supra* note 41, at 127; Fernández de Córdoba, *supra* note 35.

135. Oduntan, *supra* note 91, at 67.

136. *Id.*

137. VOGLER, *supra* note 39, at 100.

138. *Id.* at 100-01.

139. *Id.*

international policy and desire to escape the constraints of territorial jurisdiction.

C. Functionalism

The functionalist approach has emerged as an alternative to spatialism. "The essence of functionalists' argument is that the *locus* of an act need be of no moment to its legality or illegality, which can be determined solely by reference to its nature."[140] Functionalism's proponents, like advocates of the "wait and see" approach, argue that the establishment of a physical demarcation would be premature and arbitrary.[141] However, functionalists do not believe that scientific notions will, at some later time, provide the answer to the legal delimitation question.[142] Rather, functionalists claim that the nature and purpose of activities should determine the applicable law and that outer space should not be defined in reference to some legally arbitrary boundary line.[143] Instead, the concept of outer space should be "defined on the basis of a definition of the concept of space activities," and the legal threshold of outer space should coincide with the point at which space activities can be said to begin.[144] Thus, regardless of the altitude at which they occur, activities in air and space should be regulated based on an assessment of their objectives and missions.[145] "[W]herever space objects may be found to be in operation, outer space laws apply."[146] Inherent in the functionalist approach is the formation of a single legal regime, uniting both airspace and outer space as a single entity.[147] For purposes of clarity, this Article will refer to this entity as "aerospace."

Functionalist reasoning may be explained by the fact that aerospace law is a functional body of laws, and outer space's definition must therefore be a functional one.[148] Functionalists argue that numerous points support this position. They contend that, generally speaking, aerospace law includes the area of airspace transport, so aerospace law should also apply to all transport from Earth to the totality of points in

---

140. Cheng, *supra* note 90, at 347.
141. Su, *supra* note 9, at 363.
142. Oduntan, *supra* note 91, at 71.
143. Su, *supra* note 9, at 363.
144. Oduntan, *supra* note 91, at 69.
145. Vladlen S. Vereshchetin, *Outer Space*, MAX PLANCK ENCYCLOPEDIA PUB. INT'L L., para. 13 (2006), http://opil.ouplaw.com/view/10.1093/law:epil/9780199231690/law-9780199231690-e1202?rskey=OHljcc&result=2&prd=EPIL.
146. Oduntan, *supra* note 91, at 70.
147. *Id.* at 69.
148. *Id.* at 70.

aerospace.[149] Annex 7 of the Chicago Convention defines the term "aircraft" as "[a]ny machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against earth's surface."[150] Therefore, the remainder of vehicles, which pass through and beyond the atmosphere, should be classified as spacecraft.[151] There exists a region of aerospace called "mesospace," between the maximum altitude at which aircraft can operate and the lowest point where spacecraft can attain orbit, and regulation of this region must be addressed by virtue of nonspatial reasoning.[152] Thus, all space activities should be permitted at any level of altitude, as long as the subjacent state's security is respected.[153] Finally, in light of the absence of a demarcation line in the Outer Space Treaty or a definition of spacecraft in subsequent treaties applicable to outer space, the Outer Space Treaty is necessarily functional in nature.[154]

For space-capable states, the functional approach seems to be an attractive alternative to the constraints imposed by a fixed physical demarcation of vertical sovereignty, as proposed by spatialists.[155] It would protect subjacent states' security interests by disallowing internationally objectionable conduct, which would not be deemed "space activity," but would allow space activity to be freely performed at any altitude.[156] Furthermore, the functionalist approach suggests that a physical demarcation is not necessary where the nature of the activity determines the applicable law.[157] This may allow the functionalist approach to avert the issue of physical demarcation, which has long plagued the international community without resolution. In addition, by referring to the nature of particular activities rather than the *locus* of the activities in determining the applicable law, the functionalist approach may allow the aerospace regime to more adequately adapt to future developments as aerospace activity becomes increasingly diverse.

However, functionalism has faced harsh criticism and the flaws in its theory are well documented. The unification of all aerospace under a single set of laws would be a jumble of unsettled rules and would remove

149. *Id.*

150. INT'L CIVIL AVIATION ORG., AIRCRAFT NATIONALITY AND REGISTRATION MARKS, ANNEX 7 TO THE CONVENTION ON INTERNATIONAL CIVIL AVIATION (6th ed. July 2012).

151. Oduntan, *supra* note 91, at 70.

152. *Id.*

153. *Id.*

154. *Id.*

155. Su, *supra* note 9, at 363.

156. Oduntan, *supra* note 91, at 70.

157. *See id.* at 69-70.

the spatial basis, which states have painstakingly constructed to normalize international relations for decades, perhaps even centuries.[158] Bin Cheng, Honorary President of the London Institute of Space Policy and Law and a world authority on air and space law, writes, "[T]o say that spatialism should give way to functionalism in international law would be like saying that everything should be a federal matter in the United States eliminating in a stroke all [s]tate rights which after all is only a form of spatialism."[159] Cheng further points out that general international law deems few activities either universally lawful or universally unlawful.[160] For instance, in May 1960, the Soviet Union shot down a U.S. reconnaissance plane while it flew over Soviet territory.[161] Subsequently, the Soviets tried, convicted, and imprisoned the plane's pilot, and the United States accepted the Soviet action as lawful, without demur.[162] However, when the Soviet Union shot down another U.S. reconnaissance aircraft over the high seas just two months later, the United States took the matter before the United Nations Security Council, and the Soviet Union returned the surviving pilot of the second aircraft, admitting the illegality of its action.[163] Many other illustrations may be cited, but this real-life example demonstrates that it is the *locus* of the act, first and foremost, which determines its legality or illegality under international *lex lata*.[164]

Abandoning the spatial nature of international *lex lata* and replacing the customary distinctions between sovereign airspace and the *territorium extra commercium* of outer space with a one-size-fits-all system would be an extremely difficult task for the international community. Any functional aerospace regime may be rendered ineffective by its lack of clarity and complicated structure.[165] By utilizing the definitions of aircraft and spacecraft, functionalists hope to avoid the problem of defining airspace and outer space altogether.[166] However, "acceptable and precise definitions of 'aircraft' and 'spacecraft' are just as elusive as similar definitions of air law and [s]pace law."[167] Obtaining consensus on effective criteria for defining the terms aircraft and

158. Cheng, *supra* note 90, at 346.
159. *Id.* at 345-46.
160. *Id.* at 338.
161. *Id.* at 347.
162. *Id.*
163. *Id.* at 348.
164. *Id.* at 346-47.
165. Oduntan, *supra* note 91, at 70.
166. *Id.*
167. *Id.* at 70-71.

spacecraft may prove problematic, especially in light of the diverse interests among the international community and the development of aerospace objects capable of operating in both airspace and outer space.[168] The functional approach, in dismantling the international regimes of both airspace and outer space, would take a great deal of time and resources to develop and negotiate its aerospace regime. Thus, actors like Google, who hope to conduct near space activity in the near future, would be forced to wait for a decision on the nature of their conduct or whether its unconventional vehicles constitute spacecraft.

Additionally, several commentators argue that a functional system could not exist without the adoption of scientific and legal criteria common to the spatial approach, and any functional regime would necessarily have spatial roots.[169] "Without the spatial starting point of national sovereignty over airspace, it would indeed be difficult at the present stage of international relations to know exactly where to start."[170] One of the proposed distinctions between aircraft and spacecraft is based on whether the object reaches *escape velocity*—the speed required to break free from Earth's gravitational attraction—irrespective of the height at which that velocity is attained.[171] Under this inquiry, all objects that do not attain this velocity must be categorized as aircraft.[172] This determination implicitly relies on scientific information, which identifies outer space as a "place," rather than as a "focus for activities," the latter being a key tenet claimed by the functional approach.[173] Thus, it does not actually avoid the need for consensus on the point at which outer space begins. Rather, the functional approach merely shifts the focus of outer space's definition to the capability of objects to enter into outer space or on some other criteria. Perhaps more confusing about this approach is the vast number of considerations that may be used in defining outer space activity through the term spacecraft.[174] For instance, such a determination may be based on speed, altitudinal capability, or the specific nature of the object's mission, although it is not clear what might distinguish the nature of a space mission from a nonspace mission aside from its *locus*.

Unless a determination is made concerning which criteria would be the determining factor under the functional approach, it is not possible to

168. Su, *supra* note 9, at 356 n.1.
169. Oduntan, *supra* note 91, at 71; Cheng, *supra* note 90, at 345.
170. Cheng, *supra* note 90, at 345.
171. Oduntan, *supra* note 91, at 71.
172. *Id.*
173. *Id.* at 70.
174. *See id.*

gauge which regime would apply to near space activity or to Loon specifically. The functional approach seems, at this point, too jumbled and unsettled to allow for an assessment of the nature of rights in near space. Loon's equipment and capabilities do not clearly fit within the scope of typical outer space or airspace function. Although the functional approach has garnered some recent support, especially among the space powers, Loon and the operation of high-altitude UAVs would require a distinct system that does not fall within the scope of the functionalist approach, as commonly envisioned.

D. An Approach for the Future—Near Space Zonal

Although numerous states and scholars purport that the issue of delimitation of vertical sovereignty and definition of outer space is not yet ripe or that there is no need to establish such a boundary at all, whether by physical demarcation or functional classification,[175] this perspective ignores the far-reaching implications of the gap in international air and space law. Given the pace with which diverse uses and interests have developed and continue to develop in near space, the international community will inevitably face significant pressure to resolve this issue in the near future. Thus, a proactive effort to define outer space and the upper limit of state sovereignty may head off substantial future concerns among private parties and states with interests in near space activity. Google's international recognition, along with Loon's significant investment and potential benefits to the developing world, may be important driving forces in the attempt to develop international consensus on the issue. However, given the preceding discussion regarding existing propositions, it does not seem that either the functional approach or the spatialist approach is adequate to balance the interests of near space actors with subjacent states' security concerns, so a new approach must be put forth.

Numerous writers, weighing in on the extent of vertical sovereignty issue, have recognized the value in drawing parallels between aerospace and the seas, and much can be gleaned from an examination of the zonal approach taken in the United Nations Convention on the Law of the Sea (UNCLOS).[176] As the oldest recognized global commons, the seas have undergone centuries of international negotiation, regime-building, and

175. *See* Reinhardt, *supra* note 41, at 66.

176. *See, e.g.*, *id.* at 76-80; Cheng, *supra* note 90, at 346-47; Su, *supra* note 9, at 365, 375-77.

solution-seeking.[177] Furthermore, comparing the problem of defining the limits of vertical sovereignty to that of horizontal sovereignty—the extent of territorial waters—is helpful because, like air and space, territorial and international waters lack any natural boundary.[178]

Recognition of states' legitimate interests in security and the protection of natural resources, including fish stocks and deep sea minerals, led the international community to seek a resolution on the limit of horizontal sovereignty. After nearly a decade of negotiations and international meetings, the United Nations adopted UNCLOS, a comprehensive set of rules to regulate the seas and to resolve the horizontal sovereignty issue.[179] UNCLOS, in attempting to strike a balance between the interests of coastal states, seafarers, and inland states, deals with the issue of horizontal sovereignty by utilizing a zonal approach.[180] It allows coastal states to claim territorial seas no more than 12 nautical miles from shore.[181] Within these areas, states reserve a level of control similar to that retained in sovereign airspace under the Paris Convention—limited only by a right of innocent passage that allows vessels to reach the high seas or other states.[182] Beyond the territorial seas, UNCLOS grants to coastal states contiguous zones, up to twenty-four nautical miles from shore, in which coastal states have limited rights.[183] Beyond the contiguous zones, exclusive economic zones (EEZs) extend to areas up to 200 and 350 nautical miles from shore.[184] Therein, the coastal state, subject to relevant international environmental protocol, has the exclusive right to the exploitation of natural resources and retains jurisdiction over disputes involving these resources.[185] Beyond the bounds of territorial waters, the contiguous zone, and the EEZ lie the high seas.[186] This area and its resources are subject to the

177. *See* Andree Kirchner, *History of Law of the Sea*, MAX PLANCK ENCYCLOPEDIA PUB. INT'L L., paras. 22-29 (Sept. 2007), http://opil.ouplaw.com/view/10.1093/law:epil/9780199231690/law-9780199231690e1187?rskey=HssyLi&result=1&prd=EPIL; Tullio Treves, *Law of the Sea*, MAX PLANCK ENCYCLOPEDIA PUB. INT'L L., paras. 4-21 (2011), http://opil.ouplaw.com/view/10.1093/law:epil/9780199231690/law-9780199231690-e1186?rskey=2Xgss6&result=3&prd=EPIL.

178. Reinhardt, *supra* note 41, at 77.

179. *See id.*; United Nations Convention on the Law of the Sea art. 136, Dec. 10, 1982, 1833 U.N.T.S. 397. [hereinafter UNCLOS].

180. Treves, *supra* note 177, para. 23.

181. UNCLOS, *supra* note 179, art. 3.

182. *Id.* art. 28.

183. *Id.* art. 33.

184. *Id.* art. 57.

185. *Id.* art. 56.

186. *Id.* art. 86.

sovereignty of no state and the common heritage principle, including the equitable sharing of benefits, governs their appropriation and use.[187]

The right of innocent passage, granted in both territorial waters and contiguous zones, may seem to be a powerful limitation on state sovereignty.[188] However, coastal states reserve an important degree of control, even in light of this provision. In the exercise of their full sovereignty, coastal states may temporarily suspend innocent passage in order to protect their security and may take all measures necessary to ensure that the rights and facilities provided for land-locked states do not infringe upon transit states' legitimate interests.[189] Furthermore, UNCLOS lists numerous examples of non-innocent passage, creating an extremely broad category of activities that could give rise to coastal states' right to exclude.[190] These include:

> (a) any threat or use of force against the sovereignty, territorial integrity or political independence of the coastal state, or in any other manner in violation of the principles of international law embodied in the charter of the United Nations;
> (b) any exercise or practice with weapons of any kind;
> (c) any act aimed at collecting information to the prejudice of the defense or security of the coastal state;
> (d) any act of propaganda aimed at affecting the defense or security of the coastal state;
> (e) the launching, landing or taking on board of any aircraft;
> (f) the launching, landing, or taking on board of any military device;
> (g) the loading or unloading of any commodity, currency or person contrary to the customs, fiscal, immigration or sanitary laws and regulations of the coastal state;
> (h) any act of willful and serious pollution contrary to this Convention;
> (i) any fishing activities;
> (j) the carrying out of research or survey activities;
> (k) any act aimed at interfering with any systems of communication or any other facilities or installations of the coastal state;
> (l) any other activity not having a direct bearing on passage.[191]

Thus, UNCLOS creates a "quasi-property" or "quasi-sovereign" right in the territory of EEZs, while forming an absolute property right in the natural resources underlying EEZs and territorial waters. Furthermore, through its zonal approach, UNCLOS effectively fashions

187. *Id.* arts. 87, 89, 136-137.
188. *Id.* arts. 55-56.
189. *Id.* art. 25.
190. *Id.* art. 19.
191. *Id.*

a military and economic buffer zone that protects the security and financial interests of coastal states while simultaneously insulating international shipping interests by virtue of the right of innocent passage. This balance is achieved through a slight limitation on the degree of control that coastal states may exercise, which serves to promote industry, freedom of travel, and international trade. A similar approach could be taken in aerospace.

A system that follows the model of the seas would alleviate many of the shortcomings of the "wait and see," spatialist, and functionalist approaches. Keeping in mind that "[t]he ultimate goal, when reasonable security needs are met, should be of course . . . the fullest inclusive use of airspace,"[192] such a system would involve a low boundary for absolute vertical sovereignty, near the upper limit of commercial aviation at approximately 15 kilometers above sea level.[193] Below this point, the existing air regime, including the Chicago Convention, current bilateral and multilateral traffic agreements, and liability conventions, would remain in effect. Thus, airspace would remain national territory. Benefits of a low delimitation include simplicity, freedom of access to space, and opportunity for development of private interests in near space. These benefits outweigh whatever added security concerns may arise by virtue of a low limit on vertical sovereignty. Under the U.N. Charter, states have a right to take action beyond their borders to ensure national security, a right that will remain unchanged by the establishment of a low vertical limit on state sovereignty.[194]

Although states may raise concerns about such a low limit, legitimate security interests and sovereignty issues may be addressed through a zonal approach in near space. Such an approach would, like the seas, grant a right of innocent passage in the area above sovereign air space. In defining innocent passage, reference could be made to the use of the term in UNCLOS. Examples of noninnocent passage found in UNCLOS, made applicable to near space might include: any threat or use of force against the sovereignty, territorial integrity or political independence of the subjacent State or in any other manner in violation of the principles of international law embodied in the charter of the United Nations; any exercise or practice with weapons of any kind; any act aimed at collecting information to the prejudice of the defense or

192. Reinhardt, *supra* note 41, at 126.

193. Although Mr. Reinhardt proposes a 22-kilometer vertical sovereignty limit, I would propose a slightly lower limit, balanced by a degree of subjacent states' rights in near space, in order to place Loon's operations, at 20 kilometers, outside the bounds of airspace. *Id.*

194. U.N. Charter art. 51; Reinhardt, *supra* note 41, at 130.

security of the subjacent state; any act of willful and serious pollution; any act aimed at interfering with any systems of communication or any other facilities or installations of the subjacent state; or other activities not having direct bearing on passage.[195] This system would grant subjacent states significant control over the near space area above their sovereign territory. It would allow private actors, like Google, to pass through the stratosphere and the remainder of near space uninhibited by the requirements of airspace transit, but subject to limited exclusionary rights of subjacent states, should immediate security concerns arise. Such an approach would satisfy many of the security concerns of subjacent states by effectively creating a military buffer zone, like the territorial seas and the contiguous zone. At the point of orbital feasibility, this zone would give way to the outer space regime and become "the province of all mankind."

Although the proposed near space zonal approach may leave significant gaps in terms of regulation, the ICAO would be the most appropriate body for developing standards for operation in near space, a point supported by several commentators.[196] "Using the ICAO to develop standards for near space activities would allow utilization of an efficient, established, international organization with almost universal membership."[197] A vast range of standards would need to be drafted, including liability and safety provisions, and the pace of development of near space activities requires efficient lawmaking and rule implementation. By utilizing the ICAO, problems such as the development of a new organization, state ratification of a new treaty, funding, and jurisdictional clarification can be avoided.[198]

Such a system would have numerous benefits for near space actors like Google and would provide subjacent states with adequate control over the air space and near space regions above their territory to satisfy legitimate security concerns. Those simply passing through near space would be free to do so without hindrance, assuming they meet all ICAO safety and usage regulations. In the stratosphere, Loon's equipment could then freely pass over the territory of oppressive regimes on its way to desired markets. Subjacent states would retain sovereignty over air space, but would relinquish some level of sovereignty in the area above the limits of commercial aviation. This system would balance subjacent

---

195. *See* UNCLOS, *supra* note 179, art. 19.

196. *See* Reinhardt, *supra* note 41, at 132-35 (naming several others who have argued that the ICAO is the best organization for regulating near space activity).

197. *Id.* at 134-35.

198. *Id.*

state security interests and interests of near space actors in a manner that both preserves sovereignty and promotes development in the near space region.

Furthermore, this approach avoids several issues that plague the spatial and functional approaches. First, instead of relying solely on a physical demarcation, this approach would allow subjacent states to retain certain rights in near space, above the limits of vertical sovereignty. Thus, objectionable activity can be limited, and legitimate national security concerns can be given effect. The history of both the seas and aerospace has demonstrated the difficulty in obtaining the necessary consensus for establishing a physical demarcation. This is due in large part to the unwillingness of states to divest themselves of sovereignty claims. But, by allowing states to retain rights in the intermediate region of aerospace, perhaps they can recognize the benefits of low demarcation. As mentioned earlier, under the spatial approach, any agreed upon demarcation would be extremely high, and most states would not be willing to adjust this boundary to a more practicable altitude at some later date. However, by establishing a low limit on vertical sovereignty, this approach allows for the adjustment of this limit, should it become necessary in the future, because states are more likely to favor alterations that increase rather than decrease the extent of their sovereignty.

A primary critique of the functional approach is that it would require a consolidation of airspace and outer space, effectively necessitating a dismantling of the current regimes, in order to unify the two.[199] This would be time consuming, and the gaps left by each in defining its scope of applicability would render the functional approach a jumbled, confusing system, with much left to decide regarding the appropriate criteria for categorizing *spacecraft* and *space activity*. However, the suborbital zonal approach would leave the current airspace and outer space regimes intact and allow for a fairly simple right of innocent passage in near space. In addition, it would give the ICAO the authority to regulate this region, allowing effective development of near-universal standards for near space actors. Assuming states realize the benefits of a low demarcation and the merits of a broad set of rights, reserved to subjacent states, in areas above this demarcation, such a system can adequately balance the interests of subjacent states and near space actors while allowing room for development as near space becomes a medium for increasingly diverse, practical, and profitable activity.

---

199. Oduntan, *supra* note 91, at 70-71.

VII. CONCLUSION

It is clear that sovereign airspace must, at some point, give way to the global commons of outer space. However, the absence of any internationally agreed upon statement of this point of departure is a glaring omission by both the Chicago Convention and the Outer Space Treaty. Though many have recognized and debated the issue of airspace and outer space delimitation, no consensus has been reached, and many have argued that no such boundary is necessary.[200] This has left a striking gap in the *lex lata* of airspace and outer space. However, the time is now for the international community to come together and settle this question. Some may claim that defining the vertical limits of state sovereignty is an issue not yet ripe for consideration, but they fail to take adequate notice of the significant advances in technology that have enabled the development of interests in near space.

Loon is one of several interests that has arisen in near space, and it may serve as a case study for future development of rights in that area. The hurdles Loon will face in the absence of an international determination that the near space region is beyond the scope of sovereign jurisdiction may create added costs and render its vehicles unable to safely traverse near space. Furthermore, without a determination regarding the limits of vertical sovereignty, states seeking to exclude near space actors like Loon may exert extremely high claims of vertical sovereignty or exclude them arbitrarily, without the need to justify such claims through legitimate security concerns. This situation would have a negative effect on the future of near space activity and the development of an industry that could have an intensely positive impact on currently isolated parts of the globe.

The prevailing approaches on the issue of air-space delimitation, spatialism, and functionalism have each elicited some support, but neither approach provides an adequate solution. Due to the fact that both functionalism and spatialism rely on the *lex lata* of airspace and outer space in determining the applicable regime for near space, both approaches fail to take into account the distinct nature of activities in near space and the effect of the unequivocal contrast between subjacent states' absolute sovereignty over airspace and the total relinquishment of sovereignty claims in outer space. This situation has caused states to be extremely reluctant in formulating a workable airspace delineation, which would require them to effectively sign over to an international

200. *Id.* at 66.

body total control of a region where subjacent states might perceive existing threats to their national security.

Thus, a new system must be devised that strikes a balance between states' rights in protecting their territory and the rights of near space actors in accessing and utilizing near space—the near space zonal approach. By taking note of the zonal approach utilized in UNCLOS, such a system should be able to gain adequate support by ameliorating the black-and-white distinction between air and space and by providing a right of innocent passage in near space while reserving some degree of control over near space activity to subjacent states. This system can counter old reservations over a low limit on state sovereignty by reserving to subjacent states the right to exclude those engaged in nonpeaceful uses of near space. The near space zonal approach could be effectively and efficiently implemented because it keeps the existing airspace and outer space regimes intact and would rely on the ICAO to formulate regulations and enforcement mechanisms.

Whether such a system will ever come to fruition is a matter left to international policymakers. However, the need for clarification regarding the territorial categorization of near space and the rights that subjacent states may exercise against those in near space is clear. Near space is becoming a more realistic medium for economically viable, increasingly diverse uses, and the current air and space regimes cannot persist without defining their scope of application. The failure to define airspace and outer space can no longer be overlooked. As the line between air and space becomes increasingly blurry, the *lex lata* of airspace cannot reconcile the two regimes because of the distinct and mutually exclusive nature of sovereign territory and *res communis omnium*. Although Judge Posner's assertion, "Law lags science; it does not lead it,"[201] has often proved true, the law's failure to assess rights in near space may have disastrous consequences as Google and other near space actors embark upon a new era of development in a region where their right to do so remains up in the air.

201. Rosen v. Ciba-Geigy Corp., 78 F.3d 316, 319 (7th Cir. 1996).