WORLDS APART: THE LEGAL CHALLENGES OF SUBORBITAL FLIGHTS IN OUTER SPACE

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> *"The natural property of a wing is to carry something heavy aloft, up on high to the abode of the gods. There is a sense in which, of all the things that are related to the body, wings have more of the divine in them."*
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> — *Plato*[1]

I. AT THE EDGE OF SPACE

The future promises many possibilities, and one of the most challenging is the development and reimagination of travel. We are fortunate to live during the second age of space exploration and must now adapt and press forward. The development of travel will require close cooperation by all actors involved, but it will also require an understanding of the be-

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1. PLATO, PHAEDRUS 29 (Robin Waterfield trans., Oxford Univ. Press 2002).

havior of suborbital vehicles, aircraft capable of operating in outer space.

We can envision a flight, possibly fifteen years from now, with a crew and passengers aboard a suborbital vehicle en route from Miami to Paris via a high-speed elliptical trajectory that intersects the atmosphere, completing the journey within ninety minutes. What many consider impossible today could very well become reality tomorrow. It is remarkable how science fiction writers have delivered far more than originally expected. In 1968, the U.S. television audience was introduced to the science fiction show *Land of the Giants*.[2] The story is set in a not-too-distant future, focusing on the passengers and crew of the *Spindrift*, a suborbital vehicle traveling from Los Angeles to London.[3] As is always the case, these new technologies brought new challenges and new difficulties. In the show, the crew of the *Spindrift* encountered a space anomaly at the moment the suborbital craft entered outer space, causing it to deviate from its course and become lost in another world.[4] Though fictional, this story presents questions about suborbital flight that are relevant today. Both the law and science must now unite to find solutions for the upcoming challenges of space exploration.

In view of the technological development and challenges of the new space age, this Article will discuss the relevant issues of international space law in the next four sections. Part II considers the factual and legal propositions related with air and space and discusses why they should be classified as completely different environments. Part III addresses the expected claims by States regarding the appropriation and control of outer space in light of Article I (1) of the Outer Space Treaty's principle of a "Common Interest" for exploration and use.[5] This Part further discusses upcoming launches of suborbital vehi-

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2. LINCOLN GERAGHTY, AMERICAN SCIENCE FICTION FILM AND TELEVISION 49–50 (2009).

3. JON ABBOTT, IRWIN ALLEN TELEVISION PRODUCTIONS, 1964–1970: A CRITICAL HISTORY OF VOYAGE TO THE BOTTOM OF THE SEA, LOST IN SPACE, THE TIME TUNNEL AND LAND OF THE GIANTS 271 (2006).

4. Oscar De Los Santos, *Irwin Allen's Recycled Monsters and Escapist Voyages*, *in* CHANNELING THE FUTURE: ESSAYS ON SCIENCE FICTION AND FANTASY TELEVISION 25, 36 (Lincoln Geraghty ed., 2009).

5. Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bod-

cles and the space anomalies they may encounter, while taking into account how those travels relate to the governance of air and space. Part III discusses the functioning of suborbital vehicles and the characteristics that define outer space in search of an answer to define the demarcation line for outer space. Part IV notes the immediate need to develop space law to address impending technological developments and suborbital activities by governments and the private sector. The suborbital commercial industry will soon open the door to vehicles traveling in trajectories partially in outer space and thus located outside national territorial sovereignty. This Part offers a humble suggestion with two simple elements: (1) a proposed demarcation for outer space and (2) a new legal regime to manage it. This suggestion encompasses a new multi-stakeholder corporation that could draft and adopt new policies for the emerging suborbital industry.

II. Air and Space

Air and space are completely different environments. For this reason, suborbital journeys will require careful testing and planning to account for the unknown potential challenges associated with suborbital travel. The first challenge is the trajectory that suborbital vehicles (spaceplanes) will follow.[6] Suborbital flight paths will take passengers in a trajectory that will include both air space and outer space. What legal regime should govern that trajectory? The physical characteristics of air space and outer space are quite unique. For example, as noted later in Part IV, a vehicle's design defines its ability to enter outer space.[7] Once outside the atmosphere of our planet, the vehicle could be subjected to gravitational forces that do not exist within air space.[8] For this reason, it is inaccurate to compare an airplane with a suborbital spaceplane.

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ies art. I, para. 2, Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty].

6. *See* Mark J. Sundahl, *Legal Status of Spacecraft, in* Routhledge Handbook of Space Law 42, 53 (Ram S. Jakhu & Paul S. Dempsey eds., 2017) (listing two examples of spaceplanes and posing the question of whether they should be governed by air or space law).

7. *See infra* Part IV. A.

8. *See, e.g.*, Slava G. Turyshev & Viktor T. Toth, *The Puzzle of the Flyby Anomaly*, 148 Space Sci. Rev. 169, 169 (2009) (discussing techniques for

Future engineers will need to tackle many mysteries yet to be understood to facilitate suborbital travel, one of which is known as "the flyby anomaly."[9] The flyby anomaly is a space distortion which poses a challenge to orbital mechanics and a puzzle for aerospace engineers.[10] The European Space Agency explains that the flyby anomaly is an unexpected energy increase during Earth swingbys of spacecraft, which causes unexplained speed variations during the journey of a spacecraft.[11] The word *flyby* comes from the very careful planning for the trajectory of a spacecraft, in which it "passes close, but isn't 'captured' into an orbit by gravity."[12] The anomaly causes a significant change in a spacecraft's trajectory, requiring a substantial mass of propellant to maintain a highly elliptical orbit. It considerably increases the cost of a mission.[13] This anomaly is why for missions taking place purely in space, the "alternative approach is to utilize a gravitational assist from an intermediate planet that can change the direction of the velocity vector."[14] The flyby effect is well-documented, having been detected by such notable missions as Galileo, the Near Earth Asteroid Rendezvous (Shoemaker), Cassini, and the European Space Agency's Rosetta.[15] The flyby anomaly exists only in outer space, and its effect on spacecraft only occurs while outside of Earth's atmosphere.[16] This anomaly is one source of proof that air space and outer space are distinct and separate physical environments. That distinction provides the basis for

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utilizing the gravitational force exerted by other planets to change the trajectory of a spacecraft).

9. B. Jouannic et al., *The Flyby Anomaly: An Investigation into Potential Causes*, TUDELFT 1 (Dec. 31, 2015), http://repository.tudelft.nl/islandora/object/uuid:a537388f-c526-45ee-b762-514a8d0ed14f?collection=research.

10. *Id.*

11. European Space Agency, *ESA's Rosetta Spacecraft May Help Unravel Cosmic Mystery*, SPACEREF (Nov. 12, 2009), http://www.spaceref.com/news/viewpr.html?pid=29609.

12. *What is a Flyby?*, NW. UNIV. QUALITATIVE REASONING GRP., http://www.qrg.northwestern.edu/projects/vss/docs/navigation/2-what-is-flyby.html (last visited May 10, 2017).

13. Turyshev & Toth, *supra* note 8, at 169.

14. *Id.*

15. *Id.* at 170.

16. *See generally* European Space Agency, *supra* note 11 (discussing the speed variations—referred to as flyby or "swingby" effects—that have been observed in a number of spacecraft missions).

discussing suborbital flights and their relation to the delimitation of outer space.

Space, however, is just one component to consider in suborbital flights. If a vehicle is going to cross two environments in one journey, then environmental differences are crucial. In particular, we must ask, how should the boundary that separates *air space* from *outer space* be delimited? Will the development of new suborbital vehicles be the catalyst for the establishment of a boundary between air space and outer space? If this is the case, what should be the height of this boundary, and what criteria should be utilized? When addressing questions related to suborbital flights, the location of the space object may not be clear. This is primarily due to the lack of a universally recognized definition for the delimitation of outer space within international law.[17]

Finding a sustainable solution to the delimitation of outer space could aid in the planning of future launches, improve relations among nations, speed travel time for passengers, and help the private sector to properly evolve within the second space age. This question was on the agenda of the UN Committee on the Peaceful Uses of Outer Space (COPUOS) Legal Subcommittee in 1977,[18] and in 2010 this question was addressed again, this time with some limited success by the United Nations International Civil Aviation Organization (ICAO).[19] In 1951, Professor John Cobb Cooper noted that "if international relations are to be conducted in the future in anything approaching a normal manner, both the statesman and the jurist ought to know the extent to which a State has the acknowledged right to control all activity in the areas of

17. *See* Sundahl, *supra* note 6, at 53 (noting that "[n]one of the existing space treaties provide any useful guidance regarding the delimitation of outer space").

18. Comm. on the Peaceful Uses of Outer Space, *The Question of the Definition and/or the Delimitation of Outer Space: Background Paper Prepared by the Secretariat*, U.N. Doc. A/AC.105/C.2/7 (1970); *see also* Comm. on the Peaceful Uses of Outer Space, *The Question of the Definition and/or the Delimitation of Outer Space: Background Paper Prepared by the Secretariat: Addendum of 1977*, U.N. Doc. A/AC.105/C.2/7/Add.1, at 6-14 (1977).

19. *See* Comm. on the Peaceful Uses of Outer Space, Rep. of the Legal Subcomm. on the Concept of Suborbital Flights: Information from the International Civil Aviation Organization (ICAO), U.N. Doc. A/AC.105/C.2/2010/CRP.9 (2010).

space above its surface territory."[20] Indeed, Cooper noted that the territory of a State could be defined by looking to international law principles that define and demonstrate those regions in which the State can "exercise national sovereignty to the exclusion of all other States."[21] While Cooper's observation remains key, the question of the delimitation of outer space requires further analysis within the evolving context of today's suborbital vehicles.

If the orbital delimitation question alone could not offer a solution, could the design of suborbital vehicles offer additional clarification? An example from science fiction is illustrative. The *Six Million Dollar Man* was a television series based on the fictional character of astronaut Colonel Steve Austin.[22] In the pilot episode, Colonel Austin flies a lifting body aircraft—a wingless vehicle tested by NASA pilots from 1963 to 1975.[23] These vehicles were designed to fly "back to Earth from space and land[ ] . . . like an aircraft at a pre-determined site."[24] Ironically, the lifting body was designed mainly to ease the reentry of a craft into the atmosphere, giving the astronauts a more "dignified" way to return to Earth, rather than relying on a clumsy capsule with a parachute.[25] Initially, the launch of the suborbital vehicle was not a major consideration, though it is notable the term "launch point" was used to describe the takeoff location for the X-15, the first official lifting body operated by the US Air Force.[26] By associating the concept of the "launch point" with this vehicle, it is possible NASA was equating the X-15 with a spacecraft rather than an aircraft.

The new wave of commercial space activities has given States and the private sector unique opportunities and challenges to make history. The entire world seems to be benefit-

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20. John C. Cooper, *High Altitude Flight and National Sovereignty*, 4 THE INT'L L.Q. 411, 411 (1951).

21. *Id.*

22. *See* Arthur Stinner, *Physics and the Bionic Man*, 88 NEW SCIENTIST 806, 807 (1980).

23. *See NASA Armstrong Fact Sheet: Lifting Bodies*, NASA (Feb. 28, 2014), https://www.nasa.gov/centers/armstrong/news/FactSheets/FS-011-DFRC.html.

24. *Id.*

25. MILTON O. THOMPSON, AT THE EDGE OF SPACE: THE X-15 FLIGHT PROGRAM 148 (1992).

26. *Id.* at 162.

ing from the discoveries made by orbiting telescopes. For example, NASA's Kepler space observatory has opened for humanity a unique door to a world of new opportunities.[27] After years of observations and study, astronomers continue to discover new exoplanets, which in the fullness of time will offer new horizons for human exploration.[28] For example, NASA's discovery of the TRAPPIST-1 system offers new opportunities for space exploration.[29]

The road toward these horizons began at the end of World War II, a time of reflection and one that placed the United States of America in a unique position. Under President Eisenhower, the United States refocused its efforts toward education and space exploration.[30] In 1957, the Soviets launched Sputnik, the first satellite in Earth's orbit, into outer space.[31] Prompted by the emerging "space race," Eisenhower created the Advanced Research Projects Agency (ARPA)—a program which later evolved into research for a networking system—to ensure U.S. technological superiority.[32]

Apart from igniting the "space race," the launch of Sputnik also solidified one of the most important elements of international customary law: freedom of movement into outer

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27. *See Kepler and K2: Mission Overview*, NASA, https://www.nasa.gov/mission_pages/kepler/overview/index.html (last updated Feb. 8, 2017).

28. *See Exoplanet Exploration Program: NASA's Search for Habitable Planets and Life Beyond Our Solar System*, NASA, https://exoplanets.nasa.gov/exep/ (last visited May 10, 2017) (providing links to a number of descriptions of NASA missions within their exoplanet program).

29. *See* Henry Bodkin, *Nasa Discovers New Solar System TRAPPIST-1 - Where Life May Have Evolved on Three Planets*, TELEGRAPH (Feb. 23, 2017), http://www.telegraph.co.uk/science/2017/02/22/nasa-announcement-live/.

30. *Eisenhower Interactive Timeline: Lesson Plan Archive*, EISENHOWER MEMORIAL, https://timeline.eisenhowermemorial.gov/lessonplans (last visited May 10, 2017).

31. *See generally* PAUL DICKSON, SPUTNIK: THE SHOCK OF THE CENTURY 24 (2001) (narrating the historic events leading up to the Sputnik's launch and the aftermath reaction).

32. *See* ROY BALLESTE, INTERNET GOVERNANCE: ORIGINS, CURRENT ISSUES, AND FUTURE POSSIBILITIES 11 (2015) ("The idea of the Internet originated with a psychologist, Joseph Carl Robnett Licklider, who, in 1960, foresaw the utilization of computers as extensions of the human being. His idea accompanied him to his new job in the Advanced Research Projects Agency (ARPA), an agency established by President Dwight Eisenhower during the early days of the Cold War to serve as a structure for advanced technological development.").

space.[33] Indeed, Judge Manfred Lachs of the International Court of Justice noted in his dissenting opinion in the *North Sea Continental Shelf Cases* of 1969 the following:

> However, the great acceleration of social and economic change, combined with that of science and technology, have confronted law with a serious challenge: one it must meet, lest it lag even farther behind events than it has been wont to do.
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> To give a concrete example: the first instruments that man sent into outer space traversed the air space of States and circled above them in outer space, yet the launching States sought no permission, nor did the other States protest. This is how the freedom of movement into outer space, and in it, came to be established and recognized as law within a remarkably short period of time. Similar developments are affecting, or may affect, other branches of international law.[34]

Although noted in a dissenting opinion, this observation has withstood the test of time. Manfred Lachs would later note that the expansion of the activities of states brought law into new areas, permitting international law to acquire new dimensions.[35] Lachs stated international law "has followed man throughout his journey in time and space, for this is its function and destiny as reflected by history."[36] The world re-encountered the marvel of spacecraft technology thirty-six years later, when in 2004, the *WhiteKnight 1* carried *SpaceShipOne* to the edge of space.[37] As a result, when considering claims associated with outer space by States, courts should consider the

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33. *See* Ulrike M. Bohlmann & Steven Freeland, *The Regulation of Space Activities and the Space Environment*, *in* ROUTLEDGE HANDBOOK OF INTERNATIONAL ENVIRONMENTAL LAW 375, 376 (Shawkat Alam et al. eds., 2013).

34. North Sea Continental Shelf (Federal Republic of Germany v. Denmark/Netherlands), Judgment, 1969 I.C.J. Rep. 219, 230 (Feb. 20) (dissenting opinion by Lacks, J.).

35. MANFRED LACHS, THE LAW OF OUTER SPACE: AN EXPERIENCE IN CONTEMPORARY LAW-MAKING 11 (Tanja Masson-Zwaan & Stephan Hobe eds., 2014).

36. *Id.*

37. ERIK SEEDHOUSE, SUBORBITAL: INDUSTRY AT THE EDGE OF SPACE 15 (2014).

capabilities of these suborbital vehicles, a subject addressed in the following segment.

III. In Search of a Place in Heaven

> *"There are glimpses of heaven to us in every act, or thought, or word, that raises us above ourselves."*
> —*Arthur P. Stanley*[38]

Both air and space legal regimes must address the nature and future evolution of suborbital flights for the purposes of transport of passengers and cargo. Alternatively, states could create an entirely new regime to govern suborbital flights.[39] Currently there is no clear international consensus regarding the future regulation of these flights, but this is a matter that requires attention.[40] It is prudent to emphasize outer space and consider its many possibilities, because the future evolution of human travel will inevitably involve space flight. However, we cannot dismiss the considerations of State sovereignty. Professor Myers S. McDougal noted in 1963 that a "Regime of Outer Space" would require that "all the important decisions with respect to space activities [be] taken by legal process."[41] He described this legal process as being linked to a free society that shares power and values human dignity.[42] Most noticeably and prophetically, McDougal stated:

> We cannot . . . expect that claims by states to exclusive control of the air space above their territories will disappear. In our time, for commercial reasons, as well as for security, we will undoubtedly continue to share expectations of relatively exclusive control of something people choose to call airspace.[43]

McDougal's words stand in contrast to the 1966 *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies*, known as the "Outer Space Treaty."[44] Article I (1) of the treaty an-

38. Tryon Edwards, A Dictionary of Thoughts 29 (1908).
39. See *infra* Part IV.
40. Sundahl, *supra* note 6, at 53.
41. Myers S. McDougal, *The Prospects for a Regime in Outer Space*, *in* Law and Politics in Space 105, 106 (Maxwell Cohen ed., 1964).
42. *Id.*
43. *Id.* at 115.
44. Outer Space Treaty, *supra* note 5.

nounces a general principle that "[t]he exploration and use of outer space . . . shall be carried out for the benefit and in the interests of all countries . . . and shall be the *province of all mankind*."[45] The Outer Space Treaty was the product of the progressive work of the United Nations Committee on Peaceful Uses of Outer Space (UNCOPUOS) Legal Subcommittee.[46] It is still considered "one of the most significant law-making treaties concluded in the second half of the twentieth century"[47] and provides the framework on international space law, as well as the legal regime of celestial bodies.[48] Adopted by the United Nations General Assembly on December 19, 1966, the treaty entered into force on October 10, 1967.[49] As of January 2017, there are 105 State parties to the treaty, and another twenty-five have signed but have not completed ratification.[50]

Article I (2) of the Outer Space Treaty notes, "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."[51] However, concerns over jurisdiction in space still exist. This is why jurisdiction should apply to the use of suborbital vehicles in outer space instead of jurisdiction applying over a portion of outer space itself. These jurisdictional considerations of the appropriation of outer space have even greater meaning for those considering entering into activities related to the commercialization of outer space.

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45. *Id.* at art. I, para. 1 (emphasis added).

46. *See Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies*, U.N. OFFICE FOR OUTER SPACE AFFAIRS, http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html (last visited May 10, 2017); *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies*, UNITED NATION'S AUDIOVISUAL LIBRARY OF INT'L LAW, http://legal.un.org/avl/ha/tos/tos.html (last visited May 10, 2017).

47. UNITED NATION'S AUDIOVISUAL LIBRARY OF INT'L LAW, *supra* note 46; *see also* R.S. Jakhu & S. Freeland, *The Sources of International Space Law*, 56 PROC. OF THE INT'L INST. OF SPACE L. 461, 466 (2013).

48. Jakhu & Freeland, *supra* note 47, at 466.

49. *Id.*

50. *See* Comm. on the Peaceful Uses of Outer Space, Rep. of the Legal Subcomm. on the Status of International Agreements relating to activities in outer space at 1 January 2017, U.N. Doc. A/AC.105/C.2/2017/CRP.7 (2017).

51. Outer Space Treaty, *supra* note 5, at art. I, para. 2.

Jurisdiction, though, has to be tempered with responsibility, which is why Article III of the Outer Space Treaty notes that:

> States Parties to the Treaty shall carry on activities in the exploration and use of outer space, including the moon and other celestial bodies, in accordance with international law, including the Charter of the United Nations, in the interest of maintaining international peace and security and promoting international cooperation and understanding.[52]

While States must observe elements of jurisdiction and responsibility, there must also be international cooperation to face the challenges that pilots and engineers will encounter as they work together to improve travel into outer space. This was painfully demonstrated by the accident of the SpaceShipTwo-class vehicle, the *VSS Enterprise*,[53] which was destroyed in a trial run over the Mojave Desert with the tragic loss of the pilot.[54] Though this situation was unfortunate, dreams cannot be abandoned due to disaster. Both the United States and the Soviet Union sacrificed much in order to develop their space programs, and their efforts took humanity to the next level of development.[55] Soon, the *VSS Unity*—the new SpaceShipTwo-

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52. Outer Space Treaty, *supra* note 5, at art. III.

53. *See* Loren Grush, *NTSB Reveals Cause of Virgin Galactic's Deadly SpaceShipTwo Crash*, VERGE (July 28, 2015), http://www.theverge.com/2015/7/28/9056423/virgin-galactic-spaceship-crash-cause-tail-wings-feathering. It was likewise reported that the test co-pilot unlocked the spaceplane's feathering system too early. *Id.*

54. *Id.*

55. Roy Balleste, *Interstellar Travel and the Mission for Outer Space: A Human Rights Perspective*, 18 SMU SCI. & TECH. L. REV. 219, 227–28 (2015) ("Great sacrifices, unfortunately, accompany the great accomplishments in space travel. On January 27, 1967, the United States lost its first three astronauts. The scheduled Apollo 1 mission (AS-204) was the first manned enterprise of the U.S. Apollo lunar program. An accidental fire prevented the mission from taking place and killed the astronauts. Concurrently, the Soviet Union also experienced fatalities during two of its own missions. On April 24, 1967, the Soyuz 1 mission ended in disaster when the craft's parachute failed to open properly upon atmospheric reentry. As the capsule hit the ground at high speed, its sole cosmonaut was killed. The losses sadly continued. On June 30, 1971, the three-man crew of Soyuz 11 asphyxiated during the module's separation from the Salyut 1 space station. An air vent opened prematurely, exposing the crew to the vacuum of space for at least eleven minutes. Hardships from humanity's journey to the stars continued with the tragedy

class suborbital rocket-powered vehicle—will continue the journey of discovery.[56]

As a new form of travel and technology, suborbital flights will encounter not only technological challenges but future legal claims as well. Governance of these claims is directly related to the environments mentioned earlier: air and space. In both environments, suborbital vehicles experience gravitational forces based on the magnitude of their acceleration, the pull of gravity, and their position.[57] Altitude and speed are the two main elements of their functionality. These technological and environmental elements exist in the physical world, but the atmosphere is a natural demarcation that remains invisible in the legal and political sense. In order to resolve the problem of jurisdiction over suborbital flight claims, the international community will need to determine where the boundary between air and space lies. For this reason, a good way to approach proper definitions of both air and space is to recall Professor Cooper's assertion:

> My own view has always been that these terms were intended to mean exactly what the English version meant, namely, the region of space where the 'air' was present in, it must be assumed, sufficient quantities to support flight in the balloons or airplanes which were regulated by the [Paris] convention.[58]

A. *The Environment of Outer Space*

Discussions about the environment of outer space have had a long history, tracing back to 1970, when the United Nations Office of Outer Space Affairs addressed it along with vari-

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on January 28, 1986. The Space Shuttle Challenger (mission STS-51-L) broke apart seventy-three seconds into its flight and killed all seven crew members. On February 1, 2003, another tragedy occurred when the Space Shuttle Columbia (mission STS-107) disintegrated over Texas and Louisiana upon reentering the atmosphere, killing all seven crew members. It is a testament to humanity that the space program endures despite these terrible losses.").

56. *Update from Mojave: The Next Phase of Flight Test*, VIRGIN GALACTIC (Nov. 1, 2016), http://www.virgingalactic.com/update-from-mojave-the-next-phase-of-flight-test/.

57. DAVID A. VALLADO, FUNDAMENTALS OF ASTRODYNAMICS AND APPLICATIONS 141 (2013).

58. Cooper, *supra* note 20, at 413.

ous functional considerations[59] By 1984, scholars were still debating the delimitation of air and outer space. At the center of the debate were (1) the unidentified boundary between outer space and air space and (2) the implications of state sovereignty.[60]

There are two approaches to distinguish between air and space: functionalist and spatialist.[61] The functionalist approach asks whether the vehicle was classified as an aircraft or a spacecraft.[62] The spatialist approach considers whether the object traveled in the air space, outer space, or both.[63] To those two methods of classification, additional proposals for demarcation provide further clarification, such as:[64]

1) The *geo-physical* boundary: the upper limit of the atmosphere (10,000 km);
2) The *meteorological atmosphere* boundary: where the air is still directly influenced by the underlying Earth's surface and physical conditions (80 to 85 km);
3) The *propulsion of vehicles* boundary: the line between aeronautics and astronautics;
4) The *satellite's perigee* boundary: the minimum height at which a satellite can orbit;
5) The *multilevel frontier* (several frontiers): demarcating territorial sovereignty with aerodynamic flights, followed by a neutral zone (this concept will be revisited below in this paper);
6) The *effective control* boundary: based on the state's power of control over the expanse above its territory (also considering its defensive weapons capabilities);
7) And, the *geo-stationary orbit* boundary: this approach, supported by the USSR in a working paper presented at the 1979 session of the COPOUS

59. *See The Question of the Definition and/or the Delimitation of Outer Space: Background Paper Prepared by the Secretariat*, *supra* note 18; *see also The Question of the Definition and/or the Delimitation of Outer Space: Background Paper Prepared by the Secretariat: Addendum of 1977*, *supra* note 18.

60. *See* Damodar Wadegaonkar, The Orbit of Space Law 38 (1984).

61. Paul Stephen Dempsey, Public International Air Law 995 (2008).

62. Wadegaonkar, *supra* note 60, at 38.

63. *Id.*

64. Concepts 1-7 are elaborated upon in *id.* at 39.

Legal Sub-Committee, supported the concept that outer space was the region above 100 km altitude from sea level.[65] This conception was supported in Australia's 1998 Space Activities Act.[66]

The above-mentioned concepts construct a larger picture of the challenges in determining a universally recognized delimitation between outer space and air space. Yet, in order to complete that picture, other factors need to be added to the analysis. As international law scholar Gbenga Oduntan has remarked, while the notion of sovereignty appears not to rise "above the bounds of the earth's airspace . . . it makes no sense in conventional terms to speak of sovereignty in outer space."[67] Oduntan has further noted additional possible conceptions of the boundary between air and space that are equally interesting, but also equally problematic:[68]

8) The *No Present Need* Theory: While a demarcation line must be drawn somewhere, the fact that one has not been set, has not created any discernable international tensions. To create a boundary may in effect cause the opposite, in essence, opening the proverbial Pandora's box.
9) The *Aerodynamic Lift* Theory: This concept utilizes the aircraft as the demarcation line: the point where air lift has been reduced to zero and circular velocity takes over.
10) The *Bogotá Declaration* View: This unsuccessful political concept was the construct of Brazil, Colombia, the Republic of the Congo, Ecuador, Indonesia, Kenya, Uganda and Zaire—as ex-

65. *Id.* at 50. *See also* Comm. On the Peaceful Uses of Outer Space, *Historical Summary on the Consideration of the Question on the Definition and Delimitation of Outer Space: Report of the Secretariat*, U.N. Doc. A/AC.105/769, at 3 (2002).

66. *Space Activities Act 1998* (Cth) (Austl.), https://www.legislation.gov.au/Details/C2004C01013.

67. Concepts 8-12 are explained in Gbenga Oduntan, *The Never Ending Dispute: Legal Theories on the Spatial Demarcation Boundary Plane Between Airspace and Outer Space,* 1 HERTFORDSHIRE L.J. 64, 66–81 (2003).

68. Dr. Oduntan notes that "[i]t might, however, be suggested that the reason why the indecision over the issue of spatial demarcation has been allowed to fester so long is because the absence of a precise boundary is advantageous to the dominant interests in international space exploration." *Id.* at 69.

pressed in the words of the Bogotá Declaration of 1976—claiming "sovereignty up to the geostationary orbit (GSO) above their territories" (22,300 miles or 36,000 km).

11) The *Usque Ad Infinitum* Theory: In this case, some scholars suggested—erroneously—that sovereignty extended to infinity. This situation would be a violation of international law and inconsistent with basic astronomical facts.[69]

12) The *Lowest Point of Orbital Flight* Theory: This method is inadequate because it places the sovereignty demarcation at the "lowest height at which an object requires to enter into orbit and circle the Earth," basing variations of this proposition on the imprecise characteristics of the atmosphere (between 70 km and 160 km).[70]

Analyzing all of these concepts together, there is one inescapable conclusion: the line between air and space has been blurred by the advancements of technology.[71] The scholar facing these ideas should consider the functional and spatial aspects of suborbital flights in combination because both concepts, when taken together, offer greater clarification. As Hans Lindahl has noted, "Spatially speaking . . . any and every spatial boundary of a legal order, even the most 'mundane' and apparently insignificant, is also a limit that renders it discontinuous with a strange outside."[72] In other words, new developments in space exploration will have repercussions in how governments will define national and international travel. The idea that States' sovereignty boundaries could be enforced be-

69. *Id.* at 78.

70. *Id.* at 79. Dr. Oduntan also observes that "since the above basic schools of thought on the demarcation line between airspace and outer space have produced no overwhelming consensus and no international agreement, legal writers have [also] suggested several arbitrary distances. The criteria for choosing these arbitrary distances vary and depend on the particular factors that appeal most to the imagination of its proposer." *Id.* at 81.

71. Dempsey, *supra* note 61, at 41.

72. Hans Lindahl, Fault Lines of Globalization: Legal Order and the Politics of A-Legality 43 (2013).

comes incompatible with developments in, for example, cyberspace and outer space technologies.[73]

Around 1996, new approaches to delimit air space and outer space were developed, including notions regarding the *geo-physical* boundary and the characteristics of the various levels of the atmosphere.[74] The biological theory included several boundaries: the area between 50 and 80 kilometers, where "past this zone it is impossible to utilize aerodynamic phenomena"; the boundary at 120 kilometers, where the atmosphere lacks measurable physical features such as color and sound—in essence, "the aerodynamic heat barrier";[75] and the boundary at 200 kilometers, where the air space almost disappears and inertia maintains a vehicle in its trajectory unless a kinetic energy source is applied to alter its course.[76] Of all these physical factors, the most relevant is the exosphere, the transitional zone between Earth's atmosphere and outer space.[77] However beyond these, for example, different altitudes bring ordinary physics and physiology into the analysis:[78]

1) At 3 kilometers high, a supplemental oxygen source is required;
2) At 16 kilometers, a pressurized cabin is required;
3) At 20 kilometers, bodily fluids begin to bubble;
4) At 32 kilometers, turbojets are inoperable;
5) At 100 kilometers, ailerons and rudders are no longer functional.

These factors, when considered together, begin to form a definition for suborbital flight and offer the following formula that I devised as a suggested alternative to define the delimitation between air space and outer space:[79]

altitude + velocity + physiology = potential delimitation

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73. *See id.* at 2 ("A host of novel legal orders . . . can no longer be accommodated in a concept of law that takes the spatially bounded state to be the paradigm of legal order.").

74. Robert F. A. Goedhart, The Never Ending Dispute: Delimitation of Air Space and Outer Space 27 (1996).

75. *Id.* at 36.

76. *Id.* at 37.

77. *Id.*

78. David Lefrançois, The Suborbital Pilot's Ground School Manual 11, 14 (2012).

79. *Id.* at 14.

These factors include the characteristics of suborbital engines capabilities and the ability of the human body to withstand changes across the transition between air and space. The formula that emerges, and that is humbly proposed, can be considered in the larger context of a suborbital flight above the previously proposed Kármán line (100 km or 62 mi) with a maximum flight speed below orbital velocity.[80] The Kármán line originated with Theodore von Kármán, who calculated that "above an altitude of approximately 100 kilometers (62 miles, or 328,084 feet), a vehicle would have to fly faster than orbital velocity in order to derive sufficient aerodynamic lift from the atmosphere to stay aloft."[81] For this reason, von Kármán proposed that 100 kilometers be designated the boundary of space—a boundary that is now internationally recognized "for recording aeronautic achievements."[82] In addition to the Kármán line and maximum flight speed, there is one additional consideration: the concept of the *Protozone*. Joseph Pelton introduced the concept of the *Protozone* to describe the unregulated region above commercial air space and below traditional definitions of outer space.[83] The activities in the *Protozone Area*, (i.e. above 21 kilometers and below 100 kilometers) could include new applications in the not too distant future.[84] While all of the factors above provide *guidance* toward a solution delimiting outer space from air space, the Part that follows offers another potential *answer* to the challenge of demarcation.

80. *Id.*

81. Dennis Jenkins, *Extra Feature: A Word About the Definition of Space*, NASA Dryden Flight Research Ctr. (Oct. 21, 2005), https://www.nasa.gov/centers/dryden/news/X-Press/stories/2005/102105_Schneider.html.

82. *Id.*

83. Joseph N. Pelton, *A New Integrated Global Regulatory Regime for Air and Space: The Needs for Safety Standards for the 'Protozone'*, *in* Monograph Series III: Global Space Governance 293 (Ram Jakhu, et al. eds., 2015).

84. *Id.*

IV. Reaching the Abode of the Gods

"Science has not yet mastered prophecy. We predict too much for the next year and yet far too little for the next ten."
— Neil Armstrong, speech to joint session of Congress, 16 September 1969.[85]

Policy makers in the field of space law no longer have time to wait. Development of space law requires immediate attention, before governments and the private sector begin launching suborbital flights. If, as scholars Alexander Harris and Ray Harris believe, the "principle of free and equal utilization of outer space must mean there is a limit to national sovereignty where outer space begins," then a review of legal requirements and jurisdiction is required.[86] Thus, when the suborbital commercial industry finally begins launches on a regular basis, the vehicles traveling in partial trajectories in outer space will be located "outside national territorial sovereignty . . . under Article II of the Outer Space Treaty," and jurisdictional concerns of their travels will include the vehicle, but not outer space itself.[87] Indeed, Cooper noted that "[a]ny theoretical possibility of a State controlling far distant regions in space is absolutely out of the question."[88]

Over the years, these jurisdictional considerations have been a matter of discussion before international bodies. While the 2001 work of the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS) was encouraging, it fell short of offering a definition for the delimitation of outer space.[89] The report observed that some delegations expressed "the view that recent technological developments and emerging legal questions made it necessary for the Legal Subcommittee to consider the question of the definition and delimitation of outer space without delay."[90] But opposition also noted "the

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85. *Joint Meeting of the Two Houses of Congress to Receive the Apollo 11 Astronauts*, 91st Cong. Rec. 25610 (1969) (statement of Neil Armstrong).

86. Alexandra Harris & Ray Harris, *The Need for Air Space and Outer Space Demarcation*, 22 Space Pol'y 3, 3 (2006).

87. *Id.* at 4.

88. Cooper, *supra* note 20, at 418.

89. Comm. on the Peaceful Uses of Outer Space, Rep. of the Legal Subcomm. on Its Fortieth Session, UN Doc. A/AC.105/763, at para. 54–57 (2001).

90. *Id.* at para. 54.

view . . . that it was not necessary to develop any definition or delimitation of outer space when the absence of such a definition had not resulted in any legal or practical problems."[91] It is possible that those with the opposing view wanted to sidestep political and financial ramifications stemming from an official definition. This frustrating outcome seemed to reflect the political interests that normally burden these types of well-meaning committees.

A. *The Vehicles*

During its forty-eighth session in 2009, the Legal Subcommittee of the UNCOPUOS returned to the discussions on the delimitation of outer space.[92] The following year, the Legal Subcommittee considered the study of the International Civil Aviation Organization (ICAO) regarding the Concept of Suborbital Flights which correctly understood these activities to have an effect on future commercial suborbital operations.[93] If these efforts intersected with the activities of international civil aviation, then the Subcommittee would have to first identify what constituted a suborbital flight, carefully avoiding any particular delimiting altitude marker for outer space. The Subcommittee's report stated that "[a] suborbital flight is a flight up to a very high altitude which does not involve sending the vehicle into orbit."[94] To define a suborbital trajectory (and the altitude thereof), the subcommittee referenced Title 49 of the United States Code, which explains that such trajectory involves the "intentional flight path of a launch vehicle, re-entry vehicle, or any portion thereof, whose vacuum instantaneous

91. *Id.* at para. 57.

92. *See* Comm. on the Peaceful Uses of Outer Space, *supra* note 19, at para. 1. The report also noted that "[t]he present conference room paper contains the ICAO secretariat study on the Concept of suborbital flights (C-WP/12436), prepared and presented to the ICAO Council in 2005, which took note of it and requested the ICAO secretariat to further monitor" commercial suborbital operations. *Id.* at para. 3.

93. *Id.* at para. 2. A letter from the ICAO secretariat dated March 17, 2010, noted the Secretariat's awareness of commercial suborbital operations that would affect international civil aviation, as well as its belief that the information contained in its study on the concept of suborbital flights remained pertinent, and therefore, that the Legal Subcommittee could consider the study. *Id.*

94. *Id.* at para. 1.2.

impact point does not leave the surface of the Earth."[95] It isn't clear why the U.N. subcommittee chose U.S. law as the primary guidance, but perhaps they found useful the organizational work regarding suborbital flights by the U.S. Federal Aviation Administration.[96] Along with the delimitation of outer space, the Subcommittee's report also considered the proposed vehicles, and whether their use would "constitute international civil aviation and thus fall[ ] within the scope of the Chicago Convention."[97]

The Committee referenced the Chicago Convention—in particular, Chapter 1 of Annex 7—to search for a classification of vehicles (e.g. SpaceShipOne).[98] It noted that "SpaceShipOne, strictly speaking, does not operate as an aeroplane or even as an aircraft during the ballistic portion of the flight . . . ."[99] This report on the *Concept of Suborbital Flights* was relevant, but at the same time, a bit short on conclusions. Nevertheless, it made three important observations that attempted to define characteristics necessary for a vehicle to travel at the edge of the Earth's orbit:

1) The U.S. Federal Aviation Administration (FAA) granted a launch license to SpaceShipOne as a "Reusable Launch Vehicle" (RLV), and classified the ship as a rocket.[100]
2) The committee discussed the future capabilities of suborbital vehicles and noted that these commercial vehicles in the future might *fly from one State to another.*[101]
3) Under the U.S. Commercial Space Launch Amendment Act of 2004 (CSLAA), sub-orbital RLVs were to be considered as "*suborbital rockets*", namely, "[a] vehicle, rocket-propelled in whole or in part, intended for flight on a sub-orbital trajec-

95. *Id.* (quoting 49 U.S.C. § 70102 (20) (2004)).

96. *The U.S. Commercial Suborbital Industry: A Space Renaissance in the Making*, FED. AVIATION ADMIN., https://www.faa.gov/about/office_org/headquarters_offices/ast/media/111460.pdf.

97. Comm. on the Peaceful Uses of Outer Space, *supra* note 19, at para. 1.5.

98. *See id.* at para. 2.1.

99. *Id.* at para. 2.2.

100. *Id.* at para. 3.3.

101. *Id.* at para. 4.3, 5.2.

> tory, and the thrust of which is greater than its lift for the majority of the rocket-powered portion of its ascent."[102]

Since the drafting of ICAO's report, the development of new technologies alone has made the concept of suborbital vehicles more visible. Indeed, even back in 1993, it was noted that, "in spite of its extensive mandate, UNCOPUOS is not the only international forum for the discussion of legal problems relating to outer space and the elaboration of international space law."[103] A new legal framework will probably be required. As this article has noted, ICAO and UNCOPUOS do not seem equipped to handle the new technological reality. While it may be tempting to search for answers with U.N. agencies, a more out-of-the-ordinary approach may be preferable. As scholars Marietta Benkö & Kai-Uwe Schrogl have noted, it is a mistake to think that "the need for new institutional structures can be assessed only if future requirements are more clear than they are for the time being."[104] For this reason, the governance of outer space would benefit from the illuminating lens of decisions that are authoritative but not controlling, while at the same time encouraging governments to promote space age technology but avoiding the application of total control.[105] This is a primary consideration for a world community that examines the patterns of future trends, and any new "law" will be successful only if it is not simply imposed on the air and space environments.[106] Thus, the future claims can be summarized by looking at one specific challenge and its various factors. This challenge is the recognition of new and needed regulations to be drafted "from scratch or from the collaboration of existing laws," and along with it, the required immediacy

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102. *Id.* at para. 5.4 (quoting 49 U.S.C. § 70102 (19)).

103. Marietta Benkö & Kai-Uwe Schrogl, *The UN Committee on the Peaceful Uses of Outer Space, in* FORUM FOR AIR AND SPACE LAW (Marietta Benkö, ed., 1993).

104. *Id.* at 198.

105. *See* HAROLD D. LASSWELL & MYRES S. MCDOUGAL, JURISPRUDENCE FOR A FREE SOCIETY: STUDIES IN LAW, SCIENCE AND POLICY 30 (1992) (describing the confluence of law and social processes).

106. *See id.* at 408 (distinguishing various notions of what constitutes "law").

that these activities include by observing the following factors:[107]

- The actors associated with suborbital flights;
- Required safety standards;
- Management of aerospace traffic;
- New liability issues;
- Registration of space objects;
- New launching sites;
- Sovereign rights of states to govern air space above their territory and territorial waters.[108]

There is an inescapable reality regarding suborbital flights associated with the classification of these new vehicles that initially seems to relate back to the familiar aviation provisions of the Chicago Convention. Manfred Lachs has wisely noted that "Einstein's caveat that analogies have been 'a source not only of the most fruitful theories, but also of the most misleading fallacies,' . . . [where one] has simply to beware of its pitfalls and seek to grasp reality as comprehensively as possible in proceeding from tried systems to the construction of new ones."[109] He also stated that "the law of outer space must reflect the most progressive tendencies of international law. It must be directed towards the future, not to a work that has been left behind."[110] The law will have to change to accommodate new technologies; and it is the space component along with the capability to reach those tremendous heights that make suborbital vehicles capable of working as a spacecraft, thus requiring new legal definitions. While for now the initial suborbital launches will be limited to the same departure and arrival destinations, without an international component to the flight, the future of suborbital flight is tied directly to its capabilities: in other words, commercial suborbital flights will most likely operate with international trajectories, with rocket engines designed for that purpose, and into the edge of outer

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107. Thomas Cheney & Lauren Napier, *Policy Analysis: Air Versus Space, Where Do Suborbital Flights Fit into International Regulation?*, 7 J. OF SCI. POL'Y & GOVERNANCE 1, 3 (2015).

108. Convention on International Civil Aviation, arts. 1, 7, Dec. 7, 1944, 15 U.N.T.S. 295.

109. LACHS, *supra* note 35, at 21.

110. *Id.*

space. These vehicles' engines will be able to accomplish the following:[111]

1) Fly faster than the speed of sound, at Mach 5 or greater;
2) Require a supersonic-combustion ramjet engine, or scramjet engine;
3) During travel the air will become an electrically-charged field;
4) Will cruise at heights of approximately 60,000 feet;
5) May launch vertically;
6) May be powered by liquid hydrogen and oxygen;
7) May utilize a rocket propulsion system.

Looking back at the Subcommittee's report of 2010 mentioned previously, it seems that their efforts centered on trying to determine how to classify suborbital vehicles. In trying to fit a new technology into the clauses of an older legal instrument, the lack of results to provide an official definition for the demarcation of outer space was not unexpected. This exercise did, however, highlight the need to reconsider outer space law in light of near-future launches. For example, these launches are not just limited to space tourism, but also to the upcoming revolution of hypersonic commercial flights expected to be introduced by the Airbus *Concorde 2* sometime in 2021.[112]

A good way to summarize the main design capabilities of these vehicles is to look at the description provided by the FAA. The FAA explains that these vehicles have the capability to "access outer space, operate within the space environment, return safely to Earth, and can be used again."[113] These are known as RLVs, or the SRLVs, which are "those that do not attain enough velocity to enter into a sustainable orbit around the Earth, [but] may enter space for a brief period . . . and

111. Naomi Leach et al., *Boom Time! The Incredible Planes that Will Bring About a New Era in Supersonic Travel (with One Reaching a Top Speed of 12,000 mph)*, DAILYMAIL (Mar. 28, 2016, 8:00 PM), http://www.dailymail.co.uk/travel/travel_news/article-3512232/Boom-time-incredible-planes-bring-new-era-supersonic-travel-one-reaching-speed-12-000mph.html#ixzz4QUzL8x9Z.

112. *Supersonic Business Jet 'Son of Concorde' Could Take Off As Early As 2021*, FOX NEWS (Nov. 18, 2015), http://www.foxnews.com/travel/2015/11/18/supersonic-jet-gets-go-ahead.html.

113. FED. AVIATION ADMIN., *supra* note 96, at 2.

reenter," with the option of being reused in future missions.[114] It is the goal of suborbital service providers for their vehicles to reach or surpass the altitude of 100 kilometers (62 miles).[115] The FAA also delineated the various ways that these vehicles could reach the atmosphere:[116]

- vertically like a traditional launch;
-high altitude from a carrier craft;
- horizontally take off under rocket power from a runway;
- use rockets or parachutes to assist landing vertically;
- use wings to land like a glider or conventional aircraft.

The FAA's description may need to be amended soon given the constant evolution of engine design, and, along with it, our understanding of suborbital flights. The next technological evolution is the new hypersonic and space access propulsion system designed by the U.K. company Reaction Engines.[117] The company's new *SABRE class* engines "can be used for air travel at over five times the speed of sound or for reusable space launch vehicles . . . [and are] capable of flying from London to Australia in four and [a] half hours or . . . tak[ing] off into orbit from a runway before returning to base and doing it all over again."[118] The future travels into the expanse provide a sense of wonder and adventure. This adventure represents the story of humanity's entry into outer space. The concept of space travel is taking shape now that humanity has the necessary technical and technological capabilities. While the functionality of suborbital vehicles is paramount in the outer space discussion, the policy considerations that by necessity will follow are directly tied to the regime that will manage the delimitation of outer space. This management can be understood with the lessons learned from the Cyberspace Model.

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114. *Id.*

115. *Id.*

116. *Id.*

117. *Our Company*, REACTION ENGINES, https://www.reactionengines.co.uk/aboutus/ (last visited May 11, 2017).

118. *The Future of High Speed Powered Flight*, REACTION ENGINES, https://www.reactionengines.co.uk/vehicles/ (last visited May 11, 2017).

B. *The Cyberspace Model*

This humble suggestion contains two simple elements: a proposed demarcation and a basis for a legal regime to manage it. This is not to say that the space legal community lacks any viable mechanisms. My suggestion, however, acknowledges the politicized process that exists now. First, the previously noted delimitation concept for outer space by Damodar Wadegaonkar[119] of the *multilevel frontier* offers useful characteristics that are enhanced with the additional modifications added by Gbenga Oduntan (*staggered demarcation regime*), as noted below:

1) A lower demarcation line for territorial air space of approximately 55 miles to be considered as the maximum height for the air space, which will be subject to the complete and exclusive sovereignty of the subjacent state.[120]
2) A Buffer Zone for the next 45 miles, which should be recognized as an area of innocent passage for all states.[121]
3) An Outer space demarcation line of 100 miles, which should mark the beginning of Outer Space (completely free from all claims of sovereignty and jurisdiction.[122]
4) To these I would add my own formula as a point of departure: *altitude + velocity + physiology = potential delimitation.*

Second, given the slow progress of both UNCOPUOS and ICAO, one possible solution would be to create a new entity charged with devising the policy making aspects of suborbital flights and move some key governance functions to a multi-stakeholder body. This idea may sound a bit foreign, but it is possible to work with the private sector, academic stakeholders, and international organizations while maintaining the existing international legal regime. The idea of a multi-stakeholder partnership is not new and has been demonstrated by the work of the Internet Corporation for Assigned Names and Numbers (ICANN), which evolved and improved over the

119. WADEGAONKAR, *supra* note 60, at 39.
120. Oduntan, *supra* note 67, at 82.
121. *Id.*
122. *Id.*

years in great part because of how Internet policy has been allowed to develop.[123] ICANN's policy development process is managed in committees with representation from all groups within its inner structure, and governments do not have primary decision making power.[124] This process is probably why ideas turned into implemented cyberspace policy within a few years after initial conception.[125] Rapidly developing areas such as cyberspace technology and outer space technology will require the rapid development of policies due to their very nature. For example, on October 1, 2016, the United States government gave up its control over the Internet.[126] This gesture by the United States was not insignificant. For years, the U.S. Department of Commerce, and in particular its National Telecommunications and Information Administration (NTIA) bureau, supervised control of the Internet.[127] The final transfer to the private sector, under a new governance mechanism within ICANN, still required that the policy development process not replace "the NTIA role with a government-led or an inter-governmental organization solution."[128]

Cyberspace policy, though, is still created with governmental intervention: "ICANN receives input from governments through the Governmental Advisory Committee (GAC). The GAC's key role is to provide advice to ICANN on issues of public policy, and especially where there may be an interaction between ICANN's activities or policies and national laws

123. *See generally Developing Policy at ICANN*, INTERNET CORP. FOR ASSIGNED NAMES & NUMBERS, https://www.icann.org/policy (last visited May 11, 2017).

124. *See generally* BALLESTE, *supra* note 32, at 151–75; *see also*, INTERNET CORP. FOR ASSIGNED NAMES & NUMBERS, *supra* note 129.

125. *See GNSO Policy Development Process (PDP)*, INTERNET CORP. FOR ASSIGNED NAMES & NUMBERS, http://gnso.icann.org/en/node/31379/ (last updated May 31, 2016).

126. *Stewardship of IANA Functions Transitions to Global Internet Community as Contract with U.S. Government Ends*, INTERNET CORP. FOR ASSIGNED NAMES & NUMBERS (Oct. 1, 2016), https://www.icann.org/news/announcement-2016-10-01-en.

127. LENNARD G. KRUGER, CONG. RESEARCH SERV., R42351, INTERNET GOVERNANCE AND THE DOMAIN NAME SYSTEM: ISSUES FOR CONGRESS 4 (2016).

128. *NTIA Announces Intent to Transition Key Internet Domain Name Functions*, NAT'L TELECOMMS. & INFO. ADMIN. (Mar. 14, 2014), https://www.ntia.doc.gov/press-release/2014/ntia-announces-intent-transition-key-internet-domain-name-functions.

or international agreements."[129] The final policy decisions, however, rest with the ICANN Board of Directors as opposed to government actors.[130] For this reason, a potential solution—and the recommendation of this analysis—is the creation of a similar multi-stakeholder body formed with experts from academia, engineering, science, business, economics, law, policy, and government to draft and adopt new policies for the emerging suborbital industry. The outer space environment will require a hybrid management framework, and just as in the case of cyberspace, it may require specialized mechanisms applicable to its unique qualities. The reason for this proposal lies with concerns related to a politicized process that, as noted above, has not been able to produce a unified legal framework similar to that found in the Chicago Convention and the International Civil Aviation Organization. Finally, there is hope that we will find a true province for all humanity where all resources can be made open for use in their common interest.[131] Any model of governance that only considers sovereignty concerns without common interests would embrace the short term, while sacrificing the future.

V. New Horizons: Conclusion

> *"Looking at these stars suddenly dwarfed my own troubles and all the gravities of terrestrial life. I thought of their unfathomable distance, and the slow, inevitable drift of their movements out of the unknown past into the unknown future."*
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> — *H. G. Wells*[132]

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129. *Governmental Advisory Committee*, Internet Corp. for Assigned Names & Numbers, https://gacweb.icann.org/display/gacweb/Governmental+Advisory+Committee (last updated Apr. 27, 2017).

130. *See Board of Directors (Board)*, Internet Corp. for Assigned Names & Numbers, https://www.icann.org/resources/reviews/org/board (last visited May 11, 2017) (explaining the board's review process); *see also Learn How to Participate in Policy Development*, Internet Corp. for Assigned Names & Numbers, https://www.icann.org/resources/pages/participate-2014-03-17-en (last updated May 11, 2017).

131. *See* Myers S. McDougal et al., The Interpretation of Agreements and World Public Order: Principles of Content and Procedure 3 (1967) (discussing the role of community agreements in ensuring that resources are employed to maximize aggregate social value).

132. H. G. Wells, The Time Machine 144 (New York, Henry Holt & Co. 1895).

Resolving the legal ramifications of suborbital flight will be one factor that moves humanity forward in search of new horizons and beyond. Humanity endures, and the memory of previous heroic explorers continues to inspire the mission of conquering the final frontier. In air and space, we find two worlds that are not that far apart. In twenty years, we can expect to see these great marvels of engineering soaring high, piercing the firmament while traveling long distances in an instant. Our civilization hopefully will be, finally, in better harmony with its nature. Space will be that final frontier of discovery. It is in that realm where the applications of human ingenuity will bear fruit. The review of past practices, their interpretation within governance, and the humble suggestion presented here may delineate a process that hopefully honors those who have previously sought a resolution of outer space delimitation.[133] It is up to the new actors of space law to seek out the cooperation that will widen future endeavors. The best words to encapsulate those ideals can be found in President Kennedy's speech on the subject.

> Many years ago the great British explorer George Mallory, who was to die on Mount Everest, was asked why did he want to climb it. He said, 'Because it is there.' Well, space is there, and we're going to climb it, and the moon and the planets are there, and new hopes for knowledge and peace are there. And, therefore, as we set sail we ask God's blessing on the most hazardous and dangerous and greatest adventure on which man has ever embarked.[134]

A fitting conclusion to this paper is to return to the practical words of Professor Cooper. He noted that "it is obvious that we must agree that there is an upper boundary in space to the territory of the subjacent State. Under no possible theory can it be said that a State can exercise sovereign rights in outer space beyond the region of the earth's attraction . . . . On the other hand, this boundary cannot be lower than the upper

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133. *See* LASSWELL & MCDOUGAL, *supra* note 105, at 3 (noting the significance of past trends in predicting future trends in law).

134. President John F. Kennedy, Address at Rice University on America's Space Exploration Efforts, (Sept. 12, 1962) (transcript available at *1962-09-12 Rice University*, JOHN F. KENNEDY PRESIDENTIAL LIBRARY & MUSEUM, https://www.jfklibrary.org/Asset-Viewer/MkATdOcdU06X5uNHbmqm1Q.aspx).

limit of the air space."[135] These words recognize that the success of a new regime requires inspiration of those natural law principles that direct policymakers to consider *lex lata*, to better produce positive laws formulated in accordance with the ultimate benefit to humanity.[136] Traveling into outer space involves the physics of propulsion, while mastering the specifics of mechanical engineering.[137] Yet, it also requires funding and political will, along with imagination and a desire to discover new horizons. The province of all mankind is the next logical step for humanity, and an international regime that governs suborbital flights will help propel humanity toward this goal.

135. Cooper, *supra* note 20, at 417.

136. Kemal Baslar, The Concept of the Common Heritage of Mankind in International Law 21 (1998).

137. James Clay Moltz, Crowded Orbits: Conflict and Cooperation in Space 11 (2014).