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The definition and delimitation of outer space**

**Suborbital flights and the delimitation of air space vis-à-vis
outer space: functionalism, spatialism and state sovereignty^{1 2}**

**A Submission by the Space Safety Law & Regulation Committee of the
International Association for the Advancement of Space Safety**

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Abstract: *The paper examines the definition and delimitation of outer space and its relationship to air space, and proposes a remedy to the uncertainty created by the significant differences in the Air Law and Space Law regimes.*

Introduction: *UNCOPUOS and the academic community have discussed and debated the issue of the definition and delimitation between air space and outer space for more than five decades, without achieving consensus. This paper examines the relationship between this issue and the definition of suborbital flights for scientific and/ or for human transportation. The principal purpose of this paper is to present the theories and approaches that have been proposed on this topic, and the legal regime(s) that apply to such flights. This paper also proposes a solution to the dilemma as to where the altitudinal lines between air space and outer space should be drawn, which in turn will clarify the jurisdictional lines between Air Law and Space Law.*

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I. INTRODUCTION

The accelerated metamorphosis of technology, and the commercial opportunities created thereby, place strains on legal regimes created for earlier, and simpler, times.¹ The existing regimes of Air Law and of Space Law were developed at a time when the technological and commercial opportunities for Earth-to-Earth exo-atmospheric movements did not yet exist.² As a consequence, there is no unified or integrated regime of Aerospace Law, and there is significant overlap and inconsistency between the regimes of Air Law and Space Law. The growth of commercial activity in space, coupled with the proliferation of technological opportunities to develop advanced transportation and new uses of outer space, manifestly mandate an assessment of which legal regime applies – Air Law, Space Law, or in some instances, both – and the governing rules of law.³

It should be noted that all space missions start on Earth surface and transverse the air space on the way up, and sometimes also re-enter as intact object or space debris, thus posing a risk for aviation. The disintegration of Shuttle Columbia at re-entry in 2003 almost caused an aviation accident. An ever-increasing risk exists because of the continuous growth of air traffic and space traffic, which have been generally controlled, on the way up, by the use of segregated air space, and require an integrated approach for returning vehicles.⁴

¹ Professor Stephen Gorove observed, "There is a certain mystique, if not a measure of excitement or enthusiasm in contemplating future developments in any discipline.", Stephen Gorove, *Developments in Space Law: Issues and Policies* 339 (Dordrecht, Boston, London: Martinus Nijhoff Publishers, 1991).

² At that time, the only possible applications were military like the manned U.S. X-20 Dyna-Soar Program, which evolved from the German rocket technology developed toward the end of WWII. Clarence J. Geiger -History of the X-20A Dyna-Soar, Historical Division Information Office Aeronautical Systems Division Air Force Systems Command, October 1963, <http://www.dtic.mil/dtic/tr/fulltext/u2/a951933.pdf>

³ To understand the Space Law Conventions, one must understand the context in which they were drafted. The decades of the 1960s and 1970s were dominated by the nationalist jockeying of the Cold War. There were then only two space-faring nations – the United States and the Union of Soviet Socialist Republics (USSR). The only launches were by States, and most satellites were State military, science, or communications endeavors. Moreover, the infinite vastness of space itself suggested that collisions would be extremely rare events. Hence, these treaties were not drafted in today's era of widespread privately-owned and financed launches and commercial satellites, or indeed emerging space tourism and transportation, with growing congestion in the geostationary and low-earth Earth orbits, and proliferating space debris. As one scholar noted: "[The Outer Space Treaty] was negotiated long before any states seriously contemplated the possibility of a viable commercial space tourism industry." Rebekah Reed, "Ad Astra Per Aspera: Shaping a Liability Regime for the Future of Space Tourism," 46 Hous. L. Rev. 585, at 590-91 (2009).

⁴ Requirements for Warning Aircraft of Re-entering Debris, William Ailor, Paul Wilde, 2008.

The international legal regime governing air transport on issues such as liability, security, navigation and air traffic management is well developed, and set forth in various conventions, treaties, and "soft law" standards. Five multilateral Space Law instruments also define legal rights and duties, all of which were developed before commercial activity in space became dominant.⁵ Yet it is unclear whether space vehicles fall under established principles of Air Law, and if they do, whether these laws follow them into space. Moreover, it is unclear where the legal limits of air space expire, and the outer space regime of Space Law begins.⁶

A series of possible approaches have been proposed for determining whether various winged vehicles are "aircraft" or are "space objects", and for defining the boundary between air space and outer space. There are two such approaches: the functionalist and the spatialist approaches, respectively, but other approaches have also been proposed (mostly subcategories of these two).⁷

One way to answer which regime of law applies is to ask *what* type of vehicle is being considered – is it an aircraft, or a space craft, or perhaps, an aerospace vehicle? This is known as the *functionalist* approach to the problem. Another way to address this issue is to ask *where* the object at issue is – is it in air space, or in outer space, or does it traverse both? This is known as the *spatialist* approach to the question.⁸ This article examines both approaches.

The relevant multilateral conventions contain elements of both functionalism and spatialism. The Convention on International Civil Aviation of 1944 (hereafter the

⁵ Through much of the 20th century, space exploration and development was dominated by governments. Increasingly however, private for-profit firms have been investing in commercial space development. In its early years, commercial activities in outer space were principally focused on satellite communications, particularly telephone and television communications. Commercial investment is a major provider of the infrastructure of communications – both telecommunications and broadcast – of weather and geological monitoring, and of defense. More recent commercial activities have focused on launching, remote sensing and global positioning. The mining of asteroids and other near-Earth celestial bodies has not yet begun. Space tourism and the transportation of passengers in space are emerging, but embryonic, developments. Increasingly, governments are turning to the private sector to provide launch and satellite capacity. Hence, commercial space activities are gradually eclipsing governmental space activities.

⁶ Ram S. Jakhu, Tommaso Sgobba, Paul Stephen Dempsey (Eds.), *The Need for an Integrated Regulatory Regime for Aviation and Space* (Wien: Springer-Verlag: 2011), at 49. See also, Brian Abrams, *First Contact: Establishing Jurisdiction Over Activities In Outer Space*, 42 Ga. J. Int'l & Comp. L. 797 (2014); Martin Menter, *Relationship of Air and Space Law*, 19 Proc. Colloq. L. Outer Space 164 (1976); S. Bhatt, *International Aviation and Outer Space Law* (New Delhi: Asian Institute of Transport Development, 1996).

⁷ See e.g., Bin Cheng, *Legal Regime of Air Space and Outer Space: The Boundary Problem, Functionalism versus Spatialism: The Major Premises*, 5 Annals of Air & Space L. 323, 335-38 (1980); He Qizhi, *The Problem of Definition and Delimitation of Outer Space*, 10 J. Space L. 157 (1982).

⁸ Jakhu, Sgobba & Dempsey, *supra* note 6, at 50.

“Chicago Convention”) applies principles of Air Law to "air space" and to "aircraft."⁹ The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies of 1967 (hereafter the “Outer Space Treaty”) applies principles of Space Law to "outer space" and "space objects." Unfortunately, neither of these conventions defines those essential terms. These definitional failures create uncertainty and potential conflict between these two, quite different, legal regimes.¹⁰

As commercial aerospace flights (orbital and suborbital) become more frequent, and more States become space-faring nations, their use of air space also traversed by aircraft will proliferate, creating a need for clarity and defined rules of safety, security, and liability. This article attempts to propose some measure of clarity.

II. MAJOR DIFFERENCES BETWEEN THE AIR LAW AND SPACE LAW REGIMES

Air Law and Space Law are governed by vastly different legal regimes. In addition to bilateral air transport agreements and customary International Law,¹¹ Air Law is governed by a number of major multilateral Conventions. Among them are:

⁹ The “magna carta” of Air Law is the Convention on International Civil Aviation, more commonly known as the Chicago Convention of 1944. *Convention on International Civil Aviation*, 7 December 1944, 15 UNTS 295, ICAO Doc 7300/6 (entered into force 4 April 1947) [Chicago Convention], available at http://www.wipo.int/edocs/lexdocs/treaties/en/icao-ca/trt_icao_ca_001en.pdf.

The Chicago Convention is both an organic constitution of an international organization and the source of major principles of Air Law. Established by the Chicago Convention, the International Civil Aviation Organization [ICAO] was given responsibility for regulating the many technical aspects of the international civil aviation. Consequently, the jurisdiction of ICAO was extended to such matters as aircraft licensing, airworthiness certification, registration of aircraft, international operating standards, and airways and communications controls. Beyond safety and navigation, ICAO also has taken the lead on environmental and security issues, jurisdictional areas not originally contemplated when the Chicago Convention was drafted. It has promulgated Standards and Recommended Practices [SARPs] which its member States are obliged to implement uniformly, unless they find it impracticable to comply. Moreover, the Chicago Convention provides that: “over the high seas, the rules in force shall be those established under this Convention.” Hence, ICAO has law-making authority over 72% of the earth's surface. This jurisdictional scope, which is unparalleled by any other international organization, in effect, makes ICAO a paradigm of global governance. Today, ICAO is one of the largest, and most successful, specialized agencies in the United Nations family, with 191 member States. See Paul Stephen Dempsey, *PUBLIC INTERNATIONAL AIR LAW* (McGill IASL, 2nd ed. 2017).

¹⁰ This problem has been debated and discussed by legal scholars since the 1950s and 1960s, with no resolution.

¹¹ With regard to the international character of such flights (if and whenever their launch/take-off occurs in territory different from their landing), the sources of international law would apply as per Art. 38, para. 1 of the Statute of the International Court of Justice and they would be: conventional law, custom, and general principles of international law. Statute of the International Court of Justice, Art. 38: “1. The Court, whose function is to decide in accordance with international law such disputes as are submitted to it, shall apply:

- *Paris Convention of 1919* (addressing safety and navigation)
- *Warsaw Convention of 1929* (addressing air carrier liability to passengers and cargo)
- *Rome Convention of 1933* (addressing liability for surface damage caused by aircraft).
- *Chicago Convention of 1944* (addressing safety and navigation)
- *Geneva Convention of 1948* (addressing aircraft registration)
- *Hague Protocol* (addressing air carrier liability to passengers and cargo)
- *Rome Convention of 1952* (addressing aircraft operator liability for surface damage)
- *Guadalajara Convention* (addressing air carrier liability to passengers and cargo)
- *Tokyo Convention of 1963* (addressing offenses on board aircraft)
- *Montreal Protocols of 1966* (addressing air carrier liability to passengers and cargo)
- *Hague Convention of 1970* (addressing aircraft hijacking)
- *Montreal Convention of 1971* (addressing aircraft and air navigation security)
- *The Montreal Protocol of 1988* (addressing airport security)
- *Montreal Convention of 1999* (addressing air carrier liability to passengers and cargo)
- *Cape Town Convention of 2001* (addressing financial interests in aircraft)
- *Montreal Conventions of 2009* (addressing liability for surface damage)
- *Beijing Convention and Protocol of 2010* (addressing security) ¹²

Space Law is also governed by bilateral agreements between States and customary International Law, U.N. resolutions, decrees by international organizations, national legislation and regulations,¹³ and court decisions, as well as the following five multilateral Conventions:

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- a. international conventions, whether general or particular, establishing rules expressly recognized by the contesting states;
 - b. international custom, as evidence of a general practice accepted as law;
 - c. the general principles of law recognized by civilized nations;
 - d. subject to the provisions of Article 59, judicial decisions and the teachings of the most highly qualified publicists of the various nations, as subsidiary means for the determination of rules of law.”

¹² These and other Public and Private International Air Law agreements are compiled in XXX(1) *Annals of Air & Space L.* (2005). At this writing, neither the Montreal Conventions of 2009 nor the Beijing Convention and Protocol of 2010 had achieved sufficient ratifications to enter into force.

¹³ Paul Stephen Dempsey, “National Laws Governing Commercial Space Activities: Legislation, Regulation & Enforcement”, 36 *NORTHWESTERN JOURNAL OF INTERNATIONAL LAW & BUSINESS* 1 (2016).

- *The Outer Space Treaty of 1967*¹⁴
- *The Rescue Agreement of 1968*¹⁵
- *The Liability Convention of 1972*¹⁶
- *The Registration Convention of 1976*¹⁷
- *The Moon Agreement of 1979*¹⁸

Collectively, these multilateral conventions require States, *inter alia*, to adhere to principles of international law, assume responsibility and liability for activities in space (whether governmental or non-governmental), authorize and supervise the activities of

¹⁴ *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies*, 27 January 1967, 610 UNTS 205, 18 UST 2410, TIAS No 6347, 6 ILM 386 (entered into force on 10 October 1967) [*Outer Space Treaty*]. The Outer Space Treaty establishes the basic framework of international law applicable to space, declaring space to be the "province of all mankind". However, several important concepts are nowhere defined in the convention, such as "outer space", and "space object". The Outer Space Treaty provides that the exploration and use of outer space shall be the province of all mankind, free for exploration and use by all States and not subject to national appropriation by claim of sovereignty, by use or occupation, or by any other means. States shall be responsible for national space activities whether carried out by governmental or non-governmental entities, and shall be liable for damage caused by their space objects.

<http://www.unoosa.org/pdf/limited/c2/AC105_C2_2014_CRP07E.pdf>.

¹⁵ *Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched Into Outer Space*, 22 April 1968, 672 UNTS 119, 19 UST 7570, TIAS No 6599, 7 ILM 151 (entered into force 3 December 1968) [*Rescue Agreement*]. The Rescue Agreement requires that States take all possible steps to rescue and assist astronauts in distress, and return them to the launching State, and upon request, provide assistance to launching States in recovering space objects and their component parts that fall to Earth.

¹⁶ *Convention on International Liability for Damage Caused by Space Objects*, 29 March 1972, 961 UNTS 187, 24 UST 2389, 10 ILM 965 (1971) (entered into force 1 September 1972) [*Liability Convention*]. The Liability Convention imposes absolute liability upon a launching State to pay compensation for personal injury and property damage caused by its space objects on the surface of the Earth, or to aircraft. It also imposes fault-based liability for space object to space object damage. *See generally*, Marc S Firestone, "Problems in the Resolution of Disputes Concerning Damage Caused in Outer Space" (1985) 59 Tul L Rev 747; Paul Stephen Dempsey, "Liability for Damage Caused by Space Objects in International and National Law", XXXVII ANNALS OF AIR & SPACE LAW 333(2011).

¹⁷ *Convention on Registration of Objects Launched into Outer Space*, 6 June 1975, 28 UST 695, 1023 UNTS 15 (entered into force 15 September 1976) [*Registration Convention*]. The requires that the launching State maintain a registry of objects they launch into space, and to furnish to the UN, as soon as practicable, information concerning each space object.

¹⁸ *Agreement Governing the Activities of States on the Moon and Other Celestial Bodies*, 5 December 1979, 1363 UNTS 3 (entered into force 11 July 1984) [*Moon Agreement*]. The Moon Agreement provides that the Moon and other celestial bodies should be used exclusively for peaceful purposes, their environment should not be disrupted, and their natural resources shall be shared with developing nations in some, as yet, undefined way. The Moon Agreement has not yet entered into force.

Other multilateral Space Law instruments include the Protocol on the protection of security of space assets to the Cape Town Convention. *See* Yun Zhao, "Revisiting Selected Issues in the Draft Protocol to the Cape Town Convention on Matters Specific to Space Assets" (2011) 76 J Air L & Com 805.

their nationals in space, and notify and register their space objects.¹⁹ Among the requirements of the Outer Space Treaty of 1967 are the following:

- States must carry on space activities in a manner consistent with principles of international law;²⁰
- States bear international responsibility for national activities in space and on the moon and celestial bodies, including activities of both governmental and non-governmental entities;

¹⁹ See JULIAN HERMIDA, *LEGAL BASIS FOR NATIONAL SPACE LEGISLATION* 30 (Springer 2004); Stephan Hobe & Kuan-Wei Chen, "Legal Status of Outer Space and Celestial Bodies", in *ROUTLEDGE HANDBOOK ON SPACE LAW* 25, 37 (Ram Jakhu & Paul Dempsey, eds., Routledge 2017).

²⁰ Outer Space Treaty Art. III.

- The “appropriate State”²¹ must authorize and supervise the activities of its nationals in space;²²

²¹ The Article VI provides that authorization and supervision should be done by the ‘appropriate’ State. However, neither the Outer Space Treaty nor any other convention defines the term. There have been several views on this. Dr. Ricky J. Lee defines the ‘appropriate state’ as the State that is in the best position to assert jurisdiction over the non-governmental entity engaged in space activity and which physically can authorize and continuously supervise the space activities of both government and private entities of the State. Thus, if a State’s national engages in space activity, it is not the State of nationality but rather the State having territorial jurisdiction which is the appropriate State. Ricky J. Lee, *Liability Arising from Article VI of the Outer Space Treaty: States, Domestic Law and Private Operators*, Proceedings of the forty-eighth colloquium on the Law of Outer Space, 216 (2005).

See also, Stephen Gorove, *Liability in Space Law: An Overview*, 8 ANNALS AIR & SP. L. 373, 377 (1983); Burely, *Rules of International Law Governing the Commercialisation of Space Activities*, 29 PROC. COLL. L. OUTER SP. 157, at 159 (1986). Prof. Dr. Karl-Heinz Bockstiegel asserts that a ‘functional interpretation’ is best, and the ‘appropriate State’ should be defined from case to case; no single interpretation is sufficiently overwhelming to exclude all others. Dr Karl-Heinz Bockstiegel, *The Term ‘Appropriate State’ in International Space Law*, 37 PROC. COLLOQUIUM ON THE LAW OF OUTER SPACE 77, at 79 (1994). Prof. Stephen Gorove took the position that the drafters used the term ‘appropriate State’ and not the ‘State of nationality’; so ‘at least in some cases it could refer to the launching state’. Stephen Gorove, *Liability in Space Law: An Overview*, VIII ANNALS AIR & SP. L. 373, 377 (1983). Herczeg states that a) state of seat of the non-governmental entity b) the launching State and c) the State of production all are appropriate States. Herczeg, *Interpretation of the Space Treaty of 1967 (Introductory Report)*, 10 PROC. COLL L. OUTER SP. 105, 107 (1967). Prof. Bin Cheng also states that there may be more than one appropriate state and the words used in The Declaration of Legal Principles²¹ ‘states concerned’ perhaps would have been a better term. Bin Cheng, *Article VI of the 1967 Space Treaty Revisited: "International Responsibility", "National Activities", and "The Appropriate State"*, 26 J. SPACE L.7, 28-29 (1998).

Therefore, several authors have expressed different views regarding which is the ‘appropriate State’. One question that arises is whether there is only one ‘most appropriate State’, or can there be many appropriate States. Unlike the ‘state of registry’ which can be only one State pursuant to the Registration Convention, the ‘appropriate State’ has not been demarcated as one State under the Outer Space Treaty. Several States can be involved in a space activity and all of them can therefore be ‘appropriate’ States. Moreover, States have to bear responsibility for all their national activities in space; also, launching States are liable for damage caused by their space objects. In this light, it is doubtful whether States would agree to allow only one State to be in charge of supervision and authorization, while they themselves continue to be responsible and liable under the space treaties. Thus, all States involved in a space activity, including the launching State(s), would be ‘appropriate’ States.

See Bin Cheng, *Article VI of the 1967 Space Treaty Revisited: "International Responsibility," "National Activities," and "The Appropriate State"*, 26:1 J. SPACE L. 7, 9 (1998); Karl-Heinz Bocksteigel, *The Terms ‘Appropriate State,’ and ‘Launching State’ in the Space Treaties-- Indicators of State Responsibility and Liability for State and Private Activities*, 34 PROC. COLLOQ. L. OUTER SPACE 13 (1991); and Vladimir Kopal, *Issues Involved in Defining Outer Space, Space Object, and Space Debris*, 34 PROC. COLLOQ. L. OUTER SPACE 38 (1991).

²² Outer Space Treaty Art. VI. Article VI of the Outer Space Treaty imposes upon States international responsibility to provide “authorization and continuing supervision” of national activities in space, including the activities of both governmental and non-governmental entities. Dr. Ricky Lee observes, “It is clear from the terms of Article VI that states are required to ensure that activities of private entities are subject to ‘authorization’ and ‘continuing supervision’ and that they are to bear international responsibility for such activities.” Ricky J. Lee & Sarah L. Steele, *Military Use of Satellite Communications, Remote Sensing, and Global Positioning Systems in the War on Terror*, 79 J. AIR L. & COM. 69 (2014).

- States that (a) launch, (b) procure the launch, or (c) from whose territory or (d) facility an object is launched, are internationally liable for damage to another State or its national or juridical persons by such object in the air or in space;²³
- States on whose registry an object is launched must retain jurisdiction and control over the object and any personnel thereon;²⁴
- States must avoid harmful contamination and adverse environmental consequences from the introduction of extraterrestrial matter; if a State believes an activity or experiment by it or its nationals in space would potentially harm or interfere with activities of other States in space, it must consult with such States before proceeding;²⁵ and
- States must inform the UN Secretary General of the “nature, conduct, locations and results” of its activities in space.²⁶

The legal regimes that govern air space and outer space are distinct, and create a distinct conflict: while air space is an area to which State sovereignty can be attributed, outer space falls beyond sovereignty claims. Article 1 of the Chicago Convention explicitly recognizes the right of a State to extend “complete and exclusive” sovereignty over the air space above its territory.²⁷ In contrast, Article II of the Outer Space Treaty provides that outer space “[...] is not subject to national appropriation by claim of

²³ Outer Space Treaty Art. VII. Article VII provides that States that (a) launch, (b) procure the launch, or (c) from whose territory or (d) facility an object is launched, are internationally liable for damage caused to another State or its national or juridical persons by such object whether in the air or in space.

²⁴ Outer Space Treaty Art. VIII. *See* PAUL STEPHEN DEMPSEY, AVIATION LIABILITY LAW § 6.64 (Lexis Nexis 2nd ed. 2013). Article VIII of the Outer Space Treaty also requires that space objects and component parts found in a State shall be returned to the State of registry. Article VIII of the Outer Space Treaty provides that the State of registry shall retain jurisdiction and control over a space object and any personnel thereon, whether in space or on a celestial body. But it does not define the “State of registry.” The Registration Convention of 1976 provides elaboration. Convention on Registration of Objects Launched into Outer Space, opened for signature Jan. 14, 1975, 28 U.S.T. 695, T.I.A.S. 8480, 1023 U.N.T.S. 15, G.A. Res. 3235 (XXIX), entered into force on 15 September 1976. The Registration Convention defines the “State of registry” as the launching State (recall the definition above) on whose registry a space object is carried. Registration Convention Art. I. The Convention requires that every space object launched be entered in appropriate registry that the launching State shall maintain. Registration Convention Art. II. It defines the information that shall be carried on the registry. The Convention also requires that the State of registry must notify the UN Secretary General of space objects which were, but no longer are, in Earth orbit. Registration Convention Art. IV(3).

²⁵ Outer Space Treaty Art. IX.

²⁶ Outer Space Treaty Art. XI.

²⁷ Article 1, Chicago Convention:

“The contracting States recognize that every State has complete and exclusive sovereignty over the airspace above its territory.”

On State sovereignty in international aviation, *see* Steven Truxal, ECONOMIC AND ENVIRONMENTAL REGULATION OF INTERNATIONAL AVIATION 33-77 (London: Routledge 2017).

sovereignty [...]”.²⁸ Professor Steven Truxel observes, “It is now settled international law that airspace sovereignty ends where non-sovereign airspace begins.”²⁹

As another example of incongruity between the two legal regimes, pursuant to the Outer Space Treaty and the Liability Convention, liability in Space Law is vested in the launching State.³⁰ In contrast, pursuant to the Warsaw and Montreal Conventions, liability in Air Law is vested in the air carrier or aircraft operator.³¹

Table 1 succinctly summarizes the principal differences between the Air Law and Space Law regimes.

Table 1 - Major Differences between Air Law and Space Law Regimes	
Air Law	Space Law
Applies to “air space”	Applies to “outer space”
Applies to “aircraft”	Applies to “space objects”
States enjoy “complete and exclusive sovereignty” over their territorial air space	State sovereignty over outer space is prohibited
Imposes liability on the airline, or the aircraft operator	Imposes liability and oversight responsibility upon the State
Requires States to certify and register aircraft	Creates an international registration regime
Requires States to regulate safety, navigation, and security	No universal safety, navigation or security standards
Requires States to regulate noise and emissions	Environmental standards are “soft law”

The differences in the rules that govern air space and outer space constitute a major impediment to the achievement of an integrated solution, unless the international community achieves consensus on the issue of delimitation. Defining suborbital flight will enable States determine the agency most suited to regulation

²⁸ Art. II, Outer Space Treaty:

“Outer space, including the Moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.”

²⁹ Steven Truxel, *ECONOMIC AND ENVIRONMENTAL REGULATION OF INTERNATIONAL AVIATION* 32 (London: Routledge 2017).

³⁰ The “launching State” includes the State which (1) launches; (2) procures the launch; (3) from whose territory the object is launched; and (4) from whose facilities the object is launched.” Arnel Kerrest & Caroline Thro, *Liability for Damage Caused by State Activities*, in *ROUTLEDGE HANDBOOK ON SPACE LAW* 25, 61 (Ram Jakhu & Paul Dempsey, eds., Routledge 2017); Paul Stephen Dempsey, “Liability for Damage Caused by Space Objects in International and National Law”, *XXXVII ANNALS OF AIR & SPACE LAW* 333 (2011).

³¹ See Paul Stephen Dempsey, *AVIATION LIABILITY LAW* (2nd ed., Lexis/Nexis 2013).

and oversight of such activity, the associated risks, and the international obligations and liabilities attached to the State. However, linking the issue of delimitation to the altitude of currently planned human suborbital flights is potentially confusing because what determines (technically) if a space mission is suborbital, orbital or interplanetary is the velocity of the vehicle, not the altitude. For decades, unmanned suborbital flights have been performed routinely well below 100km and up to the upper boundary of Low Earth Orbits. It is for this reason that the relationship between suborbital flights and the delimitation of outer space is needed. Any agreement on the delimitation of air space and outer space has been hampered so far by conflicting interests related to security and unrestrained access to space, namely the overflight by (spy) aircraft and rockets of foreign countries. For “observation” missions using airplanes, the problem has been solved to a certain extent by the signature of the Treaty on Open Skies in 1992.³² It originated from an idea first launched by President Eisenhower in 1955 at a summit in Vienna.³³ Safety and security problems remain for overflying rockets either during climbing to orbital space, or during Earth-to-Earth suborbital flights (e.g. ICBM). Such overflights take place well above the commercial controlled national air space (i.e. above FL 600 = 18.3km), and above international air space.

III. FUNCTIONALISM AS A MEANS OF DETERMINING WHICH LAW APPLIES

One approach to answer the question of which legal regime governs is to examine what kind of object is in question. Is the vehicle an “aircraft”, a “space object”, or an aerospace object?³⁴ What is the vehicle's purpose, its activity, or its destination? Is the vehicle's primary purpose to go into outer space in order to orbit, to conduct outer space activities (an Earth-Space mission), or to provide transportation from one point on Earth to another (an Earth-to-Earth mission)? In the former case, arguably it is a space object, while in the latter case, arguably it is not.

Another approach to answering this question is to consider the technological properties, functional characteristics, design and aerodynamics of the vehicle. Is it capable of acquiring lift through the air, for example? Can the object operate without the lift generated by moving through the atmosphere, or without external oxygen to burn as fuel? Once it is categorized as a “space object”, arguably Space Law would adhere to it throughout its journey; once categorized as an “aircraft”, then arguably Air

³² This treaty entered into force in 2002. <http://www.osce.org/library/14127?download=true>).

³³ R. Cargill Hall (1992), *The Origins of U.S. Space Policy: Eisenhower, Open Skies, and Freedom of Space*. <http://www.dtic.mil/dtic/tr/fulltext/u2/a344697.pdf>

³⁴ Three possible definitions can be proposed with regards to the nature of suborbital space vehicles: they could be defined as aircraft, as spacecraft, or as hybrid aerospace vehicles of a dual nature. Stephan Hobe, Gerardine Meishan Goh *et al.*, “Space Tourism Activities – Emerging Challenges to Air and Space Law”, (2007) 33 *J. Space L.* 359 at 364.

Law would apply irrespective of its location.

A. WHAT IS AN "AIRCRAFT"?

If the object in question is designated as an "aircraft", Air Law applies to it, for the Chicago Convention of 1944³⁵ applies to "civil aircraft". Unfortunately, although the term "aircraft" appears more than 100 times in the Chicago Convention, that Convention does not define what is contemplated by the term "aircraft".

The history of the term dates back to the early 20th century. Several years after the Paris Convention of 1919 entered into force, the International Commission for Air Navigation (CINA, the international organization created by that that Convention), adopted a "Glossary of terms used in Aeronautical Technology." In that Glossary, the term "aircraft" was defined as "a machine which can derive support in the atmosphere from reactions of the air." In 1930, CINA adopted a formal resolution providing for new definitions to be applicable to all the Annexes.³⁶ The types of aircraft described therein required full atmospheric support in order to sustain flight. No means of propulsion then existed, or was then contemplated (beyond, perhaps, the science fiction literature of Jules Verne), by which any vehicle could have been navigated beyond the height where reactions of the gaseous air could give it full support and enable flight. During the several decades that the Paris Convention governed international aviation, the final definition of "aircraft" as a machine "which can derive support in the atmosphere from reactions of the air" necessarily described flight instrumentalities that required full aerodynamic support.³⁷ The US definition under its domestic law – the Air Commerce Act of 1926 – was far more expansive in scope, defining an aircraft as "any contrivance now known or hereafter invented, used or designed for navigation or flight

³⁵ *Chicago Convention*, *supra* note 9, art 3(a).

³⁶ The old definitions quoted above disappeared from Annex D and the new definitions appeared at the head of Annex A, reading as follows:

The terms used in Annexes A to G have the following meanings:

- The word 'aircraft' shall comprise all machines which can derive support in the atmosphere from reactions of the air;
- The word 'aerostat' shall mean an aircraft supported in the air statically;
- The word 'balloon' shall mean an aerostat (free or captive) non-mechanically-driven;
- The word 'airship' shall mean a mechanically-driven aerostat with means of directional control;
- The word 'aerodyne' shall mean an aircraft whose support in flight is derived dynamically from the reaction on surfaces in motion relative to the air;
- The word 'aeroplane' shall mean a mechanically-driven aerodyne supported in flight by aerodynamic reactions on surfaces remaining fixed under the same conditions of flight;
- The term 'glider' means a non-mechanically-driven aerodyne supported in flight by aerodynamic reactions on surfaces remaining fixed under the same conditions of flight.

The formal adoption of these definitions constituted a formal amendment to the Convention.

³⁷ John Cobb Cooper, *State Sovereignty and Flight: An Historical Analysis* (unpublished manuscript, 1967).

in the air."³⁸

In 1967, the UN International Civil Aviation Organization [ICAO] amended the language it had inherited from its predecessor international aviation agency, CINA, and embraced within Annex 7 to the Chicago Convention the definition of an *aircraft* as "Any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface."³⁹ This revised definition was aimed at making it clear that all air-cushion-type vehicles, such as hovercraft and other ground-effect machines, would not be classified as aircraft, and therefore not subject to ICAO jurisdiction.⁴⁰ Such support cannot be provided at higher altitudes solely on the basis of the "reactions of the air", due to the reduced density of the atmosphere.⁴¹ However, rocket engine exhaust does not need to press against the surface of the Earth to provide propulsion; they do well in the vacuum of outer space.

Until relatively recently, little thought was given to the issue of whether an aerospace craft should be placed under ICAO's jurisdiction. All space launches in the 1960s and 1970s, when the Space Law conventions were drafted, were of State vehicles. In 1944, State aircraft were explicitly exempt from ICAO jurisdiction pursuant to Article 3 of the Chicago Convention; hence there was no ability of ICAO to exert jurisdiction over Soviet Sputnik and NASA progeny.⁴² But in the near future, the dominant participants in suborbital and orbital space activities may be private commercial companies. Already, commercial activity in space has grown larger than State activity.

Under the current definition in Annex 7, an aerospace vehicle launched by a rocket might not be considered an aircraft on the ascent phase of its flight, but might well on the descent phase, when it would be using its wings to glide to destination. ICAO has the authority to amend Annex 7 to include aerospace vehicles within its definition, but

³⁸ John Cobb Cooper, "The Chicago Convention and Outer Space" (address before the American Rocket Society Conference on Space Flight, New York, 24 April 1962).

³⁹ Chicago Convention, Annex 7. Moreover, the word aeroplane was defined as, "A power-driven heavier-than-air aircraft, deriving its lift in flight chiefly from aerodynamic reactions on surfaces which remain fixed under given conditions of flight." See also, South Africa Aviation Act No. 74 of 1962 § 1.

⁴⁰ ICAO, *The Concept of Sub-Orbital Flights*, Working Paper C-WP/12436 (30 May 2005), online: ICAO <<http://www.icao.int/ICDB/HTML/English/Representative%20Bodies/Council/Working%20Papers%20by%20Session/175/C.175.WP.12436.EN/C.175.WP.12436.EN.HTM>>[*ICAO Working Paper*]. ICAO also defined an "aeroplane" as, "A power-driven heavier-than-air aircraft, deriving its lift in flight chiefly from aerodynamic reactions on surfaces which remain fixed under given conditions of flight." *Ibid*.

⁴¹ John Cobb Cooper, Ivan A. Vlasic (ed.), *Explorations in Aerospace Law, Selected Essays, 1946-1966* (Canada: McGill University Press, 1968), at 289.

⁴² NASA's Space Shuttle was the first orbital reusable launch vehicle. The Chicago Convention exempts State aircraft from its scope. Hence, the Shuttle would fall outside its scope. However, the Convention provides that when issuing regulations for State aircraft, due regard must be given to the navigational safety of civil aircraft. Chicago Convention, *supra* note 9, art. 3(a)(d).

as yet, has not done so.⁴³ However, ICAO has recognized that:

Should suborbital vehicles be considered (primarily) as aircraft, when engaged in international air navigation, consequences would follow under the Chicago Convention, mainly in terms of registration, airworthiness certification, pilot licensing and operational requirements (unless they are otherwise classified as State aircraft under Article 3 of the Convention).⁴⁴

Given that aerospace vehicles would use the same air space as commercial aviation, it would seem desirable to apply a single unified regime of air navigation to both so as to avoid the possibility of collision.⁴⁵ Moreover, ICAO's 19 Annexes to the Chicago Convention governing issues such as safety, airworthiness, navigation, licensing, and communications would seem appropriate to govern both aircraft and aerospace vehicles occupying common air space, rather than reinventing the wheel and crafting wholly new rules to govern only aerospace vehicles.⁴⁶ At this writing, the ICAO Council is evaluating the question of whether it should exert jurisdiction over suborbital flight.⁴⁷ In fact, ICAO and the UN Committee on the Peaceful Use of Outer Space [COPUOUS] have held several joint meetings and symposia and created a joint "Learning Group" on the question.

Although the relationship between ICAO and COPUOS is not formally institutional, the issue of delimitation, especially as it relates to suborbital flights and safety in human spaceflight, has been of mutual concern. Specifically, the Legal Subcommittee of COPUOS, at its forty-eight session (2009) requested ICAO to prepare "a comprehensive presentation on current and foreseeable civil aviation operation, with

⁴³ See e.g., Paul Stephen Dempsey & Michael Mineiro, *The Regulation of Aerospace Vehicles*, in SPACE SAFETY REGULATIONS AND STANDARDS (J. Pelton & R. Jakhu ed. 2010); Paul Stephen Dempsey & Michael Mineiro, *ICAO's Legal Authority to Regulate Aerospace Vehicles*, in SPACE LAW: LEGAL CONTOURS (P. Kumar, ed. 2010); Paul Stephen Dempsey & Michael Mineiro, *Space Traffic Management: A Vacuum in Need of Law*, in OUTER SPACE: WARFARE AND WEAPONS (P. Kumar, ed. 2010); RAM JAKHU, TOMMASO SBOBBA & PAUL STEPHEN DEMPSEY, *THE NEED FOR AN INTEGRATED REGULATORY REGIME FOR AVIATION AND SPACE* (Springer 2011).

⁴⁴ ICAO Working Paper, *supra* note 40 ¶ 2.3.

⁴⁵ Paul Stephen Dempsey & Michael Mineiro, "The Regulation of Aerospace Vehicles", in SPACE SAFETY REGULATIONS AND STANDARDS (J. Pelton & R. Jakhu ed. 2010); Paul Stephen Dempsey & Michael Mineiro, "ICAO's Legal Authority to Regulate Aerospace Vehicles", in SPACE LAW: LEGAL CONTOURS (P. Kumar, ed. 2010); Paul Stephen Dempsey & Michael Mineiro, "Space Traffic Management: A Vacuum in Need of Law", in OUTER SPACE: WARFARE AND WEAPONS (P. Kumar, ed. 2010).

⁴⁶ *THE NEED FOR AN INTEGRATED REGULATORY REGIME FOR AVIATION AND SPACE* (Ram Jakhu, Tommaso Sgobba & Paul Dempsey eds., Springer 2011); Ram Jakhu & Yaw Nyampong, "Are the Current International Space Treaties Sufficient to Regulate Space Safety, and Establish Responsibility and Liability?" (unpublished paper, 2007).

⁴⁷ ICAO Assembly Resolution A29-11 provides that ICAO shall continue to be responsible for stating the position of civil aviation on all related outer space matters.

particular emphasis on the upper limit of those operations”.⁴⁸ In response to this call, ICAO recognized the progressive development of suborbital flights and the direct effects that they might have on civil aviation with a letter to COPUOS in March 2010,⁴⁹ and produced the requested presentation the same year recognizing that “flights would fall within the scope of the Convention on International Civil Aviation (Chicago, 1944) and therefore within ICAO’s mandate.”⁵⁰ This close relationship between ICAO and COPUOS on the issue of suborbital flights culminated with the three joint ICAO/COPUOS aerospace symposia that took place on an annual basis beginning in 2015. According to Simonetta di Pippo, Director of the UN Office of Outer Space Affairs [OOSA], this initiative constitutes “a unique inter-agency cooperation effort between [OOSA] and ICAO on subject matters of utmost relevance to our respective organizations and to the space and aviation communities.”⁵¹ The first symposium focused on capturing the status of “existing regulations and practices, as well as safety management and systems engineering methods used, with a focus on sharing the air space with civil aviation”.⁵² The second delved deeper into the future of suborbital flights by addressing topics such as commercial space transportation, spaceport infrastructure, space traffic management and space situational awareness, as well as the future of regional and governmental cooperation in this field.⁵³ The third and last symposium addressed all previous matters with specific emphasis on the way forward through cooperation between aviation and space international bodies for a stronger aerospace sector.⁵⁴

B. WHAT IS A “SPACE OBJECT”?

If the space transportation vehicle is a "space object", presumably Space Law applies to it. However, none of the five space law conventions define precisely what is

⁴⁸ COPUOS, Legal Subcommittee, “Concept of Suborbital Flights: Information from the International Civil Aviation Organization (ICAO)”, 22 March – 1 April 2010, A/AC.105/C.2/2010/CRP.9.

⁴⁹ *Ibid.*

⁵⁰ ICAO, “Concept of Sub-Orbital Flights”, Working Paper, COUNCIL – 175th Session, C-WP/12436, 30/05/05, at 2.

⁵¹ Simonetta Di Pippo, “Third ICAO/UNOOSA Aerospace Symposium, Welcoming Remarks” (29-31 August 2017), online:

<http://www.unoosa.org/documents/pdf/spacelaw/workshops/2017/ICAOUNOOSA2017/0001_Di_Pippo_3rd_ICAO_UNOOSA_Aerospace_Symposium_29_August_2017.pdf>.

⁵² “Emerging Space Activities and Civil Aviation – Challenges and Opportunities”, online: ICAO <<https://www.icao.int/meetings/space2015/Pages/default.aspx>>.

⁵³ “2nd ICAO / UNOOSA Symposium” (15-17 March 2016), online: ICAO <[https://www.icao.int/Meetings/SPACE2016/Documents/SPACE2016%20Formatted%20Agenda_v2\(2016_03_10-PUBLIC\)_v2.pdf](https://www.icao.int/Meetings/SPACE2016/Documents/SPACE2016%20Formatted%20Agenda_v2(2016_03_10-PUBLIC)_v2.pdf)>.

⁵⁴ “Third ICAO/UNOOSA Aerospace Symposium” (29 August 2017), online: UNOOSA <<http://www.unoosa.org/oosa/en/ourwork/spacelaw/workshops/2017/icao-unoosa-symposium.html>>.

contemplated by a space object,⁵⁵ and all were drafted at a time when the only actors in space were governmental, well before commercial activities began to dominate space.⁵⁶ Professor Bin Cheng describes a space object as a man-made object that is launched or is intended to be launched into outer space.⁵⁷ Presumably, a spacecraft should be capable of moving in outer space (either orbital or suborbital) without any support from the air, and should have a power source not dependent upon external oxygen.

The functionalist approach takes as reference point the functions or activities of the vehicles. In order to answer the question “Is it a space craft or an aircraft?” one would ask: Do the vehicle’s functions resemble to those of an aircraft or of a spacecraft? What is the purpose of the vehicle’s mission, the vehicle’s design and licensing and the level of interactions among other aircraft or space craft.⁵⁸ Specifically, functionalists believe that a suborbital vehicle should be classified as an aircraft when the purpose that it fulfills is inherent to aviation activities, while it is deemed to be a spacecraft when it serves space-related purposes. In other words, this approach does not consider the location of the vehicle as critical, but rather focuses on the purpose that it serves. Although activities, such as suborbital space tourism, could be classified as space activities, the distinction is not that clear with other types of suborbital flights, such as stratospheric balloons.

One additional criterion that functionalists use in order to categorize suborbital vehicles is that of the design and the licensing of the vehicle – the physical morphology of the vehicle itself.⁵⁹ The specificities of the design of each vehicle would, according to

⁵⁵ The Liability and Registration Conventions indicate that a "space object" includes its component parts and its launch vehicle and parts thereof. The Outer Space Treaty defines a "space object" as including "component parts of a space object as well as its launch vehicle and parts thereof". Did the drafters intend to draw a distinction between "component parts" of a space object, and "parts" of a launch vehicle? Perhaps so. The French and Spanish language versions of the treaty place a comma after the word "object" and before "as", suggesting that the space object and launch vehicle are distinct as are their "component parts" and "parts thereof", respectively. As the problem of proliferation of space debris grows, when metallic shards or specks of paint orbiting at enormous speeds can cause enormous damage to an operating satellite, even rendering it inoperable, the legal question of whether debris constitutes "component parts" becomes more critical. The weight of academic literature by such prominent Space Law scholars as Professors Cheng, Gorove, Kopal and Lee suggests that the term "component parts" should include all launched in-orbit material, including satellite or launch vehicle debris. That literature is summarized in Ricky J Lee, "The Liability Convention and Private Space Launch Services" (2006) 31 *Ann Air & Sp L* 351 at 361-63. The COSMOS-954 case also supports this view.

⁵⁶ ICAO *Working Paper*, *supra* note 40.

⁵⁷ Bin Cheng, *International Responsibility and Liability for Launch Activities*, 20 *Air & Space L.* 297 (1995); Armel Kerrest & Caroline Thro, *Liability for Damage Caused by State Activities*, in *ROUTLEDGE HANDBOOK ON SPACE LAW* 59, 64 (Ram Jakhu & Paul Dempsey, eds., Routledge 2017).

⁵⁸ IAASS, "The Definition and Delimitation of Outer Space and the Safety of Aerospace Operations", Presentation, UNCOPUOS, 2016, at 10.

⁵⁹ "WVE FAA Announcement", online: World View <<http://www.worldviewexperience.com/FAA-Announcement.pdf>>.

this approach, define its legal nature. Under this view, the location of the vehicle is disconnected from its legal categorization.⁶⁰

The final aspect of the functionalist theory (i.e., the criterion of interaction with other air- or space vehicles) shares common grounds with the spatialist approach; it examines whether the collision risks of the vehicles are higher among aircraft or space craft according to the location within which the vehicle operates.

Another theory, which is closely linked to the spatialist approach, is the *aerodynamic-lift theory*. It proposes the demarcation between air space and outer space at 83 km above the surface of the Earth (or in general between 80 and 90 km),⁶¹ as this is the point after which the aircraft functions cannot be maintained, for the density of the atmosphere is not sufficient to support vehicles that have not achieved circular velocity (the air lift is virtually nil at that altitude).⁶² This theory has common characteristics with both theories mentioned above, as it considers the delimitation point as important, but still uses a functional criterion (that of the possibility to undertake physical aircraft functions) in order to justify the delimitation and classification of the vehicles.

To conclude, no theory or definition has yet been universally embraced as to what a suborbital vehicle is, or whether a hybrid vehicle capable of operation in air space and outer space is an “aircraft” or a “space object”.

C. WHAT IS AN AEROSPACE VEHICLE?

What if the vehicle is a hybrid "aerospace object", one capable of achieving lift and thereby flying in air space (on ascent, descent, or both), and also traveling into and through outer space? Thus, a vehicle like the former NASA Space Shuttle might be considered a "space object" during its launch and ascent supported by rockets, and during the orbital flight, then an aircraft during descent and landing. Arguably, parts of Air Law and Space Law would both apply to such an *aerospace* vehicle. Certain rules of Air Law might apply from launch to landing, while certain rules of Space Law would apply during the time the object was in air space.

With the launch of commercial human spaceflight, the misconception has emerged that “suborbital vehicles” are a peculiar category of winged crafts that entail

⁶⁰ The licensing procedures of the vehicle have also been proposed as a criterion of whether it is an aircraft or space craft, but this seems to lead to absurd results since the choice of the licensing category (as well as of the registration category) would logically follow its classification as air or space vehicle.

⁶¹ Similarly the World Meteorological Organization has vaguely proposed as delimitation point “the unlimited part of the universe starting with the upper atmosphere and extending above the atmosphere”, in UNCOPUOS, *Definition and delimitation of outer space: views of States members and permanent observers of the committee*, Vienna, 28 January 2016, UN Doc A/AC.105/1112 at 3 [Note by the Secretariat].

⁶² Cooper, *supra note* 38.

functional characteristics of both air and space vehicles. This is one configuration of suborbital vehicles similar to NASA X-15 airplane of the 1960s, but there are other designs with no wings based on capsule/rocket configuration, such as Blue Origin's New Shepard.⁶³ The IAASS has embraced the following definitions:

Suborbital Flight: A flight up to an altitude at which the vehicle does not reach orbital velocity.

Suborbital Vehicle: Any vehicle conducting suborbital flights per the definition above; this includes Reusable Launch Vehicles (RLV) and Suborbital Aircraft (SoA)⁶⁴

Commercial suborbital spaceflights are conducted via the use of vehicles that reach an altitude above 100 km (the theoretical line proposed by von Karman to separate the fields of aeronautics and astronautics) and reenter the atmosphere of the Earth before achieving orbit around the Earth.⁶⁵ This very nature of the suborbital vehicles, coupled with the absence of an explicit delimitation between national air space sovereignty and outer space prohibition of sovereignty, creates a number of questions about the legal nature of such vehicles, and the respective application of the appropriate legal regimes. Is it appropriate to categorize winged rocket-powered vehicles as aircraft or spacecraft, or does it require the establishment of a new category of *aerospace vehicles* with the respective application of both legal regimes that govern aviation and space activities?

In 2016, a definition of suborbital mission was introduced by the Range Safety Group through the publication of STANDARD 321-16,⁶⁶ which is meant to reflect the common understanding of the term used since the beginning of space missions. According to this definition, suborbital flight is defined as any flight of a launch vehicle, rocket, or missile that does not achieve orbital insertion. A suborbital rocket is defined as a rocket-propelled vehicle intended to perform a suborbital mission whose thrust is greater than its lift for most of the rocket-powered portion of its flight.⁶⁷ Such a definition is also included in the United States Code,⁶⁸ as well as in the US Code of

⁶³ Blue Shepard was named after Alan Shepard who in May 1961 reached the altitude of 187 km on a suborbital flight with a Mercury capsule.

⁶⁴ International Association for the Advancement of Space Safety, SAFETY DESIGN AND OPERATION OF SUBORBITAL VEHICLES GUIDELINES 7 (Oct. 2015).

⁶⁵ Ruwantissa Abeyratne, *Space Security Law* (Heidelberg: Springer, 2011), at 12.

⁶⁶ RCC (Range Commanders Council), Range Safety Group, "Common Risk Criteria Standards for National Test Ranges" (August 2016), Document 321-16, at A-6.

⁶⁷ *Id.*

⁶⁸ *See*, 51 U.S. Code § 50906.

Federal Regulations.⁶⁹ Pursuant to this definition, the trajectory and speed of a vehicle, rocket or missile determines whether it is flying orbital or suborbital.⁷⁰

According to such a definition, no univocal link between altitude reached by suborbital flight and air space/outer space limit exists. In the region between 18km (upper limit of managed air space) and 160km (lower limit of practically sustainable orbital flights) [“Near Space”], there are competing national security interests and launch operational needs. So long as such interests and needs remain unclarified, the discussion about delimitation would still remain without a precise answer. Instead a special-regime for that region that recognizes some rights to the countries beneath, would probably settle the matter.⁷¹

D. PROBLEMS WITH THE FUNCTIONALIST APPROACH

Under the functionalist approach, a suborbital vehicle that briefly passes through outer space in the course of earth-to-earth transportation presumably would remain subject to Air Law during the entire journey; but a vehicle that passes through air space in the course of Earth-to-space transportation might be considered under Space Law during its entire journey. As ICAO has observed:

It might be argued from a functionalist viewpoint that air law would prevail since air space would be the main centre of activities for suborbital vehicles in the course of an earth-to-earth transportation, any crossing of outer space being brief and only incidental to the flight.⁷²

Because aerospace vehicles share air space with commercial aircraft, the rules of air safety and navigation must be harmonious. If they operate under two separate legal regimes, the danger of aircraft and aerospace vehicle collision arises. In one sense, the spatialist approach offers greater certainty as to the legal regime applicable, particularly on the rules of navigation governing commonly used air space. Yet in another, demarking where air space ends and outer space begins has confounded scientific and

⁶⁹ See, 14 CFR para. 401.5.

⁷⁰ A suborbital flight to 100 km requires only 1.5% of the energy of an orbital flight . Caleb A Scharf, “Basic Rocket Science: Sub-Orbital Versus Orbital” (25 November 2015), *Scientific American*, online: <<https://blogs.scientificamerican.com/life-unbounded/basic-rocket-science-sub-orbital-versus-orbital/>>. It should be noted that within the suborbital systems family there are two main types: systems intended for reaching high-altitude with an almost vertical trajectory, and systems with a high cross-range capability. The motivation to consider some suborbital vehicles essentially as space vehicles instead of high altitude airplanes may be driven by marketing strategies and the desire to avoid the application of expensive commercial aviation certification rules.

⁷¹ Tommaso Sgobba, “International Space Governance”, COPUOS Scientific and Technical Subcommittee, 53rd session, Vienna, 16 February 2016 (presentation).

⁷² ICAO *Working Paper*, *supra* note 40 ¶ 6.3.

legal experts for decades.

The United States has promulgated laws governing commercial space launches, vehicles, crew, and navigation, vesting jurisdiction in its Federal Aviation Administration (FAA), which has comprehensive jurisdiction over aircraft and aviation safety and navigation.⁷³ The German Aviation Code also specifies that "spacecraft, rockets and similar flying objects" are considered to be aircraft while in air space, and thus subject to the prevailing rules and regulations governing aircraft.⁷⁴

IV. SPATIALISM AS A MEANS OF DETERMINING WHICH LAW APPLIES

Another way of determining what law applies is to assess *where* the object is.⁷⁵ The issue of where air space ends and outer space begins has been debated since the 1950s.⁷⁶ The Soviet Union's launch of Sputnik in 1957 established the principle of freedom of space – freedom of "access to and unimpeded passage through outer space for peaceful purposes."⁷⁷

⁷³ See FAA, "Office of Commercial Space Transportation", online: FAA <http://www.faa.gov/about/office_org/headquarters_offices/ast/>. See also, Paul Stephen Dempsey, "The Evolution of US Space Policy", XXXIII ANNALS OF AIR & SPACE LAW 324(2008).

⁷⁴ Comments of Germany in UN Doc A/AC.105/635/Add. 11 (26 January 2005) in UNCOPOUS, *Compilation of Replies Received from Member States to the Questionnaire on Possible Legal Issues with Regard to Aerospace Objects [Compilation of Replies Received from Member States]*, online: UNOOSA <http://www.unoosa.org/docs/misc/aero/aero_compE.doc>.

⁷⁵ For example, an amphibious vehicle may be subjected to the Law of the Sea when upon the high seas, and subject to the laws governing land transport when it comes ashore. In *Reinhardt v. Newport Flying Service Corp.*, Judge Cardozo, speaking for a unanimous court, held that a hydroplane, moored and anchored in navigable waters, was a maritime "vessel" within admiralty jurisdiction, rather than an aircraft. But Cardozo was careful to point out that even a hydroplane, while in the air, is not subject to the laws of admiralty. Under the same reasoning, an aerospace vehicle might be considered a spacecraft while in outer space, and an aircraft while in airspace. *Reinhardt v. Newport Flying Service Corp.*, 133 N.E. 371 (NY, 1921).

⁷⁶ As early as 1951, Professor John Cobb Cooper, founder of the McGill University Institute of Air & Space Law, observed 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 space above its surface territory." John Cobb Cooper, *High Altitude Flight and National Sovereignty*, 4 *The Int'l L.Q.* 411, 411 (1951). Cooper wrote, 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 limit of the air space." *Id.* at 417.

See also, John Cobb Cooper, *The Problem of Definition of 'Air Space'*, 1 *Proc. Colloq. L. Outer Space* 38 (1958); Michael Smirnoff, *The Need for a New System of Norms for Space Law and the Danger of Conflict with the Terms of the Chicago Convention*, 1 *Proc. Colloq. L. Outer Space* 105 (1958); Henri T.P. Binet, *Toward Solving the Space Sovereignty Problem*, 2 *Proc. Colloq. L. Outer Space* 11 (1959); Andrew G. Haley, *Survey of Legal Opinion on Extraterrestrial Jurisdiction*, 3 *Proc. Colloq. L. Outer Space* 37 (1960).

⁷⁷ R. Cargill Hall, *The Origins of U.S. Space Policy: Eisenhower, Open Skies, and Freedom of Space*, <http://www.dtic.mil/dtic/tr/fulltext/u2/a344697.pdf>

The *spatialist theory*, proposes the establishment of a specific delimitation between air space and outer space,⁷⁸ not solely on the basis of scientific findings, for even they lack precision with regards to delimitation.⁷⁹ For that purpose many altitude proposals have been proffered, the most prominent of which being the 100 km (*Von Karman* line) above the surface of the Earth,⁸⁰ as this is the general area (give or take tens of kilometers) where the atmosphere is so thin that aircraft wings cannot generate sufficient lift for flight, while a spacecraft cannot orbit because the atmospheric drag is excessive.⁸¹

A. SOVEREIGNTY IN AIR SPACE ABOVE LAND AND TERRITORIAL SEAS

Under the Chicago Convention, air space over national territory is subject to “complete and exclusive” State sovereignty, while under the Outer Space Treaty, States are explicitly denied territorial sovereignty in space.⁸² The reason these two regimes of Air Law and Space Law approach spatial issues so differently is rooted in historical defense and military policy considerations. The Chicago Convention,⁸³ and its predecessor, the Paris Convention of 1919, both were drafted after the technology of aircraft had revealed their destructive capacity in world wars. Thus, exclusive sovereign territorial air space was deemed essential to protect the State from attack. Article 1 of the Chicago Convention affirms the pre-existing customary international law rule that each State enjoys complete and exclusive sovereignty in the air space above its territory. Air space over territorial seas also belongs to the coastal State.⁸⁴

The Outer Space Treaty was concluded during the Cold War, in an era clouded by

⁷⁸ Gbenda Oduntan, *Sovereignty and Jurisdiction in Airspace and Outer Space: Legal Criteria for Spatial Demarcation* (New York: Routledge, 2012) at 309.

⁷⁹ *Id.*

⁸⁰ *Id.*, at 306.

⁸¹ UNCOPUOS, *Report of the Legal Subcommittee on its forty-ninth session, held in Vienna from 22 March to 1 April 2010*, UN Doc A/AC.105/942 at 29 [*Report of the Legal Subcommittee*].

⁸² Judge Manfred Lachs, of the International Court of Justice, observed:

Cuius est solum eius est usque ad cœlum et ad sidera; this principle, inherited from Roman Law, was accepted by international law and adapted to its needs. For centuries States faced no practical questions concerning the control over their airspace nor the height to which their sovereignty extended.... Only the first journey of a man-made satellite reopened the issue: what was *coelum*? Can sovereignty extend *ad infinitum*?

Manfred Lachs, *The Law of Outer Space: An Experience in Contemporary Law-Making* (Leiden: Sijthof, 1972) at 42.

⁸³ *Convention on International Civil Aviation*, 7 December 1944, 15 UNTS 295, ICAO Doc 7300/6 (entered into force 4 April 1947) [*Chicago Convention*], art 1. A nearly identical provision was included in Article 1 of the Paris Convention of 1919: *Convention Relating to the Regulation of Aerial Navigation*, 13 October 1919, 11 LNTS173, 1922 UKTS2.

⁸⁴ *Chicago Convention*, *ibid*, art 2. Article 3 of the Law of the Sea Convention extends the jurisdiction of coastal States to 12 miles, while Article 38 establishes a right of transit through the straits for aircraft: see *United Nations Convention on the Law of the Sea*, 10 December 1982, 1833 UNTS 3 (entered into force 16 November 1994).

anxiety that space might become a new arena of military conflict between the superpowers. By denying sovereignty in space, the major powers sought to diffuse potential conflict. The commercial use of space, which would be realized decades later, was considered in the negotiation of the Outer Space Treaty. During the drafting of that treaty, there was some initial disagreement regarding the legal status of private sector space activities. The United States wanted to leave the door open to private sector involvement in future space exploitation. The Soviet Union opposed this idea, up to the point that the draft they proposed included the following statement: "All activities of any kind pertaining to the exploration of outer space shall be carried out solely and exclusively by States..." The United States then proposed a compromise solution, accepted by the Soviets, according to which each country would bear the responsibility for the activities of its nationals in space. The compromise was incorporated in Article VI of the Outer Space Treaty as follows: "States ... shall bear international responsibility for national activities in outer space ... whether such activities are carried on by government agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with ... [this] Treaty. The activities of non-governmental entities in outer space, ... shall require authorisation and continuing supervision by the appropriate State party to the Treaty."⁸⁵

The right of innocent passage through territorial air space for ascending or descending space objects has not been established under either conventional or customary international law. The US Space Shuttle usually ascended and descended over US air space or over the oceans. Until the opening of the new Vostochny Cosmodrome located approximately at 600–800 km from the Pacific Ocean, depending on launch azimuth, the Russian rockets flew over the vast Russian air space. On relatively few occasions has a space object flown over the territorial air space of a State other than the launching State, but well above controlled air space;⁸⁶ when territorial air space has been entered or overflowed, the reason for the absence of objection usually is because the underlying State was unaware, not because it acquiesced sovereignty over its air space.⁸⁷

B. THE ABSENCE OF SOVEREIGNTY IN AIR SPACE ABOVE THE HIGH

⁸⁵ T. Sgobba & S. Chiesa, "Toward an International Space Station Safety Authority" - ESA SP-486, Joint ESA-NASA Space Flight Safety Conference, 11-14 June 2002).

⁸⁶ AIAA Atmospheric and Space Environments Conference 2 - 5 August 2010, Toronto, Ontario Canada AIAA 2010-7996 - Over-flight Risk Considerations for the Launch of an ELV Rocket to an ISS Inclination Steven Millard* Federal Aviation Administration, Washington, DC, 20591

⁸⁷ On other occasions, entry was requested and granted, as in 1990 when the Soviet Union granted the United States permission to overfly its territory on the final flight stage of the Space Shuttle Atlantis. Comments of the Russian Federation, UN Doc A/AC.105/635/Add. 1 (15 March 1996) in Compilation of Replies Received from Member States, *ibid.* Article 19 of the Russian Federation Act on Space Activity of 1993 authorizes a single innocent flight through its airspace provided sufficient notice of the time, location and flight path is conferred in advance. Arguably, however, one might infer a right of innocent passage during periods of force majeure ("accident, distress, emergency, or unintended landing") from the Rescue Agreement. Rescue Agreement, *supra* note 15, art II.

SEAS

Air space beyond the territorial seas, and above the high seas, is open for use by all. However, under the Chicago Convention, the rules governing such air space are those promulgated by ICAO in SARPs.⁸⁸

C. THE ABSENCE OF SOVEREIGNTY IN OUTER SPACE

The Outer Space Treaty declares outer space to be the common property of mankind, to be used freely "for exploration and use by all States",⁸⁹ and not subject to national appropriation or otherwise subjected to the sovereignty of any State.⁹⁰

No rule of conventional or customary international law defines where air space ends and outer space begins. Some have suggested the van Karman Line be adopted as the dividing line between air space and outer space, approximately 100 km above the Earth's surface.⁹¹ But within a range of several tens of kilometers from the Karman Line, neither a satellite (above) can sustain an orbital flight, nor an aircraft (below) can generate sufficient lift for sustained flight. The 100km altitude proposed by von Karman is where the control surfaces of a vehicle (e.g. rudder, elevator and ailerons of an airplane, or fins of a rocket) lose the capability to control (aerodynamically) the attitude of a vehicle and alternatives means are needed, namely the RCS (reaction control system).⁹² Besides the 100 km proposed demarcation altitude, many more numbers

⁸⁸ *Chicago Convention*, *supra* note 9, art 12.

⁸⁹ *Ibid.*

⁹⁰ *Ibid.*, art II. Outer space has been referred to as the "global commons". See Stephan Hobe & Kuan-Wei Chen, *Legal Status of Outer Space and Celestial Bodies*, in *ROUTLEDGE HANDBOOK ON SPACE LAW* 25, 29 (Ram Jakhu & Paul Dempsey, eds., Routledge 2017).

Certain equatorial States have attempted to assert sovereignty over the geostationary orbit above their territories. The 1976 Bogota Declaration sought to achieve sovereignty by equatorial States over the geostationary orbit above them. See Declaration of the First Meeting of Equatorial Countries, 3 December 1976, ITU Doc WARC-BS 81-E. But these declarations have not been recognized by other States on grounds that such territorial claims are inconsistent with Articles I and II of the Outer Space Treaty of 1967. Ram Jakhu, "The Legal Status of the Geostationary Orbit" (1982) 7 *Ann Air & Sp L* 333.

⁹¹ Physicist Theodore von Karman calculated that this was the height at which a vehicle would have to travel at orbital velocity to have sufficient lift to derive support from the atmosphere. The air is not adequate to sustain flight at above approximately 80 km, and satellites begin to fall back into the Earth's atmospheres at about 120 km. See Dean N Reinhardt, "The Vertical Limit of State Sovereignty" (2007) 72 *J Air L & Com* 65. Certain national laws, such as the legislation of Australia, draw a jurisdictional line of outer space as that above 100 km.

⁹² One of the key objectives of the X-15 airplane experimental program was to demonstrate the use of the RCS. "The X-15 used conventional aerodynamic controls for flight in the dense air of the usable atmosphere. The controls consisted of rudder surfaces on the vertical stabilizers to control yaw (movement of the nose left or right) and canted horizontal surfaces on the tail to control pitch (nose up and down) when moving in synchronization or roll when moved differentially. For flight in the thin air outside the Earth's atmosphere, the X-15 used a reaction control system. Hydrogen peroxide thrust

have been presented, the most popular ones ranging from 40 to 160 km.⁹³ Although the issue has been debated at COPUOUS since the 1960s, as we shall see below, no consensus has yet been reached.⁹⁴

D. PROBLEMS WITH THE SPATIALIST APPROACH

The spatialist approach poses problems as well. One major problem is that there is no consensus as to where to draw the line of demarcation between air space and outer space.⁹⁵

Yet without such a demarcation, the legal regime remains murky, with different States asserting different sovereignty claims in areas that other States consider outer space, thereby creating potential conflict.⁹⁶ Commercial suborbital spaceflights use vehicles that reach an altitude of approximately 100 km, the theoretical line proposed by Theodore von Kármán to separate the fields of aeronautics and astronautics. This line has been recognized by the Fédération Aéronautique Internationale for aviation records. But setting the boundary of territorial air space that high would restrict launches to the discretion of the underlying State. Setting the boundary between sovereign air space and non-sovereign outer space at 100km would create a wall so high that many smaller and landlocked States would be restricted in their ability to participate in aerospace transportation.

Though both the Chicago Convention of 1944 and its predecessor, the Paris Convention of 1919, recognized that States enjoy complete and exclusive sovereignty over the air space above their territories, neither instrument prescribed how high such a territorial claim could be made. Though the Outer Space Treaty forbids the exertion of

rockets on the nose of the aircraft provided pitch and yaw control. Those on the wings furnished roll control" NASA Armstrong Fact Sheet: X-15 Hypersonic Research Program - <https://www.nasa.gov/centers/armstrong/news/FactSheets/FS-052-DFRC.html>

⁹³ *Questions on suborbital flights for scientific missions and/or for human transportation*, UN-COPUOUS, UN General Assembly (29 November 2013), UN Doc. A/AC.105/1039/Add. 2.

⁹⁴ In fact, UNCOUOUS has been unable to produce a treaty of any kind since the ill-fated Moon Agreement in 1979.

⁹⁵ "There is currently not a clear internationally recognized boundary of outer space and, consequently, not a proper definition despite the separate bodies of international law governing air space and outer space." Yun Zhao, "A Legal Regime for Space Tourism: Creating Legal Certainty in Outer Space" (2009) 74 *J Air L & Com* 959 at 963. Professor Bin Cheng observed: "there are probably as many criteria as there are speakers and writers on the subject: gravitational effect, effective control, actual lowest perigee of orbiting satellites, theoretical lowest perigee of orbiting satellites, the Karman line, limit of air drag, limit of air flight, the atmosphere and its various levels, an absolutely arbitrary height ... (100 kilometres) or one-hundredth of the [E]arth's radius (64 kilometres....)." Bin Cheng, "The Legal Regime of Airspace and Outer Space: the Boundary Problem" (1980) 5 *J Space L* 323. In the early, 20th Century, some scholars proposed borrowing from Maritime Law and limiting territorial airspace to the cannon-shot rule.

⁹⁶ Varlin Vissepo, "Legal Aspects of Reusable Launch Vehicles (2005) 31 *J Space L* 165 at 175.

State sovereignty over outer space, it also fails to define where outer space begins.⁹⁷ Some also argue that establishing a boundary too high might hamper certain space activities; once established, it will be difficult to amend, particularly if it should need to be lowered.⁹⁸ Moreover, if a legal question arose during a flight near the point of demarcation between air space and outer space, it might be difficult to determine on which side of the line the event occurred.⁹⁹

Another problem is that an aerospace vehicle may enter suborbital space for only a short time, while its primary activity and mission is in air space. Here we reiterate the point that while current suborbital space tourism vehicles are designed to reach an altitude slightly above 100km, a suborbital flight is such, no matter the altitude, so long as the velocity is below 28,400km/h (orbital velocity). Unmanned research suborbital flights have been carried out for decades by sounding rockets for a range of altitudes between 50km and 1,500km¹⁰⁰ Military suborbital flights (e.g. ICBM - Intercontinental Ballistic Missile, or ASAT Anti-Satellite weapons) can reach much higher altitudes.¹⁰¹

According to the spatialist theory, everything that operates below the hypothetical delimitation between air space and outer space would qualify as aircraft whereas anything that operates above would qualify as spacecraft. However, what should the approach be for those suborbital aerospace vehicles that principally operate within the air and remain in outer space for less than a few minutes before reentering the Earth's atmosphere? Under a functionalist approach, it might be more appropriate to apply Air Law to the entire movement. A spatialist approach might require that vehicles be certified under, and regulated by, two separate legal regimes - one, an Air Law regime created by ICAO, and another, a Space Law regime created by some future space navigation organization.

V. COPUOUS STRUGGLES WITH THE LEGAL QUESTION

The USSR launched Sputnik, the first satellite in space, in 1957. Two years later, the issue of the delimitation between air space and outer space was raised before the U.N. Committee on the Peaceful Use of Outer Space [COPUOS].¹⁰² Renewed interest in

⁹⁷ "The air transportation regime, characterized by state sovereignty over air space, substantially differs from the space travel regime where no state can claim sovereignty over outer space." Zhao, "A Legal Regime for Space Tourism: Creating Legal Certainty in Outer Space", *supra* note 95, at 963.

⁹⁸ Robert Goedhart, *The Never Ending Dispute: Delimitation of Air Space and Outer Space* (Gif-sur-Yvette: Editions Frontières, 1996).

⁹⁹ Vissepo, *supra* note 96, at 172.

¹⁰⁰ What is a Sounding Rocket? https://www.nasa.gov/missions/research/f_sounding.html.

¹⁰¹ "In May of 2013, the Pentagon revealed that China had launched a suborbital rocket from the Xichang Satellite Launch Center in southwest Sichuan province that reached a high-altitude satellite orbit [36,000km]" Jaganath Sankaran Limits of the Chinese Antisatellite Threat to the United States, *Strategic Studies Quarterly*, Winter 2014).

¹⁰² Stephan Hobe & Kuan-Wei Chen, *Legal Status of Outer Space and Celestial Bodies*, in ROUTLEDGE HANDBOOK ON SPACE LAW 25, 27 n. 18 (Ram Jakhu & Paul Dempsey, eds., Routledge 2017).

the issue began in 1966, when the item was proposed by France for inclusion in the Legal Subcommittee agenda.¹⁰³ The Subcommittee first considered the issue in 1967. The delegates to the Legal Subcommittee divided into two groups: those who supported a specific delimitation line between air space and outer space for reasons of “sovereignty and national independence, equality of rights, mutual advantage and non-interference in domestic affairs,”¹⁰⁴ and those that did not consider the issue of sufficient contemporary importance to warrant resolution.¹⁰⁵

In 1970, the Secretariat prepared a comprehensive background paper summarizing the views that had been expressed by the delegations to date.¹⁰⁶ It noted the need to designate a delimitation altitude created by the fact that “the rule of law establishing complete and exclusive sovereignty of States in that air above their territories and territorial waters does not apply to outer space.”¹⁰⁷ The need for delimitation was also expressed as a prerequisite to the further development of space activities while providing “a precise sphere of application of [the existing outer space] rules.”¹⁰⁸ Nevertheless, faced with the complexity of the issue and the lack of consensus, coupled with the scientific difficulty in identifying a natural boundary between air space and outer space, the issue lay unresolved and dormant for several years.¹⁰⁹

¹⁰³ UNCOPUOS, *Historical Summary on the Consideration of the Question on the Definition and Delimitation of Outer Space*, Report of the Secretariat, Legal Subcommittee, Forty-First Session, Vienna 2-12 April 2002, Item 6 (a) of the provisional agenda, Matters relating to the definition and delimitation of outer space, 18 January 2002, A/AC.105/769m, at 2.

¹⁰⁴ *Ibid.*

¹⁰⁵ According to the historical summary on the issue provided by the A/AC.105/769 report of the Secretariat in 2002, the methodology that was proposed by the delegates as appropriate to examine the delimitation altitude was once more divided into two camps, one supporting the “natural environment” approach, and the other the functional approach, the latter adopting the criterion of “devices employed or the activities carried out.” *Ibid.*

¹⁰⁶ UNCOPUOS, *The Question of the Definition and/or the Delimitation of Outer Space, Background Paper prepared by the Secretariat*, 7 May 1970, A/AC.105/C.2/7.

¹⁰⁷ *Ibid* at 6.

¹⁰⁸ *Ibid* at 6.

¹⁰⁹ The background paper summarized the three principal approaches as follows:

- Both the Chicago Convention and the Geneva Convention on the High Seas suggest the extension of national sovereignty to airspace and the sea respectively based on specific State needs and freedoms, leading to territorial airspace and territorial waters. As a result, a similar notion of “territorial outer space” would align with the interests of States to exercise freedoms in this new field of human exploration. Such freedoms comprise the freedom of navigation, that of commercial/economic exploitation, communication, and transportation and similar freedoms were considered as necessary for the use of outer space and for a consequent delimitation point (both vertical and horizontal) for the purposes of extending the exercise of national sovereign activities and the respective national jurisdictions over them. UNCOPUOS, *The Question of the Definition and/or the Delimitation of Outer Space, Background Paper prepared by the Secretariat*, 7 May 1970, A/AC.105/C.2/7.
- In particular, the background paper states that: “Both international agreements and national law on airspace refer to the sovereignty over air space above the territory of a state, that is to “territorial air space”. Continental territories to which national sovereignty applies account for

Although most of the representatives at the Legal Subcommittee recognized the need for delimitation, such need was not formally endorsed in an effort to avoid political tensions.¹¹⁰ In an environment overshadowed by the tensions of the Cold War, left the formal discussions on the issue in limbo for more than five years until 1976, when it reappeared in the Legal Subcommittee. In the meantime, however, the discussions among the delegates continued at the informal level and were captured in a synoptic table prepared by the Secretariat in 1976¹¹¹ which summarized the approaches as:

- Demarcation based on the equation of the upper limit of national sovereignty with the concept of 'atmosphere',¹¹²
- Demarcation based on the division of atmosphere into layers,¹¹³
- Demarcation based on the maximum altitude of aircraft flight (theory of navigable air space),¹¹⁴

about 29 per cent of the earth's surface while the rest of it is covered by sea, It has been noted that at least with respect to many legal issue the problem of delimitation of air space from outer space is actually the problem of delimitation of territorial air space from outer space since the legal regime of airspace above the high seas is similar to that of outer space in so far as the principle of freedom of use or flight is concerned." UNCOPUOS, *The Question of the Definition and/or the Delimitation of Outer Space, Background Paper prepared by the Secretariat*, 7 May 1970, A/AC.105/C.2/7, at 9.

- Another approach that emerged was based on the *stricto sensu* space regime, namely the Outer Space Treaty itself. Specifically, this approach conducts a systemic interpretation of the Outer Space Treaty by combining the provisions of Articles II and IV: While Article II prohibits the extension of national sovereignty in outer space, paragraph 1 of Article IV, is considered, according to this approach, to set limit of national sovereignty where the prohibition inherent to Article IV begins, *i.e.* the placement of objects that carry weapons of mass destruction or nuclear weapons in orbit around the Earth. Consequently, this approach considers that lower limit of outer space commences where the placement of such orbits is possible. UNCOPUOS, *The Question of the Definition and/or the Delimitation of Outer Space, Background Paper prepared by the Secretariat*, 7 May 1970, A/AC.105/C.2/7, at 11.
- Although the supporters of the aforementioned approaches considered the delimitation as a necessary prerequisite for both the development of the space industry and the national space activities as well as a sustainable legal regime to surround spaceflight, a third approach proposed the consideration of the issue at a later stage of the development of space activities, and then only when a practical need would arise and bring with it potential conflicts. UNCOPUOS, *The Question of the Definition and/or the Delimitation of Outer Space, Background Paper prepared by the Secretariat*, 7 May 1970, A/AC.105/C.2/7, at 12-14.

¹¹⁰ *Ibid.*

¹¹¹ UNCOPUOS, *The Question on the Definition and/or Delimitation of Outer Space, Background Paper prepared by the Secretariat, Addendum*, 21 January 1977, A/AC.105/C.2/7/Add. 1.

¹¹² *Ibid.*, at 44-47.

¹¹³ *Ibid.*, at 48-51.

¹¹⁴ *Ibid.*, at 52-55.

- Demarcation based on aerodynamic characteristics of flight instrumentalities (von Karman line),¹¹⁵
- Demarcation according to the lowest perigee of an orbiting satellite,¹¹⁶
- Demarcation based upon the Earth's gravitational effects,¹¹⁷
- Demarcation based on effective control,¹¹⁸
- Demarcation based upon the division of space into zones,¹¹⁹
- Demarcation based on combination of various spatial approaches and other proposals and,¹²⁰
- Arbitrary boundary between air space and outer space.¹²¹

When the issue was formally brought again in the COPUOUS Legal Subcommittee in 1977,¹²² the approaches had not changed significantly, although new views had been added, principally based on the emergence of the idea to develop suborbital vehicles with a possible hybrid legal nature.¹²³ A working group was established in 1984 to examine the issue more closely. Since the approaches remained the same (namely the spatial and the functional) and given the fact that scientific definition of outer space was not yet settled, the working group considered the matter based on the existing approaches with a focus on the 100 Km von Karman line as the delimitation point most acceptable to the majority of States, being the only one with some scientific support.¹²⁴

A change in the landscape emerged during the 1980s when the commercial space industry's needs came to the fore. The issue was now strictly linked to the functions and purposes that the aerospace vehicles served. The dominant view considered the definition delimitation issue critical for the creation of certainty to the actors involved in aerospace systems operations.¹²⁵ It was thus suggested that the legal regime governing aerospace vehicles should be defined, which would, in turn, require the definition and

¹¹⁵ *Ibid*, at 56-58.

¹¹⁶ *Ibid*, at 59-65.

¹¹⁷ *Ibid*, at 66-68.

¹¹⁸ *Ibid*, at 69-71.

¹¹⁹ *Ibid*, at 72-74.

¹²⁰ *Ibid*, at 75.

¹²¹ *Ibid*, at 76-78.

¹²² UNCOPUOS, *Historical Summary on the Consideration of the Question on the Definition and Delimitation of Outer Space*, Report of the Secretariat, Legal Subcommittee, Forty-First Session, Vienna 2-12 April 2002, Item 6 (a) of the provisional agenda, Matters relating to the definition and delimitation of outer space, 18 January 2002, A/AC.105/769m, at 3.

¹²³ *Ibid*.

¹²⁴ UNGA, *Official Records of the General Assembly*, 30th Sess, Supp N 20 (A/10020), para 27; see also, UNCOPUOS, *Historical Summary on the Consideration of the Question on the Definition and Delimitation of Outer Space*, Report of the Secretariat, Legal Subcommittee, Forty-First Session, Vienna 2-12 April 2002, Item 6 (a) of the provisional agenda, Matters relating to the definition and delimitation of outer space, 18 January 2002, A/AC.105/769m, at fn. 4.

¹²⁵ *Ibid*, at 4.

delimitation between air space and outer space.¹²⁶ The methodology proposed was to examine the needs and views of the delegates as to what the applicable law on aerospace vehicle operations should be, and follow the majority of the opinions on a 'custom-emergence' basis. However, since the approaches remained the same (i.e., functionalist and the spatialist), no agreement was achieved.

The methodological approach involved the issuance of a questionnaire addressing issues related to or influenced by the delimitation (and/or the absence of it).¹²⁷ In that manner, the Legal Subcommittee wished to frame the delimitation issue through its practical implications, rather than perpetuate a fruitless discussion on the delimitation line *per se*. The questionnaire's purpose was to capture the *opinio juris* of States as to what the regime governing hybrid activities should be and as such, in a customary approach, to draw a conclusion about what the definition and delimitation should consist. With minor changes, the questionnaire is still being circulated among member States and other observers to the Legal Subcommittee of the COPUOS. Most of the State responses consider, as a main issue, the safety concerns that the use of hybrid vehicles might pose. Among the principal approaches embraced by the respondents were:

- The spatial approach enjoys support from the perspective of sovereignty and safety issues as it provides a higher degree of certainty as to the applicable law.¹²⁸
- The definition of 'aerospace objects' should be examined thoroughly prior to discussing the issue of delimitation. This was considered necessary due to the close relationship between the technological evolution of aerospace objects and their possible actual functions in air space/outer space in the future. Specifically, it was expressly noted that "the twofold capacity to 'travel' and to 'fly into orbit' as a specific characteristic of the aerospace object, is closely linked with the developing technology in view of a possible legal definition consistent with the technological evolution."¹²⁹
- There is no need for a specific demarcation and definition as it would be preferable to solely apply one legal regime to the functions of hybrid aerospace vehicles: "In fact, the overall flight of aerospace objects should be submitted to a sole legal regime, exactly to avoid unnecessary dualism (more or less justified in the case of the territorial and open sea because of the very low speed of ships and

¹²⁶ *Ibid*, at 4-6.

¹²⁷ *Ibid*, at 4-6.

¹²⁸ COPUOS, *Questionnaire on Possible Legal Issues with Regard to Aerospace Objects: Replies from Member States*, 15 March 2016, Add. 1, A/AC.105/635/Add.1, at 5.

¹²⁹ COPUOS, *Questionnaire on Possible Legal Issues with Regard to Aerospace Objects: Replies from Member States*, 18 March 2016, Add. 1, A/AC.105/635/Add.2, at 3.

other similar factors), which undoubtedly produce confusion and malfunction of the whole legal system governing space activities.”¹³⁰ Similarly, it has been suggested that the question of which legal regime applies should focus on the “purpose of the object and its final destination rather than taking as the point of reference the physical space through which it travels.”¹³¹

- Delimitation is necessary in order to define the legal regime applicable to aerospace vehicles as one that is defined by the destination of the vehicle.¹³²
- The demarcation theory is not necessary if the vehicle is planned to: (i) orbit the Earth, (ii) land on an extraterrestrial surface, or (iii) return to the Earth by landing within the territory from where it took off. In the above cases only Space Law should apply, whereas if the functions of the vehicle requires that foreign aerospace be traversed, then Air Law should be applicable for the functions conducted within foreign air space.¹³³
- “On the basis of existing international law, the general principle could be that aerospace objects travelling through air space are considered aircraft and that, when they travel through outer space, they are considered spacecraft. However, in the light of technological advances and the wide range of objects that can be covered by the concept of ‘aerospace object’, it would be advisable to analyze the possibility of creating a special legal regime.”¹³⁴
- There is no need for delimitation, as a hybrid aerospace vehicle should be considered in a way similar to an “amphibious vehicle that is also equipped to navigate in water while driving on land”, and as such, Space Law should apply.¹³⁵
- The Air Law and Space Law regimes should be adapted to accommodate “aerospace vehicles”: “Owing to the absence of the concept of aerospace vehicles in legal texts, however, some slight adaptation would be required. In other words, both air law and space law need to accommodate, by way of slight

¹³⁰ COPUOS, *Questionnaire on Possible Legal Issues with Regard to Aerospace Objects: Replies from Member States*, 4 December 1966, Add. 3, A/AC.105/635/Add.2, at 3.

¹³¹ COPUOS, *Questionnaire on Possible Legal Issues with Regard to Aerospace Objects: Replies from Member States*, 21 January 2014, Add. 10, A/AC.105/635/Add.10, at 7.

¹³² COPUOS, *Questionnaire on Possible Legal Issues with Regard to Aerospace Objects: Replies from Member States*, 5 February 2008, Add. 5, A/AC.105/635/Add.5, at 6.

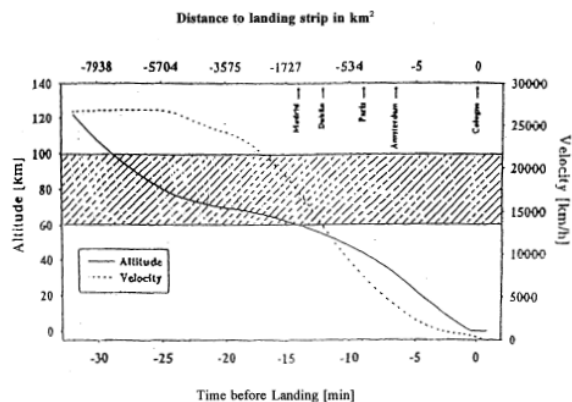
¹³³ COPUOS, *Questionnaire on Possible Legal Issues with Regard to Aerospace Objects: Replies from Member States*, 21 January 2012, Add. 6, A/AC.105/635/Add.6, at 4.

¹³⁴ COPUOS, *Questionnaire on Possible Legal Issues with Regard to Aerospace Objects: Replies from Member States*, 13 January 2003, Add. 7, A/AC.105/635/Add.7, at 12.

¹³⁵ COPUOS, *Questionnaire on Possible Legal Issues with Regard to Aerospace Objects: Replies from Member States*, 26 January 2015, Add. 8, A/AC.105/635/Add.8, at 5.

insertions and alterations, 'aerospace vehicles' within their scope, while at the same time upholding the values of both air and space law. The International Civil Aviation Organization and the Committee on the Peaceful Uses of Outer Space, with their expertise in the fields concerned, could negotiate with each other and play a decisive role here."¹³⁶

- One more approach considering the fast-developing technology supports that: "Neither international treaties nor national legislation refer to or define an 'aerospace object. . . . It would, nonetheless, be preferable to have a uniform regime applicable to all aerospace objects. To establish an applicable regime on the basis of the special characteristics of a given object would make the regime itself unworkable, given the development of the technology and the consequent increasing diversity of aerospace objects. It would therefore be necessary to take into account not only the technology, but also the function and purpose of such an object."¹³⁷
- A different approach was proposed by Germany in 1996 and is based on safety requirements that are peculiar to the nature of aerospace vehicles. Specifically, it is suggested that right before their landing, such vehicles, are under extreme conditions in terms of the relationship between altitude and velocity as well as maneuverability. Therefore, it has been suggested that a special regime is established between 60 and 100km (the reentry stage with the highest security requirements) and cleared from any other air or space traffic, bearing with it the creation of a specific legal regime.¹³⁸



¹³⁶ COPUOS, *Questionnaire on Possible Legal Issues with Regard to Aerospace Objects: Replies from Member States*, 17 February 2003, Add. 11, A/AC.105/635/Add.11, at 21.

¹³⁷ COPUOS, *Questionnaire on Possible Legal Issues with Regard to Aerospace Objects: Replies from Member States*, 8 February 2007, Add. 14, A/AC.105/635/Add.14, at 4.

¹³⁸ COPUOS, *Questionnaire on Possible Legal Issues with Regard to Aerospace Objects: Replies from Member States*, 15 February 1996, A/AC.105/635 at 5.

Source: UNCOPUOS¹³⁹

The last possible scenario would be the acceptance that suborbital vehicles share common characteristics with both categories, the one of air- and that of space craft. In that case, both regimes would successively apply, solution that would create legal ambiguities especially with regards to registration and liability issues, since the double-faceted nature of the vehicles would require registration under both regimes, which would lead to the phenomenon of double registration, forbidden under both air and space law regimes.¹⁴⁰

Consequently, it should be emphasized that in instances where both the Air Law and Space Law regimes conflict, there will inevitably be inconsistency. As commercial aerospace launches become more numerous, their use of air space also traversed by aircraft will proliferate, creating a need for clarified rules of safety, security, navigation, and traffic control. The lack of precise “rules of the road” may result in collision, and a proliferation of space debris – the largest environmental threat to the development of space.¹⁴¹

To sum up, the Legal Subcommittee of COPUOS has made significant progress with regards to the methodology appropriate to resolving the problem of delimitation, yet with no tangible resolution. The issue was included in the COPUOS Legal Subcommittee’s agenda in 1966, with a comprehensive background paper produced in 1970 presenting the approaches of all COPUOS delegations. The wording of the item was changed in 1972 when it was included in the agenda of the Subcommittee’s session of 1972 as “matters relating to the definition and/or delimitation of outer space and outer space activities.”¹⁴² During the ensuing decade, an exchange of views on the issue took place within the Legal Subcommittee with result a synoptic table of the States’ views that was presented to the Legal Subcommittee in 1976, and two working papers by the former USSR, one submitted to the Legal Subcommittee and the second to COPUOS itself, supporting the view that definition and delimitation should occur by agreement among States.¹⁴³ In 1984, the Subcommittee established a working group on the question of definition and delimitation, and the same year the General Assembly requested the Subcommittee to take into account “matters relating to the definition and delimitation of outer space and to the character and utilization of the geostationary

¹³⁹ COPUOS, *Questionnaire on Possible Legal Issues with Regard to Aerospace Objects: Replies from Member States*, 15 February 1996, A/AC.105/635 at 5.

¹⁴⁰ Ruwantissa Abeyratne, *Convention on International Civil Aviation: A Commentary* (Heidelberg: Springer, 2014), vii, 253.

¹⁴¹ Joseph N. Pelton, Ram S. Jakhu (Eds.), *Space Safety Regulations and Standards* (UK, USA: Elsevier, 2010) at xxii.

¹⁴² UNCOPUOS, *Historical Summary on the Consideration of the Question on the Definition and Delimitation of Outer Space*, Report of the Secretariat, Legal Subcommittee, Forty-First Session, Vienna 2-12 April 2002, Item 6 (a) of the provisional agenda, Matters relating to the definition and delimitation of outer space, 18 January 2002, A/AC.105/769m, at 2.

¹⁴³ *Ibid.*

orbit, including consideration of ways and means to ensure the rational and equitable use of the geostationary orbit without prejudice to the role of the International Telecommunication Union.”¹⁴⁴ From 1993 to 1995 a questionnaire on the matter was discussed and finalized. The questionnaire focused on “possible legal issues with regard to aerospace objects” and is still circulated today. During the past decade the issue has been designated by the Legal Subcommittee as agenda item titled “matters relating to the definition and delimitation of outer space”¹⁴⁵ while ICAO’s involvement has shifted the discussions towards a holistic aerospace approach to air space delimitation as well as regulation of suborbital flights.

VI. THE NEED FOR A UNIFIED LEGAL REGIME

Future transportation systems will be highly influenced by the legal regime in which they are developed. Commercial development of space would be much enhanced by clarity, stability and predictability of law.¹⁴⁶ Failing to define the boundary of outer space may “thwart the proper and orderly governance of outer space and the certainty and strength of international law governing space activities.”¹⁴⁷ The absence of uniformity of law, and conflicting and overlapping laws will impair the market's interest in investment in space transportation, and the insurance industry's ability to assess and price risk.¹⁴⁸

Commercial investment in space transportation systems is expensive, depends on as yet unproved technology, and is fraught with risk. Clear legal rules can help define the degree, or consequences, of risk, and reduce uncertainty, providing the predictability necessary to support commercial investment. Conversely, legal uncertainty can increase risk and chill investment.

¹⁴⁴ *Ibid.*

¹⁴⁵ *Ibid.*

¹⁴⁶ See generally, Stephan Hobe, "Aerospace Vehicles: Questions of Registration, Liability and Institutions" (2004) 29 *Ann Air & Sp L* 377 (2004).

¹⁴⁷ Stephan Hobe & Kuan-Wei Chen, *Legal Status of Outer Space and Celestial Bodies*, in ROUTLEDGE HANDBOOK ON SPACE LAW 25, 28 (Ram Jakhu & Paul Dempsey, eds., Routledge 2017).

¹⁴⁸ What is needed is a "secure framework of regulations and legal responsibility ... [to] encourage increased activities in the future." Peter Nesgos, "Commercial Space Transportaton: A New Industry Emerges" (1991) 16 *Ann Air & Sp L* 393 at 412. Professor Yun Zhao observes:

"Space travel stands at exactly the same crossroad as air transportation did in the early 1920s. The potential liability for accidents is a major obstacle. The legal vacuum in this respect deters the commercialization of space travel. Insurance is not a way out since the huge cost of insurance for space travel will be passed on to the tourists and the ticket prices will go far beyond a reasonable level and kill the whole space industry. Accordingly, the formulation of appropriate liability regime for space travel appears all the more important."

Zhao, "A Legal Regime for Space Tourism: Creating Legal Certainty in Outer Space", *supra* note 95, at 963. That conclusion is stated a bit stronger than many would have stated it (one might doubt it would "kill the whole space industry"), but a consensus exists among Space Law scholars that the conflicting laws and resultant uncertainty will impede its full potential.

Professor van der Dunk observes, “The need to unequivocally establish a boundary between air space and outer space has been denied by some key space-faring states, notably the United States, as it is deemed largely theoretical if not even dangerous for proper development of legal regulation of space activities.²²⁴ However, with the impending kick-off of proper private commercial sub-orbital flights carrying humans on board for commercial purposes, this conundrum should not be allowed to linger.”¹⁴⁹ Many other academics and commentators have urged that legal rules be refined to take account of commercial needs in space.¹⁵⁰ Some have suggested that the emerging legal regime should be one of Air Law.¹⁵¹ Others prefer the regime of Space Law.¹⁵² Still others have urged immunity from liability for commercial activities in space for a developmental period.¹⁵³

As we have seen, neither “air space” nor “outer space” is defined in the relevant

¹⁴⁹ Frans G. von der Dunk, *Beyond What? Beyond Earth Orbit? . . .! The Applicability of the Registration Convention To Private Commercial Manned Sub-Orbital Spaceflight*, 43 Cal. W. Int'l L.J. 269, 326 (2013).

¹⁵⁰ Damodar Wadegaonkar argues that, “it would be advantageous to have a proper definition [i.e., agreement on the boundary of outer space] so that misunderstandings or uncertainty may not lead to international stress-conflict situations.” Damodar Wadegaonkar, *The Orbit of Space Law* 41 (London: Stevens & Sons 1984). See also, Henri Wassenbergh, “Access of Private Entities to Airspace and Outer Space” (1999) 24 Ann Air & Sp 311 at 325; Henri Wassenbergh, “The Art of Regulating International Air & Space Transportation” (1998) 23 Ann Air & Sp 201; Bruce Stockfish, “Space Transportation and the Need for New International Legal and Institutional Regime” (1992) 17-II Ann Air & Sp L 323; John C. Kunich, “Planetary Defense: The Legality of Global Survival,” 41 Air Force L. Rev. 119, 130 (1997); and J. Parkerson, “International Legal Implications of the Strategic Defense Initiative,” 116 Mil. L. Rev. 81 (1987);

¹⁵¹ Charity Ryabinkin, “Let There Be Flight: It's Time to Reform the Regulation of Commercial Space Travel” (2004) 69 J Air L & Com 101; Zhao, “A Legal Regime for Space Tourism: Creating Legal Certainty in Outer Space”, *supra* note 95, at 982.

¹⁵² Freeland, as quoted in Jakhu, Sgobba & Dempsey, *supra* note 6, at 68-69. Blending functionalist and spatialist principles, Professor Freeland argues:

the most appropriate approach seems to be the application of space law to the entire journey on the basis of the proposed function of the spacecraft carrying tourists – that is, the intention that it involves flight in outer space. The alternate 'exclusive' approach – to apply air law to the entire space tourism activity – appears unworkable given the lack of sovereignty that exists in outer space.

Ibid at 9. Professor Hobe makes a similar argument: “the provisions of the Chicago Convention are based on the principle of sovereignty in national airspace and are therefore generally not applicable to activities which take place in outer space.” Hobe, *supra* note 146, at 382. Similarly, Professor Zhao argues, “The air transportation regime, characterized by state sovereignty over air space, substantially differs from the space travel regime This fundamental difference justifies the necessity of developing a distinct legal regime for space travel.” Yun Zhao, “Developing a Legal Regime for Space Tourism: Pioneering a Legal Framework for Space Commercialization” (2005) 48 Proceedings of the Colloquium on the Law of Outer Space 198. It is unclear why it is unworkable to have an Air Law regime apply to non-territorial outer space, inasmuch as a sophisticated body of both Public and Private International Air Law has developed involving intercontinental flights over the high seas, where no State has sovereignty. Over the high seas, which comprise more than 70% of the planet, the rules of the air are those established by ICAO. See *Chicago Convention*, *supra* note 9, art 12.

¹⁵³ Susan Trepczynski, “The Benefits of Granting Immunity to Private Companies Involved in Commercial Space Ventures” (2006) 31 Ann Air & Sp L 381 at 403.

treaties. The development of suborbital flights would benefit from the delineation of where air space ends and outer space begins.¹⁵⁴

A. AN ICAO FOR SPACE?

Perhaps the simplest, and most sensible initial effort would be for ICAO to amend its Annexes to redefine aircraft to include aerospace vehicles, so that when they fly in air space used by civil aircraft, the rules of safety and navigation would be identical.¹⁵⁵ This would solve several, but not all, of the legal and safety issues discussed in this essay. ICAO could regulate aerospace vehicles by amending the definition of an "aircraft" to include aerospace vehicles. It created the definition of aircraft, and amended it to clarify that air cushion vehicles were not within the Chicago Convention; ICAO could amend its Annexes again to clarify that sub-orbital vehicles fall within the definition of "aircraft." Annex 7 already includes gliders, balloons, helicopters, ornithopters, rotorcraft, and gyroplanes within the definition of "aircraft."¹⁵⁶ Balloons have no wings. If a balloon can legally be deemed to be an "aircraft", then an suborbital aerospace vehicle can be deemed to be an "aircraft" as well, even if it is in the shape of a rocket.

One potential model definition for the term "aircraft" was that promulgated by the US Congress in the Air Commerce Act of 1926: "any contrivance now known or hereafter invented, used or designed for navigation or flight in the air."¹⁵⁷ The Canadian Parliament has defined an aircraft as "any machine capable of deriving support in the atmosphere from reactions of the air, and includes a rocket."¹⁵⁸ Another source recommends that suborbital vehicles be included in the Air Law regime, and orbital vehicles be placed within the Space Law regime.¹⁵⁹ ICAO could amend particular annexes to define the rules of safety and navigation for "aircraft" so redefined.¹⁶⁰

Alternatively, ICAO could promulgate a new Annex 20 on "Space Standards." There is precedent for this as well. Article 37 of the Chicago Convention vests in ICAO the authority to promulgate SARPs as Annexes thereto. The Convention lists eleven specific areas to which ICAO is instructed to devote itself, mostly focusing on safety and navigation. Yet, since its creation, including, for example, the promulgation of wholly new Annexes addressing environmental and security issues. . Beyond safety and navigation, as air transport has grown and evolved, ICAO has focused on other

¹⁵⁴ See Bin Cheng, *The Legal Status of Outer Space and Relevant Issues: Delimitation of Outer Space and Definition of Peaceful Use*, 11 J. SpaceE L. 89, 98 (1983).

¹⁵⁵ See Jakhu & Nyampong *supra* note 46.

¹⁵⁶ Chicago Convention Annex 7.

¹⁵⁷ Cooper, "The Chicago Convention and Outer Space", *supra* note 38.

¹⁵⁸ *Aeronautics Act*, RSC § 3(1) (1985).

¹⁵⁹ Vissepo, *supra* note 96, at 214.

¹⁶⁰ As the organization that drafted the Montreal Convention of 1999 addressing air carrier liability, and the several aviation security conventions, ICAO could also clarify whether aerospace vehicles fall under their provisions as well.

areas not explicitly listed in Article 37, ICAO has taken the lead on environmental and security issues, jurisdictional areas not originally contemplated when the Chicago Convention was drafted. Article 37 is sufficiently broad to permit such jurisdictional assertions, as it provides that ICAO may promulgate SARPs addressing "such other matters concerned with the safety, regularity, and efficiency of air navigation as may from time to time appear appropriate."¹⁶¹ If suborbital vehicles were included in the definition of "aircraft" as contemplated in the Chicago Convention, it is likely that special provisions would be introduced to accommodate specific requirements of operation and safety peculiar to the craft involved. Some international regulatory body is needed to provide uniform standards for national certification of space launch systems and vehicles, and their navigation through air space.

ICAO might also define the limits of air space by amending an Annex, though some may argue that such a change would require a new Protocol amending the Chicago Convention itself, or perhaps an entirely new multilateral convention. This is by no means a new proposal. As early as 1956, Professor John Cobb Cooper urged that the definition of air space should be determined by the United Nations and that pertinent regulations should be promulgated by ICAO.¹⁶²

Others may argue that a separate space traffic management system, under a new international space management organization, should be established. As early as 1960, one source insisted:

It has been questioned whether ICAO should amend its Annexes and widen the scope of its definition of aircraft so as to include rockets and missiles and even satellites. In view of the specific character of outer space law and inasmuch as those contrivances are mostly used in outer space, it is suggested that spacecraft are different from the contraptions regulated by the air law conventions and should be dealt with in separate international instruments.¹⁶³

Yet, these observations were written at a time when the only space activities consisted of launching satellites into orbit. Today, we confront the issue of suborbital vehicles, which are very similar to "contraptions regulated by the air law conventions". Moreover, it would be difficult to justify replication of the able and detailed work already done by ICAO on issues such as safety, navigation, security and liability, at least with respect to flights in the Earth's atmosphere.

Dr. Nandasiri Jasentuliyana, former Director of OOSA, has called for UNCOPUOS

¹⁶¹ *Chicago Convention*, *supra* note 9 art 37.

¹⁶² John Cobb Cooper, "Legal Problems of Upper Space" (address before the American Society of International Law, Washington, DC, 26 April 1956), quoted in Andrew Haley, "The Law of Space – Scientific and Technical Considerations" (1958) 4 NY L Forum 266. In 1962, Professor Cooper wrote that ICAO should interpret what is contemplated by "airspace" under Article I of the Chicago Convention. Cooper, *supra* note 38.

¹⁶³ See Verplaetse as quoted in Jakhu, Sgobba & Dempsey, *supra* note 6, at 63.

to promulgate "Space Standards" similar to ICAO's SARPs, and to draft a convention creating an international framework for space vehicles.¹⁶⁴ Yet, for three decades, UNCOPUOS has been unable to promulgate any multilateral legal instrument for ratification by States.¹⁶⁵ If UNCOPUOS is able to break its deadlock, so much the better. If not, as the United Nation's arm for air transportation, ICAO should provide clarification on the issues of what is contemplated by aircraft, and what is contemplated by air space, and then set about to provide standards of harmonization as SARPs, which Member States would be obliged to follow. Under the Chicago Convention, each Member State is obliged, "to collaborate in securing the highest practicable degree of uniformity" on such issues,¹⁶⁶ and to "keep its own regulations uniform, to the greatest possible extent" with SARPs.¹⁶⁷

Formal clarification of what law applies would be highly desirable. The fundamental principles embedded in the respective legal regimes of Air Law and Space Law are quite different – one recognizing territorial sovereignty, and the other denying it; one imposing limited liability upon the carrier or the aircraft operator, and the other imposing unlimited liability on the State. These conflicts and inconsistencies may unravel the uniformity of law that the conventions seek to attain, and inhibit investment in commercial space transportation systems.

The time has come for the international community to promulgate conventional international space laws with an eye to facilitating – and indeed, promoting – commercial activity in space. Space transportation would also be facilitated by harmonizing space laws with the prevailing rules of safety, navigation, security and liability applicable under air law. The public's safety demands no less.¹⁶⁸

B. THE LAW OF THE SEA CONVENTION OF 1982 AS A MODEL FOR DELIMITING AIR SPACE AND OUTER SPACE

The United Nations Convention on the Law of the Sea of 1982 [UNCLOS] was concluded after almost a decade of negotiations during the third UN Conference on the Law of the Sea (UNCLOS III, 1973-1982); at this writing, it has been ratified by 168 States.¹⁶⁹ It replaced a series of earlier relevant Conventions, including the 1958 Geneva Conventions on the Law of the Seas, which mostly focused on maritime matters, such as

¹⁶⁴ Nandasiri Jasentuliyana, *International Space Law and the United Nations* (Boston: Kluwer Law International, 1999) at 379-82.

¹⁶⁵ UNCOPUOS has drafted guidelines and principles, but since the ill-fated Moon Agreement, has failed to achieve the consensus necessary to advance a treaty.

¹⁶⁶ *Chicago Convention*, *supra* note 9 art 37.

¹⁶⁷ *Ibid*, art 12.

¹⁶⁸ Jakhu, Sgobba, Dempsey, *supra* note 6, at 61-64.

¹⁶⁹ UN, Division for Ocean Affairs and the Law of the Sea, "Chronological lists of ratifications of, accessions and successions to the Convention and the related Agreements", online: UN, Oceans and law of the Sea <http://www.un.org/depts/los/reference_files/chronological_lists_of_ratifications.htm>.

the navigation of merchant and military fleets, than on matters of exploration and exploitation of the Sea.¹⁷⁰ The UNCLOS contains 320 articles and provides a thorough regime of rights and obligations of States over all parts of the Sea, by dividing them into several categories (e.g. Internal Waters, Territorial Waters, Archipelagic Waters, Contiguous Zone, Exclusive Economic Zone, Continental Shelf, and High Seas), with different sets of State rights and obligations over each of these categories.¹⁷¹

Because of this distinction, the implications of the UNCLOS on State sovereignty constitute a critical issue, as States can exercise different levels of sovereign powers depending upon which part of the Sea in which they undertake their activities. More specifically, the functions that the UNCLOS serves are twofold as far as the implications on sovereignty are concerned: on the one hand, the Convention extends State sovereignty over parts of the Sea in the form of extended territorial sovereignty and attributes to States rights over areas that have been accepted as *res communis*, such as the High Seas,¹⁷² and over areas characterized as ‘common heritage of mankind’, such as the Area and its resources,¹⁷³ extending State jurisdictional control over areas beyond State sovereignty.¹⁷⁴ At the same time, however, the UNCLOS restricts such sovereign rights in deference to the rights of other States.¹⁷⁵

During its preparatory work on the UNCLOS, the International Law Commission [ILC] noted the limited character of the exercise of State sovereignty in this domain by referring to the example of territorial waters. Specifically, the ILC emphasized that although the sovereign rights of a coastal State over its territorial waters are equivalent to those over its terrestrial territory, sovereignty can only be exercised under multiple restrictions and always in accordance with international law,¹⁷⁶ losing thus the complete and exclusive character of sovereignty’s traditional meaning.¹⁷⁷ Such restriction to sovereignty could, for instance, be illustrated through the example of the right of innocent passage that coastal States have agreed to respect.¹⁷⁸

¹⁷⁰ Tullio Treves, “United Nations Convention on the Law of the Sea” (2008), online: UN Audiovisual Library of International Law <www.un.org/law/avl>, at 1-5.

¹⁷¹ *Ibid.*

¹⁷² UNCLOS Art. 87.

¹⁷³ UNCLOS Art. 136.

¹⁷⁴ Tullio Treves, *supra* note 169 at 2.

¹⁷⁵ Donald R. Rothwell & Alex G. Oude, *The Oxford Handbook on the Law of the Sea* (UK: Oxford University Press, 2015), at 295.

¹⁷⁶ *Ibid.*, at 97.

¹⁷⁷ Tullio Treves, *supra* note 169 at 1-5.

¹⁷⁸ UNCLOS, article 17: “Subject to this Convention, ships of all States, whether coastal or land-locked, enjoy the right of innocent passage through the territorial sea.”

Specifically, UNCLOS establishes several different areas, over which the legal regime differs:

- In *Internal Waters*, the coastal State holds exclusive sovereignty.
- The *Territorial Waters* of a State extend to 12 nautical miles from the coastal baseline.¹⁷⁹ The coastal state may set laws, regulate any use and use any resource there. Maritime vessels are given the right of "innocent passage" through territorial waters,¹⁸⁰ though aircraft are not. Coastal state "sovereignty extends to the air space over the territorial sea as well as to its bed and subsoil."¹⁸¹ However, "sovereignty over the territorial sea is exercised subject to this Convention and to other rules of international law",¹⁸² which would include the Chicago Convention.
- *Straits* "used for international navigation between one part of the high seas or an exclusive economic zone and another part of the high seas or an exclusive economic zone"¹⁸³ are treated differently, even if within the 12-mile territorial seas. In straits, both ocean vessels and aircraft enjoy the right of "transit passage", defined for aircraft as, "overflight solely for the purpose of continuous and expeditious transit of the strait between one part of the high seas or an exclusive economic zone and another part of the high seas or an exclusive economic zone. . . ", though certain limitations are imposed.¹⁸⁴ Further, aircraft in transit passage must "observe the Rules of the Air established by the International Civil Aviation Organization as they apply to civil aircraft; state aircraft will normally comply with such safety measures and will at all times

¹⁷⁹ United Nations Convention on the Law of the Sea, Art. 3, Dec. 10, 1982, 1933 U.N.T.S. 397 [hereinafter UNCLOS].

¹⁸⁰ UNCLOS Art. 17.

¹⁸¹ UNCLOS Art. 2 ¶ 2.

¹⁸² UNCLOS Art. 2 ¶ 3.

¹⁸³ UNCLOS Art. 37.

¹⁸⁴ UNCLOS Art. 38 ¶ 2. Art. 39 provides:

1. Ships and aircraft, while exercising the right of transit passage, shall:

(a) proceed without delay through or over the strait;

(b) refrain from any threat or use of force against the sovereignty, territorial integrity or political independence of States bordering the strait, or in any other manner in violation of the principles of international law embodied in the Charter of the United Nations;

(c) refrain from any activities other than those incident to their normal modes of continuous and expeditious transit unless rendered necessary by *force majeure* or by distress;

(d) comply with other relevant provisions of this Part. . . .

3. Aircraft in transit passage shall:

(a) observe the Rules of the Air established by the International Civil Aviation Organization as they apply to civil aircraft; state aircraft will normally comply with such safety measures and will at all times operate with due regard for the safety of navigation;

(b) at all times monitor the radio frequency assigned by the competent internationally designated air traffic control authority or the appropriate international distress radio frequency.

- operate with due regard for the safety of navigation"¹⁸⁵
- The *Archipelagic Waters* can be within a coastal State's territory depending on the distance between islands. Unlike the States with straits running through them, the archipelagic State may designate air lanes for use by aircraft, which shall enjoy free passage therein.¹⁸⁶
 - The *Contiguous Zone*, beyond the 12 mile territorial water limit, extends a further 12 nautical mile from the territorial sea baseline within which the coastal State may enforce its customs, fiscal, immigration or sanitary laws.¹⁸⁷
 - The *Exclusive Economic Zone* [EEZ] extends 200 nautical miles from the baseline. Here, the coastal State has exclusive rights overall economic resources. More specifically, it enjoys, "sovereign rights for the purpose of exploring and exploiting, conserving and managing the natural resources, whether living or non-living, of the waters superjacent to the seabed and of the seabed and its subsoil, and with regard to other activities for the economic exploitation and exploration of the zone, such as the production of energy from the water, currents and winds"¹⁸⁸ Nevertheless, in the EEZ, other States continue to have the rights of overflight and navigation as they would on the high seas.¹⁸⁹

¹⁸⁵ UNCLOS Art. 39 ¶ 3.

¹⁸⁶ As relevant to aviation, UNCLOS Art. 53 provides:

1. An archipelagic State may designate . . . air routes thereabove, suitable for the continuous and expeditious passage of . . . aircraft through or over its archipelagic waters and the adjacent territorial sea.
2. All . . . aircraft enjoy the right of archipelagic sea lanes passage in such . . . air routes.
3. Archipelagic sea lanes passage means the exercise in accordance with this Convention of the rights of navigation and overflight in the normal mode solely for the purpose of continuous, expeditious and unobstructed transit between one part of the high seas or an exclusive economic zone and another part of the high seas or an exclusive economic zone.
4. Such . . . air routes shall traverse the archipelagic waters and the adjacent territorial sea and shall include all normal passage routes used as routes for international navigation or overflight through or over archipelagic waters
5. Such . . . air routes shall be defined by a series of continuous axis lines from the entry points of passage routes to the exit points. . . . [A]ircraft in archipelagic sea lanes passage shall not deviate more than 25 nautical miles to either side of such axis lines during passage, provided that such . . . aircraft shall not navigate closer to the coasts than 10 per cent of the distance between the nearest points on islands bordering the sea lane. . . .
8. Such . . . traffic separation schemes shall conform to generally accepted international regulations.
9. In designating or . . . substituting traffic separation schemes, an archipelagic State shall refer proposals to the competent international organization with a view to their adoption. The organization may adopt only such . . . traffic separation schemes as may be agreed with the archipelagic State, after which the archipelagic State may designate, prescribe or substitute them.
10. The archipelagic State shall clearly indicate the axis of . . . the traffic separation schemes designated or prescribed by it on charts to which due publicity shall be given. . . .
12. If an archipelagic State does not designate . . . air routes, the right of archipelagic sea lanes passage may be exercised through the routes normally used for international navigation.

¹⁸⁷ UNCLOS Art. 33.

¹⁸⁸ UNCLOS Art. 56 ¶ 1.

¹⁸⁹ UNCLOS Art. 58.

And though it is not specified in UNCLOS, the Chicago Convention clearly provides that the rules in force over the high seas are those established by ICAO.¹⁹⁰

- The *Continental Shelf* is the natural prolongation of the land not more than 350 nautical miles under the seas. Although the coastal State enjoys exclusive economic rights over the natural resources in the shelf, though they do not possess sovereignty over the shelf itself,¹⁹¹ "The rights of the coastal State over the continental shelf do not affect the legal status of the superjacent waters or of the air space above those waters."¹⁹²
- The *High Seas* "are open to all States, whether coastal or land-locked. Freedom of the high seas is exercised under the conditions laid down by this Convention and by other rules of international law. It comprises, *inter alia*, both for coastal and land-locked States: (a) freedom of navigation; [and] (b) freedom of overflight; . . ."¹⁹³ This freedom of aerial circulation was first recognized in Article 2(4) of the Geneva Convention of the High Seas. Further, Article 89 of the Law of the Sea Convention provides that no State, "may validly purport to subject any part of the high seas to its sovereignty." Hence, the principle of freedom of the seas pertains to the high seas for both ocean vessels and aircraft.

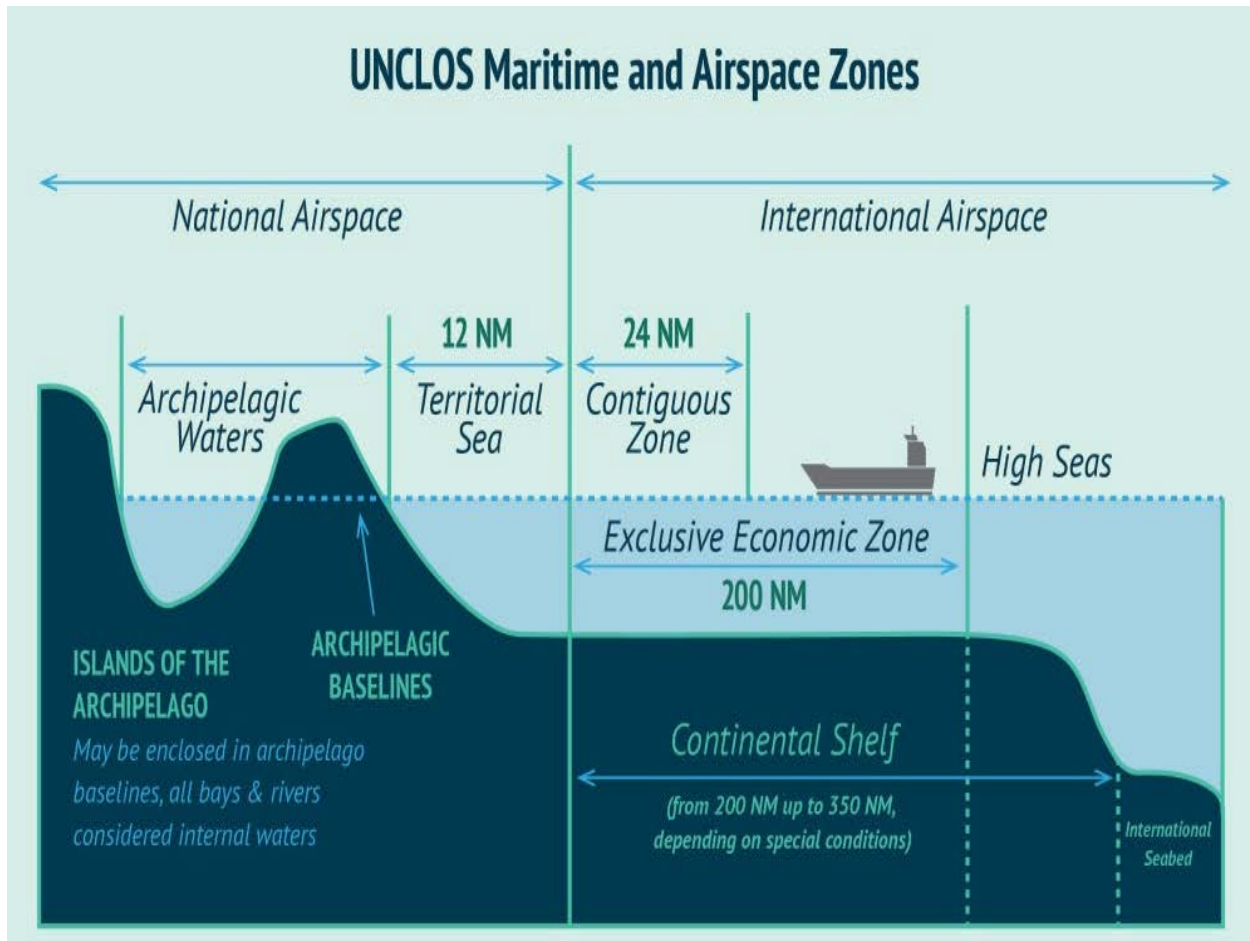
The following Chart graphically depicts the legal regime established by the Law of the Sea Convention:

¹⁹⁰ Chicago Convention, Art. 12.

¹⁹¹ Kay Hailbronner, *Freedom of the Air and the Convention on the Law of the Sea*, 77 Am. J. Int'l L. 490, 506 (1983).

¹⁹² UNCLOS Art. 78.

¹⁹³ UNCLOS Art. 87.



The Law of the Sea Convention could serve as a model for defining legal rules in space. This Convention:

- (1) defines Territorial Seas, where States enjoy sovereignty;
- (2) defines the Exclusive Economic Zone, where States enjoy limited rights; and
- (3) defines the High Seas, where no sovereignty exists, and is free for use by all.

Similarly, a new treaty could do the same to resolve the dilemma of what legal rules apply to flight. It could:

- (1) define what constitutes Air Space, where sovereign rights exist;
- (2) define Near Space, where limited rights of States exist; and
- (3) define Outer Space, where no sovereignty exists and is free for use by all.

Thus, legal rights in the Territorial Seas as described in UNCLOS are analogous to those in Air Space of the Chicago Convention; legal rights on the High Seas as described in UNCLOS are analogous to those which exist in Outer Space pursuant to the Outer Space Treaty; and legal rights of the Contiguous Zone and the Exclusive Economic

Zone as described in UNCLOS are analogous to those which could be created in a multilateral treaty describing the legal rights of States in Near Space. Let us now examine what might be the legal regime, and metes and bounds, of Near Space.

C. "NEAR SPACE" AS A PATH TO A NEW REGIME OF AIR & SPACE LAW

On the basis of this review of the development of the questions on the definition of outer space and delimitation between air space and outer space, several observations can be made. First, the fact that the COPUOUS Legal Subcommittee considered it necessary to examine the issue through the lens of collateral issues, such as the nature of suborbital vehicles and suborbital flights, reveals that the need to delimit or define outer space is not one on its own, but rather one emerging from NewSpace¹⁹⁴ activities that bring with them novel needs. Similarly, the fact that such new activities require further clarification on the issue and the simultaneous perpetuity in not agreeing on a delimitation point indicate that the delimitation and definition of outer space might not be the right question to be asked. Last, these conclusions coupled with the emerging security concerns that arise from the function and especially the reentry of the reusable launch vehicles in the atmosphere turn the discussion to a definition/delimitation of a different kind: one that is adjusted and addresses the specific needs of such vehicles and other emerging space activities that utilize the same areas.

The peculiarities of the suborbital vehicles pose the need for the establishment of a separate, intermediate, zone between air space and outer space.¹⁹⁵ This zone would cover emerging space activities (commercial and military) that use altitudes from approximately 20km to 160km, the so called "Near-Space." Commercial and military interests have begun to develop operating systems in Near-Space. Such systems include suborbital vehicles, stratospheric balloons, pseudo-satellites and high-altitude drones. Some will operate a few minutes, hours, weeks, months, or years. Some tourism sub-orbital flights may reach 130km in order to give its customers more zero-gravity time. Operations in near-space are a potential threat for air traffic beneath and for the public on ground, in the case of failures or malfunctions. They are also a threat for space outbound and returning traffic. Joseph Pelton, a pioneer in this approach notes that:

¹⁹⁴ The term NewSpace is used to describe a category of non-traditional space activities that (will) use advanced space technologies. Such activities include primarily human space flight, extraterrestrial settlement, exploitation of celestial bodies' natural resources, and any other futuristic space activities that the current space industry plans to achieve in the future. The main characteristics of such activities include the effort to minimize space exploration costs, efficient investment return, incremental development, and broad consumer market targets. See, "NewSpace, The Alternative Route to Space", online: HobbySpace <<http://www.hobbyspace.com/NewSpace/>>.

¹⁹⁵ Joseph N Pelton, "Urgent Security Concerns in the "Proto-Zone"" (May 2016), Presentation at the 4th International Manfred Lachs Conference on Conflicts in Space and the Rule of Law, McGill University, Institute of Air and Space Law Montreal, online: IASL <https://www.mcgill.ca/iasl/files/iasl/mlc4_presentation_j_pelton.pptx>, slide 3.

The area above commercial air space, *i.e.* 21 km and below the area that can allow satellites to stay in orbit above Earth, *i.e.* 160km is finding more and more applications and this region needs to be concerned formally by space legal experts. Uses of this region include stable high altitude and stratospheric craft such as aerostats, Unmanned Aerial Systems (UAS), High Altitude Platform Systems (HAPs) and so-called “dark-sky” research and relay stations. . . .¹⁹⁶

The following operational boundaries exist between aviation and space:

- 160 Km, lowest practical operating orbit for satellites
- 120 Km, re-entry threshold for space systems;
- 50 Km, upper limit of atmospheric buoyancy (balloons)
- 18 km, upper limit of civil aviation traffic

One alternative would be to define the 50-120km region (or, alternatively, the 18-160km region) as “Near Space”, and treat it as an intermediate region legally as we do under UNCLOS the region between “territorial seas” and “high seas”. In particular: innocent passage (commercial activities) would be allowed, but the safety risk for overflown population should be compliant with international norms (to be defined, presumably by ICAO). The economic exploitation of such zone (e.g. use of pseudo-satellites) should be the exclusive prerogative of the country underneath. Finally, in this region, overflights for military purposes (e.g. ICBM tests) should be undertaken only if authorized by the overflown country.

Using the jurisdictional zones established by the Law of the Sea Convention as a model, a new treaty, or an amendment to Art. 12 of the Chicago Convention could establish:

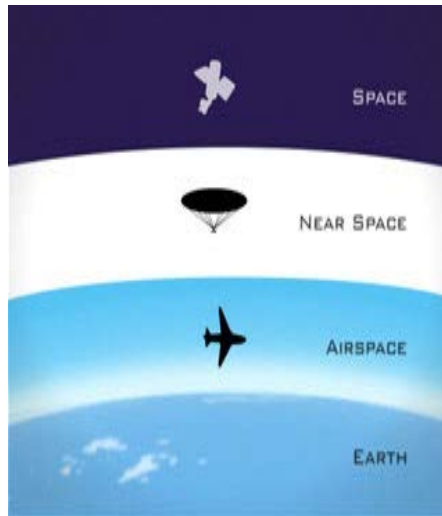
- **The Outer Space Zone**, above 120km (or, alternatively, above 160km): subject to Space Law.
- **The Near Space Zone**, between 50-120km (or, alternatively, 18-160km): like a mix of the UNCLOS Contiguous Zone and Exclusive Economic Zone, open to innocent passage by all, with aerial safety and navigation rules established (presumably by ICAO),¹⁹⁷ enforced by States in Flight

¹⁹⁶ *Ibid*, at 3. Robert Goedhart favors a spatial boundary, located above 50-60km achievable by air-breathing aircraft, and below the lowest safe perigee for orbiting space objects, roughly 100-110km. He urges an intermediate zone between these elevations--a nonsovereign meso-space-- “as a kind of corridor for ascending and descending space craft whilst the matter of its legal status is in abeyance” Robert F.A. Goedhart, *THE NEVER ENDING DISPUTE: DELIMITATIONS OF AIR SPACE AND OUTER SPACE* 151 (Singapore: Edition Frontieres, 1996). However, other sources allege satellites can operate in the 95-110km range, and argue that outer space starts somewhere between 80-110km. Stephan Hobe & Kuan-Wei Chen, *Legal Status of Outer Space and Celestial Bodies*, in *ROUTLEDGE HANDBOOK ON SPACE LAW* 25, 28-29 (Ram Jakhu & Paul Dempsey, eds., Routledge 2017).

¹⁹⁷ In developing rules of navigation, ICAO may consider these suggested “rules of the road”:

Information Regions, and whose aerospace and launch vehicles are subject to Air Law. It could also be restricted against overflights by foreign State aircraft absent permission of the underlying State.

- **The Air Space Zone**, below 50km (or, alternatively, below 18km): subject to the exclusive territorial sovereignty of the underlying State, as they are today.



In embracing this approach, a definition and delimitation of outer space would be achieved in an indirect manner, *i.e.* by establishing and defining the metes and bounds of a middle, intermediate, zone, the lowest altitude of which would signify the end of air space, while the highest would define the beginning of outer space. In this manner, not only would the activities undertaken within these specified limits be regulated through new laws specifically adjusted to the needs of Near Space activities, but the establishment of the boundaries of Near Space would also allow for clarification as to the highest altitude where Air Law ceases to exist and the lowest altitude where Space Law commences. Except for the easier legal definition and regulation of suborbital activities, Dr. Pelton identifies other issues that such an approach would answer, including safety coordination issues, strategic security, air traffic control management, stratospheric pollution, frequency interferences, satellite navigation

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- Overflown countries must be informed when another country plans to perform operations in their Near-Region (transit or loitering), and about the features of such operation (duration, trajectory, etc.);
 - Authorization must be always granted for civil operations in Near-Space as long as the risk for overflown countries does not exceed an internationally agreed standard level;
 - In time of peace, permission must be requested to overfly countries for military/intelligence operations in their Near Space region; and
 - Overflown countries have the right/duty to coordinate the traffic in the Near-Space region and charge for such services at internationally agreed rates.

software improvements and related technical issues.¹⁹⁸ Professor Ram Jakhu and Dean Joseph Pelton observe:

The need for a more comprehensive and detailed legal/regulatory framework for outer space represents one of the most politicized and complex challenges ahead for our and future generations. All stakeholders need to work together to find a path forward in order to meet these challenges. The existing international regulatory framework, while important, cannot stand up on its own to the strains that the ever-increasing range of space activities – and the possibilities that still lie before us – impose. ... [L]aws and institutions, given the certainty and predictability of behavior they both facilitate, will continue to play a crucial role in shaping and guiding the future of space activities.¹⁹⁹

What would be the benefits of legal clarity? Predictability of outcomes would be enhanced if the question of whether Air Law, or Space Law, or a new regime of “Aerospace Law” applied to suborbital flights. Commercial development of space would be facilitated by clarity, stability and predictability of law. Uniformity of law will improve the market’s interest in investment in space transportation, and the insurance industry’s ability to assess and price risk. Delineation of which legal regime applies – in air space, near space, and outer space – will clarify rights and obligations, and enhance the margin of safety for aircraft, spacecraft and aerospace vehicles operating in all three zones.

¹⁹⁸ *Ibid*, at 8-10.

¹⁹⁹ GLOBAL SPACE GOVERNANCE: AN INTERNATIONAL STUDY 602 (Ram S. Jakhu & Joseph N. Pelton Eds, Springer International, Cham, Switzerland 2017).