The Vertical Limit of State Sovereignty

by

Dean N. Reinhardt

Institute of Air and Space Law
McGill University
Montreal, Canada

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Abstract

There is no international agreement on the vertical limit of State sovereignty, the boundary between territorial airspace and outer space. The need for defining this boundary has been debated for over 50 years. Today, the need to settle this gap in the law is growing in importance. This thesis concludes that setting a low vertical limit on State sovereignty is the best approach because it will allow all States free access to space and enable uniform international rules to be set at a relatively low altitude.

Chapter I discusses territorial sovereignty and examines the evolution of vertical sovereignty. It then compares this to the evolution of the law governing territorial seas and concludes by examining the airspace laws of several States. Chapter II reviews the reasons demarcation is important. Chapter III discusses past proposals for demarcation and recommends setting a low vertical limit on State sovereignty.

Résumé

Il n'y a aucun traité international réglant la question de la limite verticale à la souveraineté des Etats et, de ce fait, aucune délimitation n'a été tracée entre l'espace aérien territorial et l'espace extra-atmosphérique. La question de savoir s'il convient d'établir une démarcation fait l'objet de débats depuis plus de 50 ans. Aujourd'hui, le besoin de combler cette lacune juridique se fait de plus en plus sentir.

Cette thèse arrive à la conclusion que la fixation d'une délimitation à une altitude relativement basse constituerait la meilleure des solutions car elle permettrait à tous les Etats d'accéder librement à l'espace et rendrait possible l'établissement de normes internationales uniformes à une altitude relativement basse.

Le chapitre I traite tout d'abord de la souveraineté territoriale et examine l'évolution de la souveraineté verticale. Dans un deuxième temps, une comparaison est faite avec le développement des normes régissant les eaux territoriales. Enfin, les lois nationales de plusieurs Etats régissant leur espace aérien sont analysées. Le chapitre II passe en revue les raisons pour lesquelles l'établissement d'une démarcation est important. Le chapitre III traite des propositions qui, dans le passé, avaient appelé à une démarcation claire et recommande la fixation d'une limitation à la souveraineté étatique à une altitude basse.

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Outline

INTRODUCTION

> [T]here is no immediate urgency about defining the upper boundary of "airspace" or reaching international agreement on the upward or outward extent of territorial sovereignty in space.
>
> - The Honorable John A. Johnson, First General Counsel of the U.S. National Aeronautics and Space Administration, 1959.[1]

> I see no good reason for postponing a systematic effort to explore and reach agreement on this question of delimiting the upward reach of territorial sovereignty, that is, the exclusive power and authority of the underlying state. It is not the kind of question, in my opinion, that will be answered by the accumulation of scientific knowledge or by further experience in space technology.
>
> - The Honorable John A. Johnson, First General Counsel of the U.S. National Aeronautics and Space Administration, 1961[2]

The debate over the delineation of the boundary between State sovereignty and "outer space" (the vertical limitation of State sovereignty) predates the space age. Many articles were written on the subject in the 1950s as the space age was dawning. However, the debate did not begin then; it began during the early days of aircraft flight and unfortunately it continues into the twenty-first century. Because there is no agreed delineation between a State's territory and free outer space, the vertical limit of State sovereignty is unsettled and each State is left to define the limits of its vertical sovereignty. However, no State has explicitly done this.

There are several reasons delineation is important today. First, new technologies are under development that may soon allow various types of vehicles to operate at high altitude. Suborbital space tourism is nearing commercial

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[1] John A. Johnson, Address Before the House Committee on Science (Mar. 11, 1959), *in* Colonel Martin Menter, Astronautical Law 30 (1959) (unpublished thesis, Industrial College of the Armed Forces) (on file with the McGill University Nahum Gelber Law Library).

[2] John A. Johnson (Apr. 28, 1961), *in* 55 PROC AM. SOC'Y INT'L L. 165, 167 (1961) [hereinafter Johnson, PROCEEDINGS].

application. Several concepts for intercontinental vehicles that would operate in the upper atmosphere are under development. Finally, senior members of the U.S. Air Force have expressed an interest in operations in what they have termed "near space," the part of the atmosphere between 65,000 feet (about 12.3 miles or 19.8 km) and 186 miles (300 km).[3] This area is above the altitude conventional aircraft normally operate in and below the lowest orbit (or perigee[4]) of most satellites.[5]

Delineation is important to ensure equal access to space. Although outer space is free,[6] if States are allowed to claim vertical sovereignty up to the point where orbital dynamics are possible, other States will be precluded from having free access to space.[7] By setting a low limit of vertical sovereignty, launching States will have the potential of freely accessing space, but neighboring States could still legitimately express concerns based on safety. Mr. John A. Johnson, the first General Counsel of the U.S. National Aeronautics and Space Administration (NASA) and formerly the General Counsel of the U.S. Air Force,[8]

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[3] *See* Lorenzo Cortes, *Air Force Chief Cites Vitality of "Near Space" Capabilities*, DEF. DAILY, Sept. 16, 2004.

[4] "The point on an elliptical orbit at which the satellite is closest to the Earth is called the perigee of the orbit, and the point at which it is furthest from the Earth is called the apogee." DAVID WRIGHT ET AL., THE PHYSICS OF SPACE SECURITY 24 (2005), *available at* <http://www.ucsusa.org/publications/report.cfm?publicationID=1042>.

[5] *See* David Bond, *Persistent Perspective*, AV. WK. & SPACE TECH., Dec. 20, 2004, at 19.

[6] *See* Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, Jan. 27, 1967, art. I, 18 U.S.T. 2410, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty] ("Outer space, including the moon and other celestial bodies, shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law, and there shall be free access to all areas of celestial bodies.").

[7] In 1964, Mr. Johnson said,

> It is evident that if territorial sovereignty—that is, the exclusive control of the underlying State which now applies to the area denominated "air space"—is to embrace the entire space below the lowest altitude at which the orbiting of earth satellites has occurred, man will not—to use Ambassador Stevenson's words—"be free to venture into space on the same basis that he has ventured on the high seas."

John A. Johnson, *Freedom and Control in Outer Space*, *in* PROCEEDINGS OF THE CONFERENCE ON SPACE SCIENCE AND SPACE LAW 138, 140 (Mortimer D. Schwartz ed., 1964) [hereinafter Johnson, *Freedom and Control*].

[8] *See Air Force Aide Named Space Agency Counsel*, N.Y. TIMES, Oct. 8, 1958, at 10.

said in 1964, "there should therefore be no legal basis for protesting, merely on grounds of unpermitted presence, the overflight of national territory by ascending and descending spacecraft, regardless of altitude."[9] Setting a low limit on State sovereignty will not mean that States will have total freedom of action. Even in space, States cannot take actions that harm the interests of other States.[10] But States will have to point to a legitimate safety concern before objecting to another State's activities. They will not be able to object merely on the basis of overflight. This should encourage States to work together to draft uniform rules of operation.

Another issue raised by the absence of an international definition of the space boundary is liability for space activities. Vehicles operating at high altitude but not in orbit may not be covered by either the Convention on International Liability for Damage Caused by Space Objects[11] (the Liability Convention) or the Convention for the Unification of Certain Rules for International Carriage by Air[12] (the Montreal Convention) so domestic tort law would have to be used to determine liability. As more vehicles operate in the upper atmosphere the potential for collisions increases so liability claims are likely to increase. An international agreement that "space" begins above a certain altitude could provide certainty for liability by defining the term "space object." If a space object caused damage on the ground or to aircraft in flight, the liability convention would apply and the absolute liability it provides[13] would come into play. Other international agreements also could benefit from a precise delineation of vertical sovereignty. For example, the Preliminary Draft Protocol on Matters Specific to Space Assets,

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[9] Johnson, *Freedom and Control*, *supra* note 7, at 141.
[10] *See* Outer Space Treaty, *supra* note 6, art. IX.
[11] Convention on International Liability for Damage Caused by Space Objects, Mar. 29, 1972, 24 U.S.T. 2389, 961 U.N.T.S. 187 [hereinafter Liability Convention]. *See infra* notes 294–297, 308 and accompanying text.
[12] Convention for the Unification of Certain Rules for International Carriage by Air, May 28, 1999, S. TREATY DOC. NO. 106-45, 2242 U.N.T.S. 350 [hereinafter Montreal Convention]. The Montreal Convention "applies all international carriage of persons, baggage or cargo performed by aircraft for reward." *Id.* art. 1(1). The Convention does not define the term "aircraft."
[13] Article II of the Liability Convention provides: "A launching State shall be absolutely liable to pay compensation for damage caused by its space object on the surface of the earth or to aircraft in flight." Liability Convention, *supra* note 11, art. II.

prepared by the International Institute for the Unification of Private Law (UNIDROIT) as a protocol to the Convention on International Interests in Mobile Equipment (opened for signature on November 16, 2001) does not define space although this term is pivotal in determining the application of the protocol.[14]

The increased activity in the upper atmosphere (or in near space) should be governed by uniform international rules. For safety reasons, it would be beneficial to have uniform standards similar to those that exist for operations in the lower atmosphere. Uniformity is more often than not a precondition for safety.[15] One possibility would be to have the International Civil Aviation Organization (ICAO)[16] develop these standards as it does for operations in international airspace.[17]

Finally, States need to know the limits of other States' sovereignty to avoid conflict along the borders. The time has come to settle this gap in the law.

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[14] *See* Preliminary Draft Protocol on Matters Specific to Space Assets, *available at* <http://www.unidroit.org/english/workprogramme/study072/study072j/72j-13rev-e.pdf>. For example, the draft protocol states:

> "space assets" means:
> (i) any identifiable asset that is intended to be launched and placed in space or that is in space;
> (ii) any identifiable asset assembled or manufactured in space;
> (iii) any identifiable launch vehicle that is expendable or can be reused to transport persons or goods to and from space; and
> (iv) any separately identifiable component forming a part of an asset referred to in the preceding sub-paragraphs or attached to or contained within such asset.
> As used in this definition, the term "space" means outer space, including the Moon and other celestial bodies.

Id. art. I(g) (footnotes omitted).

[15] *See* MYRES S. MCDOUGAL ET AL., LAW AND PUBLIC ORDER IN SPACE 590 (1963).

[16] *See* Convention on International Civil Aviation, Dec. 7, 1944, art. 43, 61 Stat. 1180, 15 U.N.T.S. 295 [hereinafter Chicago Convention] ("An organization to be named the International Civil Aviation Organization is formed by the Convention. It is made up of an Assembly, a Council, and such other bodies as may be necessary.").

[17] *See infra* note 383 and accompanying text.

CHAPTER I: TERRITORIAL SOVEREIGNTY

Vertical Sovereignty

States have exercised sovereignty over the space above land at least as far back as the Roman Empire. Roman law (and the law of succeeding States) recognized, regulated, and protected private rights in space above the surface.[18] Because a State cannot impose its will within the territory of another State, these States therefore all claimed territorial sovereignty above their surface territory.[19] Although writers generally agree that Roman law recognized private rights in air space, the writers do not agree on the extent of the right recognized.[20]

At the beginning of the twentieth century "international flight was practically unregulated."[21] In 1902, Paul Fauchille of France, Rapporteur for the Institute of International Law on the subject of the legal status of the airships, proposed that States should only have exclusive rights in the airspace immediately over their territory up to an altitude of 1,500 meters (4,920 feet).[22] Some of Fauchille's proposals were translated by Professor John C. Cooper as:

> the air is free—States having only rights necessary for their self-preservation, such rights relating to the prevention of spying, to the customs, to the sanitary police, and to the necessities of defense;
>
> subject to certain exceptions, air navigation is prohibited in a "security" zone extending 1500 meters up from the surface territory of a State;

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[18] *See* John Cobb Cooper, *Roman Law and the Maxim "Cujus est solum" in International Air Law*, *reprinted in* JOHN COBB COOPER, EXPLORATIONS IN AEROSPACE LAW 54, 57–58 (Ivan A. Vlasic, ed., 1968) [hereinafter COOPER, EXPLORATIONS IN AEROSPACE LAW].

[19] *See id.*

[20] *See id.* at 59.

[21] *See* John Cobb Cooper, *The International Air Navigation Conference, Paris 1910*, 19 J. AIR L. & COM. 127 (1952) [hereinafter Cooper, *Air Navigation Conference*], *reprinted in* COOPER, EXPLORATIONS IN AEROSPACE LAW, *supra* note 18, at 104, 106 (*noting* that German zeppelins flew over Switzerland and German balloons frequently landed in France).

[22] *See* NICHOLAS GRIEF, PUBLIC INTERNATIONAL LAW IN THE AIRSPACE OF THE HIGH SEAS *in* 14 UTRECHT STUDIES IN AIR AND SPACE LAW 50–51 (G.C.M. Reijnen et al. eds., 1994).

> only public aircraft of a State are permitted to fly freely in the security zone of that State;
>
> the subjacent State may also regulate landing and departure through the security zone above its territory . . . .[23]

The opposite view was expressed in 1906 by Professor John Westlake of the United Kingdom who advocated no upward limit of State sovereignty.[24]

> In the air the higher one ascends, the more damage the fall of objects will cause on the earth. If there exists a limit as to the sovereignty of the State over the oceanic space, none exists for the sovereignty of the State over the air space. The right of the subjacent State remains the same whatever may be the distance.[25]

Professor Westlake did support "a right of innocent passage for foreign aircraft such as international law recognized for surface vessels through" territorial seas.[26] In 1910 Fauchille revised his suggestion by decreasing the vertical limit of State sovereignty to only 500 meters (1,640 feet).[27] The same year, Dr. J. F. Lycklama à Nijeholt published a book asserting there was no upper limit on State sovereignty.[28] "We therefore conclude that state sovereignty reaches quite as high

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[23] John Cobb Cooper, *A Study on the Legal Status of Aircraft* [hereinafter Cooper, *A Study*], *reprinted in* COOPER, EXPLORATIONS IN AEROSPACE LAW, *supra* note 18, at 205, 218 (footnotes omitted).

[24] *See* John Cobb Cooper, *High Altitude Flight and National Sovereignty* [hereinafter Cooper, *High Altitude Flight*], *reprinted in* COOPER, EXPLORATIONS IN AEROSPACE LAW, *supra* note 18, at 256, 258.

[25] *Id.* (*quoting* Professor Westlake).

[26] *See* Cooper, *Air Navigation Conference*, *supra* note 21, at 112.

[27] *See* GRIEF, *supra* note 22, at 51; Cooper, *A Study*, *supra* note 23, at 221.

> Fauchille since 1901 had been the leading advocate of freedom of flight-space, opposing the principle of State sovereignty. . . . In 1910 he began to seek general acceptance of the formula "air navigation is free" as a compromise. However, he personally never receded from his original 1902 position that "the air is free."

Cooper, *Air Navigation Conference*, *supra* note 21, at 109 n.15.

[28] Professor Cooper described Dr. Nijeholt's book as "a far-sighted and now classic treatise on 'Air Sovereignty.'" *See* John Cobb Cooper, *Flight Space and the Satellites*, 7 INT'L & COMP. L.Q. 82, 83 (1958).

as the state's interest can reach, the possibility of which but ends at the uttermost limit of the atmosphere."[29]

In May and June of 1910, the first diplomatic conference to consider flight regulation met in Paris.[30] During the conference, France tried to "avoid a decision on the question of freedom of flight-space or State sovereignty. . . . France thus adopted in principle the position which had been taken by Paul Fauchille."[31] The United Kingdom recognized full sovereignty rights of States over their flight-space and did not recognize a right of innocent passage.[32] The position of Germany recognized that States had full and absolute sovereignty in the usable space over their lands, but would have allowed aircraft of a contracting State to take off, land, and fly over other contracting States.[33] Similar to the position of the U.S. during the drafting of the Chicago Convention in 1944[34] and today, Germany's position may be explained because:

> its great technical progress in the design and construction of the zeppelins and other dirigibles for both military and civil use had put it so far ahead of other European powers that it would have much to gain and little to lose by an exchange of the widest possible flight privileges.[35]

Although the diplomatic conference adjourned without signing a convention, it had completed most of the clauses of a draft convention.[36] The 1910 conference "first evidenced general international agreement that usable space above the lands and waters of a State is part of the territory of that State" and that no general right of innocent passage through the usable space above a State

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[29] J. F. LYCKLAMA À NIJEHOLT, AIR SOVEREIGNTY 46 (1910). Dr. Nijeholt summarized and critiqued the views of her contemporaries as well, including Fauchille and Westlake. *See id.* at 9–21.
[30] *See* Cooper, *Air Navigation Conference*, *supra* note 21, at 105.
[31] *Id.* at 108–09.
[32] *See id.* at 112–13.
[33] *See id.* at 110–11.
[34] *See infra* note 61 and accompanying text.
[35] Cooper, *Air Navigation Conference*, *supra* note 21, at 119.
[36] *See id.* at 105.

existed for aircraft.[37] The conference did not set a vertical limit on State sovereignty.[38]

After the 1910 Paris conference ended without agreement, many European States asserted absolute vertical sovereignty.[39] Interestingly, although German balloon flights over France prior to 1914 are often discussed, in 1914 Germany cited French military aviators flying over German and Belgian areas as one of its reasons for declaring war on France.[40] Professor Cooper translated a relevant part of the "little known and seldom read German Declaration of War on France" as:

> The German administrative and military authorities have established a certain number of flagrantly hostile acts committed on German territory by French military aviators. Several of these have openly violated the neutrality of Belgium by flying over the territory of that country; one has attempted to destroy buildings near Wesel; others have been seen in the district of the Eifel, one has thrown bombs on the railway near Carlsruhe and Nuremberg.[41]

After WWI, the Aeronautical Commission of the Peace Conference in Paris met to examine fundamental principles for air navigation.[42] The Commission consisted of delegates from many European States as well as Japan, Cuba, Brazil,

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[37] *See id.*

[38] *See id.* at 123.

> In the French statement on the entry of foreign aircraft a recommendation was made that the convention should include a restriction prohibiting aircraft navigation below a height to be stated in the convention, so as to protect the population against the indiscretions of aircraft and the noise of their motors. The German delegation opposed this proposal and it had no support. The draft conventions as approved by the conference and the rules adopted by the First Commission all dealt with flight-space as being subject to uniform regulation at whatever height used. The conference clearly rejected any division of usable space into horizontal zones.

Id.

[39] *See* John Cobb Cooper, *State Sovereignty in Space: Developments 1910 to 1914*, *reprinted in* COOPER, EXPLORATIONS IN AEROSPACE LAW, *supra* note 18, at 125, 126–36.

[40] *See id.* at 126.

[41] *Id.*

[42] *See* John Cobb Cooper, *U.S. Participation in Drafting Paris Convention 1919*, 18 J. AIR L. & COM. 266 (1951), *reprinted in* COOPER, EXPLORATIONS IN AEROSPACE LAW, *supra* note 18, at 137, 140.

and the U.S.[43] The Commission drafted the Convention Relating to the Regulation of Aerial Navigation, known as the Paris Convention.[44] Article 1 of the Convention recognized the exclusive sovereignty of all States over the air space above their territory, including above territorial waters.[45] The Paris Convention did not define the term "air space."[46] After the Paris Convention entered into force, an annex was adopted which defined aircraft as "all machines which can derive support in the atmosphere from reactions of the air."[47] However, according to Professor Cooper, this did not limit a State's vertical sovereignty, "the Paris Convention is not to be construed as meaning that in international law States have territorial rights only in this airspace. The airspace was accepted as part of State territory but no international determination was made as to the regions of space above."[48]

The Paris Convention did not provide for a right of innocent passage, but it did encourage States to allow innocent passage, saying "each contracting State undertakes in time of peace to accord freedom of innocent passage above its territory to the aircraft of the other contracting States."[49] However, apparently the idea of innocent passage was not looked upon favorably; article 15 which provided in part that "every aircraft of a contracting State has the right to cross the air space of another State without landing" was amended in 1929 to make this right conditional.[50] The new paragraph 4 of article 15 said,

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[43] *See id.*
[44] Convention Relating to the Regulation of Aerial Navigation, Oct. 13, 1919, 11 L.N.T.S. 173 [hereinafter Paris Convention].
[45] *See id.* art. 1.

> The High Contracting Parties recognise that every Power has complete and exclusive sovereignty over the air space above its territory.
> For the purpose of the present Convention, the territory of a State shall be understood as including the national territory, both that of the mother country and of the colonies, and the territorial waters adjacent thereto.

Id.
[46] *See* Cooper, *High Altitude Flight*, *supra* note 24, at 259.
[47] *Id.* (*quoting* from the annex).
[48] *Id.*
[49] Paris Convention, *supra* note 44, art. 2.
[50] *See* MCDOUGAL ET AL., *supra* note 15, at 262.

> Every contracting State may make conditional on its prior authorisation the establishment of international airways and the creation and operation of regular international air navigation lines, with or without landing on its territory.[51]

The right of innocent passage "provided for by Article 2 [was] thus largely limited to civil aircraft used for pleasure or occasional commercial flights."[52] The Paris Convention was ratified by most European States and "its statement of airspace sovereignty became an accepted part of international law."[53]

In 1928 the U.S. helped draft the Pan American Convention on Commercial Aviation[54] (known as the Havana Convention) which repeated the Paris Convention's recognition of complete and exclusive sovereignty of a State over airspace above its territory.[55] The Havana Convention also provided a similarly limited right of innocent passage,[56] and "for the operation of scheduled international air services, under the Havana Convention, just as in the case of the Paris Convention, a prior consent was required by the states on the route."[57]

On September 11, 1944, the U.S. invited its allies and neutral States to participate in an international civil aviation conference.[58] Although the U.S.S.R. was invited to attend, and its delegates were en route to attend the conference, they were recalled before arriving without explanation.[59] The conference met in

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[51] *Id.*
[52] *Id.*
[53] John Cobb Cooper, *Airspace Rights Over the Arctic* [hereinafter Cooper, *Airspace Rights Over the Arctic*], *reprinted in* COOPER, EXPLORATIONS IN AEROSPACE LAW, *supra* note 18, at 171, 175.
[54] Pan American Convention on Commercial Aviation, Feb. 20, 1928, 47 Stat. 1901, 129 L.N.T.S. 225.
[55] "The high contracting parties recognize that every state has complete and exclusive sovereignty over the air space above its territory and territorial waters." *Id.* art. 1.
[56] *See id.* art. 4 ("Each contracting state undertakes in time of peace to accord freedom of innocent passage above its territory to the private aircraft of the other contracting states, provided that the conditions laid down in the present convention are observed.").
[57] MCDOUGAL ET AL., *supra* note 15, at 263.
[58] *See* Cooper, *A Study*, *supra* note 23, at 237.
[59] *See* John Cobb Cooper, *The Chicago Convention—After Twenty Year*, 19 U. MIAMI L. Rev. 333 (1965), *reprinted in* COOPER, EXPLORATIONS IN AEROSPACE LAW, *supra* note 18, at 439, 440. The U.S.S.R. became a party to the Chicago Convention on October 15, 1970. *See* International Civil Aviation Organization, *Status of Convention on International Civil Aviation Signed at Chicago on*

Chicago, Illinois, from November 1 to December 7, 1944.[60] The U.S. and many people from other States hoped that the convention would negotiate a treaty that would reverse the precedent of the Paris Convention and provide freedom of navigation.[61] Instead, the resulting treaty, the Convention on International Civil Aviation[62] (known as the Chicago Convention), reaffirms in article 1 that all States have complete and exclusive sovereignty over the airspace above their territory.[63] There are currently 188 States that are parties to the Chicago Convention.[64] Professor Cooper, who attended the 1944 Chicago Conference as adviser to the U.S. delegation and served as chairman of one of the two drafting committees, wrote that he "reported out the present article 1 which had been adapted from the Paris Convention [and on] behalf of the drafting committee, he recommended its adoption."[65] A State's territorial airspace includes the area above its territorial waters.[66] The Chicago Convention does not provide any right of innocent passage[67] and scheduled international air services are only allowed with special permission of the contracting States.[68]

Like the Paris Convention, the Chicago Convention does not define the term "airspace" or its upper limit. According to Professor Cooper:

> I can tell you as a matter of unwritten history that the effect, if any, of the [German] V-2 [rocket] on the legal conclusion applicable to flight was not put forward, nor discussed at Chicago. . . . Article I of the Chicago Convention dealing with air space sovereignty was modeled on the Paris Convention. It did not take into

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7 December 1944 (visited June 9, 2005) <http://www.icao.int/icao/en/leb/chicago.htm> [hereinafter *Status of Chicago Convention*].

[60] *See* Cooper, *A Study*, *supra* note 23, at 237.

[61] *See* MCDOUGAL ET AL., *supra* note 15, at 264–65.

[62] Chicago Convention, *supra* note 16.

[63] *See id.* art. 1.

[64] *See Status of Chicago Convention*, *supra* note 59.

[65] John Cobb Cooper, *Air Law—A Field for International Thinking*, 4 U.N. TRANSP. & COMM R. 1 (1951), *reprinted in* COOPER, EXPLORATIONS IN AEROSPACE LAW, *supra* note 18, at 1, 8.

[66] *See* Chicago Convention, *supra* note 16, art. 2.

[67] "In order that there would be no more uncertainty as to the exact meaning of the term 'innocent passage,' it was altogether omitted from the Convention." MCDOUGAL ET AL., *supra* note 15, at 265.

[68] *See* Chicago Convention, *supra* note 16, art. 6.

> consideration the fact that there had been a few rocket flights of V-2's prior to the time of the drafting of the Chicago Convention.[69]

An annex to the Chicago Convention defines 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."[70] Professor Cooper wrote an article in 1956 titled *Legal Problems of Upper Space*[71] in which one of his conclusions was:

> The Chicago Convention contains no definition of "airspace" but it may well be argued that, as it was adapted from the Paris Convention, it deals with no areas of space other than those parts of the atmosphere where the gaseous air is sufficiently dense to support balloons and airplanes.[72]

Therefore, the international recognition of absolute State sovereignty of airspace expressed in article 1 of the Chicago Convention only extends up to the point where flight by conventional aircraft and balloons is possible. However, as Loftus Becker, the Legal Advisor to the Secretary of State,[73] wrote in 1959,

> Even if such international agreements as the Chicago Convention of 1944 be interpreted as conferring "complete and exclusive" sovereignty only within some limit of "air space"—a concept not defined either in the Convention, by lawyers, or by scientists—it should be noted that this does not of itself establish that the U.S. has no rights above these limits.[74]

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[69] G. Vernon Leopold & Allison L. Scafuri, *Orbital and Super-Orbital Space Flight Trajectories*, 36 U. Det. L.J. 515, 518 n.15 (1959) (alternations in original). The German V-2 rocket climbed to an altitude of 60 miles (96.5 km) on its way to its target. *See* MCDOUGAL ET AL., *supra* note 15, at 201.

[70] *Aircraft Nationality and Registration Marks, Annex 7 to the Convention on International Civil Aviation* § 1 (4th ed. 1981). Balloons are considered to be aircraft as well. *See id.*

[71] John Cobb Cooper, *Legal Problems of Upper Space* [hereinafter Cooper, *Upper Space*], *reprinted in* COOPER, EXPLORATIONS IN AEROSPACE LAW, *supra* note 18, at 268.

[72] *Id.* at 272.

[73] Loftus Becker was the Legal Advisor to the Secretary of State from June 1957 until August 1959. *See* U.S. Dep't of State, *Legal Advisors* (visited June 9, 1959) <http://www.state.gov/r/pa/ho/po/12106.htm>.

[74] Loftus Becker, *U.S. Foreign Policy and the Development of Law for Outer Space*, JAG J., Feb. 1959, at 4, 7 [hereinafter Becker, *U.S. Foreign Policy*].

Professor Cooper earlier reached the same conclusion by 1951, writing "[t]he territory of the State extends upward *at least* as far above the surface as to include a region which can be roughly defined as 'airspace.'"[75]

Today, access to a foreign State's airspace by aircraft for international commerce can be obtained only through bilateral or multilateral agreement.[76] There are now many thousand individual bilateral and multilateral agreements in force which are necessary for airlines to operate international air service. These are negotiated by States and cumulatively represent a great expenditure of time, energy, and treasure that could have been more productively used in other areas.

Comparison to the Territorial Sea

The problem of defining a State's vertical sovereignty is fundamentally based on the lack of a natural boundary separating air and space. This is similar to the lack of natural boundaries separating "international waters" from a State's "territorial waters." Coastal States historically have made claims to waters adjacent to their territory, called the "territorial sea." The width of States' claims to territorial seas has varied greatly. At least three reasons are given to justify these claims: State security; customs and commercial supervision of ships; and because the welfare of the coastal State depends upon its exclusive enjoyment of the products of the sea in its territorial waters.[77] The early claims by States to territorial seas of 3 nautical miles (nm) (3.5 miles or 5.5 km) apparently were based on the maximum range of naval cannons.[78] The U.S. has always claimed only a limited territorial sea, adopting a 3-mile territorial sea in 1793.[79]

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[75] Cooper, *High Altitude Flight*, *supra* note 24, at 260.
[76] *See* MCDOUGAL ET AL., *supra* note 15, at 268.
[77] *See* JOHN TAYLOR MURCHISON, THE CONTIGUOUS AIR SPACE ZONE IN INTERNATIONAL LAW 25 (1957).
[78] *See id.* at 26.
[79] *See* Loftus Becker, Some Political Problems of the Legal Adviser, Address Before the American Society of International Law (Apr. 26, 1958) [hereinafter Becker, Political Problems], *in* 38 DEP'T ST. BULL. 832, 834 (1958).

In the eighteenth century the U.K. began expanding its claimed territorial sea to combat smuggling.[80] A 1736 Act of Parliament extended jurisdiction to four leagues.[81] As the smugglers adapted to each new claim, the U.K. responded by increasing its claims further.[82] In 1794, jurisdiction was extended in some cases up to fifty miles (80 km) and in 1805 it was extended in some cases up to 100 leagues (300 miles or 480 km).[83] Interestingly, throughout this period there is no record of any other State objecting to this infringement on their rights of navigation.[84] Finally, in the late nineteenth century the U.K. consolidated all of its customs laws and decreased its territorial sea claims to between one and four leagues.[85]

In the twentieth century, States claimed territorial seas of varying widths. However, according to Mr. Becker, "by the latter part of the 19th century or the early part of the 20th century, the 3-mile limit was firmly established as customary international law."[86] In 1958, three conventions were drafted in Geneva codifying various aspects of the law of the sea.[87] Unfortunately, these conventions did not specify the maximum width of the territorial sea that States could claim.[88] States continued to claim varying widths for their territorial seas, some even claimed up to 100 nm (115 miles or 185 km).

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[80] *See* MURCHISON, *supra* note 77, at 29.
[81] *See id.* at 31.
[82] *See id.* at 32.
[83] *See id.* at 32–33.
[84] *See id.* at 33.
[85] *See id.* (a marine league equals three miles).
[86] Becker, Political Problems, *supra* note 79, at 834. *See also* NIJEHOLT, *supra* note 29, at 18 (*asserting* three miles is "the generally adopted breadth of the territorial waters.").
[87] Convention on the High Seas, April 29, 1958, 13 U.S.T. 2312, 450 U.N.T.S. 82; Convention on the Continental Shelf, April 29, 1958, 15 U.S.T. 471, 499 U.N.T.S. 311; Convention on the Territorial Sea and Contiguous Zone, April 29, 1958, 15 U.S.T. 1606, 516 U.N.T.S. 205.
[88] *See* Convention on the Territorial Sea and Contiguous Zone, *supra* note 87, §§ I–II; John Astley III & Michael N. Schmitt, *The Law of the Sea and Naval Operations*, 42 A.F. L. REV. 119, 121 (1997).

The United Nations sponsored several conferences between 1973 and 1982 to update the 1958 conventions.[89] These conferences led to the United Nations Convention on the Law of the Sea, known as the Law of the Sea Convention, which entered into force in 1994.[90] The Law of the Sea Convention specifies that States may claim no more than 12 nm (13.8 miles or 22.2 km) for their territorial seas.[91] A State's sovereignty extends to the air space above the territorial sea,[92] so its territorial airspace does not begin at the coast. The Law of the Sea Convention also allows States to make territorial claims to "historic" bays.[93] To qualify as a historic bay, a State must have exercised continuous and open authority over the bay and the authority must be acquiesced to by other States.[94] In 1997, 15 States made claims to historic bays.[95] The Convention recognizes a right of innocent passage for all ships through the territorial seas of coastal States.[96] The Convention does not require any prior notice or authorization before exercising the right of innocent passage. The Convention grants all ships and aircraft a right of transit passage through a strait from one part of the high seas (or an economic exclusive zone (EEZ)) to another part of the high seas (or EEZ).[97]

The mere existence of a law does not mean it will be followed or uniformly interpreted. Even after the Law of the Sea Convention entered into force, problems still arise over varying claims by States to territorial waters. In 1999, nine States claimed territorial seas extending beyond 12 nm (13.8 miles or 22.2 km)[98] and Ecuador, El Salvador, Liberia, and Sierra Leone claimed 200 nm (230

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[89] *See* Astley & Schmitt, *supra* note 88, at 121.
[90] United Nations Convention on the Law of the Sea, Dec. 10, 1982, 1833 U.N.T.S. 396, 21 I.L.M. 1261 (entered into force on Nov. 16, 1994) [hereinafter the Law of the Sea Convention].
[91] *Id.* art. 3.
[92] *See id.* art. 2(2); Chicago Convention, *supra* note 16, art. 2.
[93] *See* Law of the Sea Convention, *supra* note 90, art. 10(6).
[94] *See* GRIEF, *supra* note 22, at 18.
[95] *See* Astley & Schmitt, *supra* note 88, at 126.
[96] *See* Law of the Sea Convention, *supra* note 90, arts. 17–26.
[97] *See id.* arts. 37–45.
[98] *See Oceans and the Law of the Sea: Report of the Secretary-General*, 54th Sess., Agenda Items 40(a) and (b), ¶ 86, U.N. Doc. A/54/429 (1999).

miles or 370 km) wide territorial seas.[99] Also, the maximum 12 nm width of each State's territorial sea is measured from baselines that are somewhat difficult to determine.[100] Regarding the right of innocent passage, over 25 States require prior permission before exercising the right and 13 require prior notification.[101] However, overall compliance of States with the Law of the Sea Convention's provisions on the establishment of the outer limits of territorial seas is considered to be "very high."[102]

The various interpretations of the Law of the Sea Convention's provisions can lead to conflict.[103] The U.S. does not recognize any claims to historic bays or claims to territorial seas beyond 12 nm (22.2 km).[104] It demonstrates its lack of recognition of excessive maritime claims by conducting a freedom of navigation program.[105] This is done by sending U.S. Navy and Coast Guard ships into the contested waters.[106] These actions prevent excessive territorial claims of States from becoming accepted as international norms.[107] The freedom of navigation operations "have oftentimes persuaded States to bring their practices into conformity with the UN Convention on the Law of the Sea."[108]

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[99] *See* WILLIAM S. COHEN, U.S. DEP'T OF DEFENSE, ANNUAL REPORT TO THE PRESIDENT AND THE CONGRESS app. H (2000) [hereinafter COHEN, 2000 REPORT], *available at* <http://www.defenselink.mil/execsec/adr2000/>.

[100] *See* Law of the Sea Convention, *supra* note 90, arts. 3–15.

[101] *See* Astley & Schmitt, *supra* note 88, at 132.

[102] *See Oceans and the Law of the Sea: Report of the Secretary-General*, *supra* note 98, ¶ 85.

[103] *See infra* notes 368–381 and accompanying text.

[104] *See* Astley & Schmitt, *supra* note 88, at 126.

[105] *See* COHEN, 2000 REPORT, *supra* note 99, app. H. The most widely known U.S. freedom of navigation operations involved U.S. Navy operations in the Gulf of Sidra off of the coast of Libya in the 1980s. *See* GRIEF, *supra* note 22, at 18.

[106] *See* Astley & Schmitt, *supra* note 88, at 126.

[107] *See* WILLIAM S. COHEN, U.S. DEP'T OF DEFENSE, ANNUAL REPORT TO THE PRESIDENT AND THE CONGRESS app. H (2001) [hereinafter COHEN, 2001 REPORT], *available at* <http://www.defenselink.mil/execsec/adr2001/index.html>.

[108] *Id.* Like the U.S. Navy, the U.S. Air Force conducts a freedom of navigation program in the air. *See* Air Force Doctrine Document 2-3, *Military Operations Other Than War*, 3 July 2000, at 18, *available at* <http://www.e-publishing.af.mil/pubfiles/afdc/dd/afdd2-3/afdd2-3.pdf>.

Before the Law of the Sea Convention entered into force, Ronald Regan, the President of the U.S., expanded the U.S. territorial sea to 12 nm (22.2 km)[109] although the U.S. has not ratified the Law of the Sea Convention.

The U.S.S.R. is a good example of a State that has repeatedly made maritime claims that do not comport with international law. In 1927, the U.S.S.R. established an official territorial sea of 12 nm (22.2 km).[110] Although by 1961 the U.S.S.R. had ratified three of the four Law of the Sea Conventions, "the Soviet Union maintains that nothing in international law requires a nation to adhere to a particular width of territorial sea belt or to use any particular method of measurement of the base line from which a territorial belt extends seaward."[111] The U.S.S.R. abused three concepts of international law to unilaterally annex "over three million square kilometers of the high seas" between 1931 and 1961.[112] For example, in 1957 the U.S.S.R. declared the "Bay of Peter the Great" near Vladivostok to be a historic bay and said no foreign ships would be allowed to enter.[113] According to Mr. Stephen Harbin, a U.S. Department of State Foreign Service Officer,[114] "[t]he 'Bay' of Peter the Great is a rather shallow indentation and does not meet the 'semicircle' definitional test."[115] The U.S. protested this declaration in a series of diplomatic notes, concluding in one that the U.S. "reserves its right to take such action as it deems necessary to protect each and all of its right in that area."[116]

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[109] *See* Presidential Proclamation No. 5928 of December 27, 1988, 54 Fed. Reg. (1989).
[110] *See* William N. Harben, *Soviet Attitudes and Practices Concerning Maritime Waters*, 15 JAG J. 149, 149 (1961).
[111] *Id.*
[112] *Id.* at 150. The article of Mr. Harben includes a map showing all of the maritime claims of the U.S.S.R. *See id.* at 151.
[113] *See id.* at 152.
[114] *See id.* at 149 n*.
[115] *See id.* at 152.
[116] *See* U.S. Note to U.S.S.R. (Mar. 6, 1958), *reprinted in* 38 DEP'T ST. BULL. 461 (1958).

State Positions Concerning Vertical Sovereignty

In the years since the drafting of the Chicago Convention, States have taken different positions on the extent of vertical sovereignty and definitions of their national airspace. There is no consensus today.

Australia

In 2002, Australia began reforming its National Airspace System (NAS) based on international standards as applied in the U.S. but with a defined upper limit of 60,000 feet (18.3 km) for Class A airspace.[117] For space launch licensing purposes, Australia's Space Activities Act of 1998 defines a space object as a payload carried to or back from "an area beyond the distance of 100 km above mean sea level."[118] These acts do not mean, however, that Australia is renouncing any claims of sovereignty it may have to the area above 60,000 feet or even above 100 km (62 miles).

The Federal Republic of Germany

In 1961, Germany amended its Law Concerning Air Navigation of January 10, 1959, to include spacecraft and rockets in its definition of "aircraft."[119] The law does not define the upper extent of this airspace.

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[117] *See* Stephen Angus, NAS Implementation Group Concept 10 (Version 5.0), *available at* <http://www.dotars.gov.au/airspacereform/docs/nas_concept.doc>. *See also* National Airspace System Implementation Group (Australia), Airspace for Everyone, Airspace Adviser No. 1.1, at 16, 18 (2003), *available at* <http://www.dotars.gov.au/airspacereform/docs/Airspace_for_everyone.pdf>.

[118] Space Activities Act 1998, § 8 (Austl.), *available at* <http://www.comlaw.gov.au/comlaw/Legislation/ActCompilation1.nsf/0/9ACAE6DB9C35F901CA256F7100526E2D/$file/SpaceAct98.pdf>.

[119] *See* Law Amending the Law Concerning Air Navigation (6th Amendment), art. 1(2), Jul. 25, 1964, *reprinted in* STAFF OF SENATE COMM. ON COMMERCE, 89TH CONG., 1ST SESS., 1 AIR LAWS AND TREATIES OF THE WORLD 777 (Comm. Print 1965). The amended article 1(2) provided,

The Russian Federation and the U.S.S.R.

Prior to the launch of Sputnik on 4 October 1957, U.S.S.R. attorneys asserted that the sovereignty of a State extended to unlimited height.[120] After Sputnik, U.S.S.R. authors rejected the prior Soviet writings and argued that no State could claim sovereignty in space.[121] Responding to unofficial claims that Sputnik had violated the territory of other States, Dr. G. Zadorozhni, a Soviet lawyer, wrote that Sputnik did not "penetrate the air space over any territories, rather it is these territories which run under . . . the orbit of the satellite's movement."[122] But the U.S.S.R. continued to claim vertical sovereignty with no defined upper limit.[123]

South Africa

South Africa's laws apparently leave a gap between the areas defined as airspace and outer-space.[124] Its aviation act mirrors the definition in Annex 7 to

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"Aircraft shall be deemed airplanes, helicopters, dirigibles, glider planes, free and captive balloons, kites, flight models and other instrumentalities intended for the use of the airspace, in particular spacecraft, rockets and similar flight instrumentalities." *Id.*

[120] *See* MCDOUGAL ET AL., *supra* note 15, at 234–35. However, a widely cited article on this subject by two U.S.S.R. authors must be considered in light of the fact that it was written in direct response to U.S. Secretary of State Dulles' argument [*see infra* notes 133–135 and accompanying text] that U.S. balloon flights over the U.S.S.R. did not violate its sovereignty. *See* MCDOUGAL ET AL., *supra* note 15, at 235 n.120.

[121] *See* MCDOUGAL ET AL., *supra* note 15, at 235.

[122] *See 200th Circuit By Satellite To-Day*, TIMES (London), Oct. 18, 1957, at 7 (*translating* an article in the newspaper Soviet Russia); Leopold & Scafuri, *supra* note 69, at 528 (also quoting Dr. Zadorozhni).

[123] According to the Air Code of Dec. 29, 1961,

> The complete and exclusive sovereignty over the airspace of the U.S.S.R. shall belong to the U.S.S.R.
>
> Airspace of the U.S.S.R. shall be deemed to be the airspace above the land and water territory of the U.S.S.R. including the space above the territorial waters as determined by the laws of the U.S.S.R. and by international treaties concluded by the U.S.S.R.

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

[124] *See* South Africa Department of Transportation, White Paper on National Policy on Airports and Airspace Management (1997), *available at* <http://www.transport.gov.za/library/docs/white-paper/airport-wp.html>.

the Chicago Convention,[125] apparently limiting airspace to the maximum height at which aircraft can derive support from the atmosphere.[126] However, a separate law defines "outer space" as "the space above the surface of the earth from a height at which it is in practice possible to operate an object in an orbit around the earth."[127]

The United Kingdom

During an October 1999 session of the U.K. House of Lords, Lord Macdonald of Tradeston (then the Minister of State, Department of the Environment, Transport, and the Regions) said "The UK does not have a working definition of the upper limit of UK airspace, but for practical purposes the limit is considered to be at least as high as any aircraft can fly."[128] So although the U.K. has apparently set no upper limit to its sovereignty, it also is not limiting any future claims it may assert.

The United States

Although the U.S. agreed with the principle of airspace sovereignty expressed in the Paris Convention, the U.S. signed it but did not ratify it.[129] In the Air Commerce Act of 1926 the U.S. claimed complete sovereignty of the airspace

[125] *See* Aircraft Nationality and Registration Marks, Annex 7 to the Convention on International Civil Aviation § 1 (4th ed. 1981).
[126] *See* South Africa Department of Transportation, *supra* note 124 (citing the Aviation Act, 1962 (Act No. 74 of 1962) (S. Africa)).
[127] Space Affairs Act, 1993 (Act No. 84 of 1993) art. 1 (S. Africa), *available at* <http://www.oosa.unvienna.org/SpaceLaw/national/south_africa/space_affairs_act_1993E.html>.
[128] Lord Macdonald of Tradeston, *Airspace Upper Limit*, Oct. 21, 1999 (visited May 6, 2005) <http://www.publications.parliament.uk/pa/ld199899/ldhansrd/vo991021/text/91021w03.htm> (emphasis added).
[129] *See* Cooper, *Airspace Rights Over the Arctic*, *supra* note 53, at 175.

over the lands and waters of the U.S.[130] The U.S. ratified the Havana Convention in 1931[131] and the Chicago Convention in 1946.[132]

The U.S. position on the vertical extent of State sovereignty changed repeatedly in the 1950s and 60s. In 1956, during a news conference discussing U.S.S.R. protests of U.S. high altitude balloons violating U.S.S.R. airspace, U.S. Secretary of State John Foster Dulles said "the question of the ownership of upper air is a disputable question. . . . What the legal position is, I wouldn't feel in a position to answer because I do not believe that the legal position has even been codified . . . ."[133] Later in the same news conference, Secretary Dulles answered a question by saying, "Yes, I think that we feel [that the U.S. has the right to send balloons at a certain height anywhere around the globe], although . . . there is no clear international law on the subject."[134] Secretary Dulles was asked the approximate height at which a balloon leaves the area of sovereignty and he responded:

> I just can't answer that question. I am very sorry. But it is the same problem that we get on a minor scale when you deal with a question as to whether a man who has a house near an airfield has a right to prevent planes flying over his piece of land and his home. . . . [A]lthough certainly everybody admits that if you own a piece of land, you do control the air a certain distance up. But precisely what the distance is has never been decided, even in domestic law. When you get into international law, the problem is

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[130] *See* An Act To Encourage and Regulate the Use of Aircraft in Commerce, and for Other Purposes, Pub. L. No. 69-254, §6, 44 Stat. 568 (1926), *repealed by* Act of August 23, 1958, § 1401, 72 Stat. 731, 806.

[131] *See* U.S. DEP'T OF STATE, PUB NO. 8441, 2 TREATIES AND OTHER INTERNATIONAL AGREEMENTS OF THE U.S. OF AMERICA 1776-1949, at 698 (1969). The U.S. renounced the Havana Convention in 1947 after ratifying the Chicago Convention. *See id.*

[132] *See Status of Chicago Convention, supra* note 59.

[133] *Transcript of the Record of News Conference Held by Dulles*, N.Y. TIMES, Feb. 8, 1956, at 10. Although the quote above appears to be a definitive statement, Secretary Dulles qualified it by arguing that the balloons were not interfering with aircraft rather than discussing sovereignty, saying there is a "recognized practice to avoid putting up into the air anything which could interfere with any normal use of the air by anybody else." *Id.* The next day Secretary Dulles said the U.S. position was that the legal status of the upper air and the spaces beyond it was still undetermined, and that recognition of any national claim there might raise questions as to the legality of other modern media, such as radio waves and even the projected space satellite. *The Balloon Controversy*, N.Y. TIMES, Feb. 9, 1956, at 30.

[134] *Transcript of the Record of News Conference Held by Dulles, supra* note 133.

> also obscure. I don't know how high a balloon has to go before you get out of the bounds of sovereignty, so to speak.[135]

Shortly after Sputnik's launch, several U.S. Air Force staff officers thought the U.S. should protest Sputnik's orbit over the U.S. as a violation of sovereignty but the U.S. did not file a protest.[136] In May 1958, Mr. Becker, although careful to say he was not taking a position, suggested to Congress that State sovereignty might extend up to 10,000 miles.[137] In 1962, U.S. Air Force Major General John M. Reynolds, the Vice Director of the Joint Staff, expressed the U.S. Department of Defense position on an international agreement on a boundary between air and space as being "neither necessary nor desirable at this time. Should a finite boundary be forced upon us, 20 miles or less would be least disadvantageous."[138] At some point in the 1960s the U.S. State Department proposed encouraging an international agreement defining outer space but the U.S. Air Force convinced the U.S. Department of Defense to resist this idea and apparently the U.S. State Department never proceeded.[139]

After examining U.S. laws, Professor Cooper concluded in 1965 that the U.S. claimed "complete, absolute and exclusive jurisdiction to control all types of

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[135] *Id.*

[136] *See* DELBERT R. TERRILL, JR., THE AIR FORCE ROLE IN DEVELOPING INTERNATIONAL OUTER SPACE LAW 27 (1999), *available at* <http://www.maxwell.af.mil/au/aul/aupress/Books/Terrill/terrill.pdf>. Ultimately, the U.S. Air Force did not urge the U.S. State Department to protest because the U.S.S.R.'s orbiting of Sputnik helped to establish a legal norm of freedom of outer space. *See id.*

[137] *See* Loftus Becker, Major Aspects of the Problem of Outer Space, Address Before the Special Senate Committee on Space and Astronautics (May 14, 1958) [hereinafter Becker, Problem of Outer Space], *in* 38 DEP'T ST. BULL. 962, 966 (1958).

> I think it important to note, however, that one of the suggestions that has been made in this regard is that the airspace should be defined to include that portion of space above the earth in which there is any atmosphere. I am informed that astronomically the earth's atmosphere extends 10,000 miles above its surface. It follows that it would be perfectly rational for us to maintain that under the Chicago Convention the sovereignty of the U.S. extends 10,000 miles from the surface of the earth, an area which would comprehend the area in which all of the satellites up to this point have entered.

Id.

[138] TERRILL, *supra* note 136, at 53.

[139] *See id.* at 54.

flight in its territorial airspace zone" but that the U.S. had not specified the upper boundary of its sovereign airspace zone.[140] The U.S. currently claims "exclusive sovereignty of airspace of the U.S."[141] The term "airspace" is not further defined. In the subsection defining the "use of airspace," use is linked to "aircraft."[142] But the term "aircraft" is broadly defined as "any contrivance invented, used, or designed to navigate, or fly in, the air."[143] This definition is broad enough to include rockets and other high altitude vehicles that do not rely on aerodynamic lift to "fly." In various sections of the U.S. Code, the term "outer space" is used in the definition of other terms but is not itself specifically defined.[144]

In 2001 the U.S. Federal Aviation Administration's (FAA) Office of Associate Administrator for Commercial Space Transportation (CST) published a concept of operations for commercial space transportation in the U.S. NAS.[145] It was designed "in anticipation of the evolution of a NAS environment in the 21st century that fully integrates commercial space operations."[146] It notes that "[h]istorically, commercial launch operations have occurred at coastal federal ranges utilizing only ELVs [expendable launch vehicles]. As a result, these space operations have had minimal impact on NAS operations due to their infrequent occurrence and offshore trajectories."[147] However, in the future,

> [c]hanges in the magnitude and complexity of space operations will place new demands on the NAS as vehicles in route to and from earth orbit and beyond transition through airspace that is

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[140] John Cobb Cooper, *Contiguous Zones in Aerospace–Preventive and Protective Jurisdiction*, 7 A.F. L. REV. 15 (1965) [hereinafter Cooper, *Contiguous Zones*], *reprinted in* COOPER, EXPLORATIONS IN AEROSPACE LAW, *supra* note 18, at 316, 319–20. *See also* Becker, Problem of Outer Space, *supra* note 137, at 966 ("The U.S. Government has not recognized any top or upper limit to its sovereignty.").
[141] 49 U.S.C. § 40103(a)(1).
[142] *See* 49 U.S.C. § 40103(b).
[143] 49 U.S.C. § 40102(a)(6).
[144] *See, e.g.*, 15 U.S.C. § 5802; 42 U.S.C. § 14701; 49 U.S.C. §§ 70101, 70102.
[145] *See* OFFICE OF ASSOCIATE ADMINISTRATOR FOR COMMERCIAL SPACE TRANSPORTATION, FEDERAL AVIATION ADMINISTRATION, CONCEPT OF OPERATIONS FOR COMMERCIAL SPACE TRANSPORTATION IN THE NATIONAL AIRSPACE SYSTEM (Version 2.0, May 11, 2001), *available at* <http://ast.faa.gov/files/pdf/CST_CONOPS_v2.pdf>.
[146] *Id.* § 1.
[147] *Id.* § 1.1.

> currently the near exclusive domain of aviation traffic. . . . [T]he expected increase in frequency of commercial launches and reentries, from a broad range of locations, in the U.S. will contribute substantially to competition for airspace amongst NAS users. Therefore, the FAA must now consider a 'Space and Air Traffic Management System' (SATMS) that equitably supports both the evolving commercial space transportation industry and the mature and continuously growing aviation industry in a systematic, integrated manner. Thus, the SATMS represents an evolutionary expansion of the U.S. air traffic management system to encompass the people, infrastructure, policies, procedures, rules, and regulations necessary to fully integrate space and aviation operations under a single infrastructure.[148]

One part of the plan anticipates an eventual ceiling on the U.S. NAS.[149] This would be done to "demarcate the FAA's operational responsibilities."[150] No agency is specified to handle traffic control above the NAS and the space vehicle operator is responsible for safety of navigation.[151] Although the FAA is considering defining an upper limit to the U.S. NAS, this would not preclude the U.S. from continuing to claim sovereignty above that point.

Interestingly, for at least the limited purpose of defining the qualifications of an astronaut, the U.S. Air Force defines "space" as the area 50 miles (80.4 km) above the earth's surface in a 2003 regulation.[152]

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[148] *Id.*

[149] *See id.* § 2.3. An earlier version of this concept of operations anticipated setting a vertical limit on the U.S. NAS by 2005. *See* OFFICE OF ASSOCIATE ADMINISTRATOR FOR COMMERCIAL SPACE TRANSPORTATION, FEDERAL AVIATION ADMINISTRATION, CONCEPT OF OPERATIONS FOR COMMERCIAL SPACE TRANSPORTATION IN THE NATIONAL AIRSPACE SYSTEM § 2.3 (Feb. 8, 1999), *available at* <http://www.spacefuture.com/archive/concept_of_operations_in_the_national_airspace_system_in_2005.shtml>.

[150] OFFICE OF ASSOCIATE ADMINISTRATOR FOR COMMERCIAL SPACE TRANSPORTATION, *supra* note 145, § 2.3.

[151] *See id.* at 4 n.3.

[152] *See* Air Force Instruction 11-402, *Aviation and Parachutist Service, Aeronautical Ratings and Badges*, 29 July 2003, para. 2.3.2, *available at* <http://www.e-publishing.af.mil/pubfiles/af/11/afi11-402/afi11-402.pdf>.

CHAPTER II: NEED FOR DEFINITION

Technologies Driving Delineation

As early as the 1960s there were many proposals for "space planes." These created potential legal issues that were not yet resolved by international law. However, only one of these, the U.S. Space Shuttle, is actually operational and many of the potential legal issues never materialized. Elizabeth Kelly provides a detailed review of space plane experiments and proposals.[153]

The current ideas for vehicles operating in near space are more diverse than a pure space plane. They include relatively low-cost suborbital vehicles capable of providing short flights for tourists, vehicles operating at high altitude with intercontinental ranges, and autonomous long-endurance high altitude vehicles used to conduct surveillance or as communications platforms. Some of these have moved beyond paper and have demonstrated their capabilities.

Space Tourism

On October 4, 2004, on the 47th anniversary of the launch of Sputnik, SpaceShipOne, a private vehicle designed in the U.S., won the Ansari X-Prize after ascending to 367,463 feet (69.6 miles or 112 km).[154] This is 13,000 feet higher than the previous "unofficial" record set by NASA's X-15 program.[155] During the flight, SpaceShipOne accelerated to Mach 3.09 on ascent and Mach

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[153] Elizabeth Kelly, The Spaceplane: The Catalyst for Resolution of The Boundary and "Space Object" Issues in the Law of Outer Space? 7–28 (1998) (unpublished LL.M. thesis, McGill University (Montreal)) (on file with the McGill University Nahum Gelber Law Library).
[154] Michael A. Dornheim, *SpaceShipWon; FAA Administrator Hints Spaceships May be Treated Like Experimental Aircraft*, AV. WK. & SPACE TECH., Oct. 11, 2004, at 34 [hereinafter Dornheim, *SpaceShipWon*].
[155] *Id.* The maximum altitude obtained by an X-15 was 354,200 feet (67.1 miles, 108 km). Kelly, *supra* note 153, at 8.

3.26 during descent.[156] Although the vehicle reached a high altitude and supersonic speed, SpaceShipOne was not designed for long distance travel: it descends almost vertically, traveling no more than 3 miles (4.8 km) horizontally.[157] A short video of a flight of SpaceShipOne is available on the internet.[158]

SpaceShipOne was designed and constructed by Burt Rutan and his company, Scaled Composites.[159] SpaceShipOne is dropped from a special carrier aircraft, called White Knight, also designed by Scaled Composites.[160] This allows SpaceShipOne to save weight by only carrying enough fuel to power it through the less dense layers of the atmosphere.[161] White Knight released SpaceShipOne at 47,000 feet (14.3 km).[162] The entire program cost approximately $25 million.[163]

Although SpaceShipOne was designed specifically to the requirements of the X-Prize[164] and only had seats for three people, Virgin Galactic recently invested $100 million to develop a larger version of the vehicle capable of carrying five

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[156] Dornheim, *SpaceShipWon*, *supra* note 154.
[157] Michael A. Dornheim, *Affordable Spaceship*, AV. WK. & SPACE TECH., Apr. 21, 2003, at 64.
[158] *See* The Discovery Channel, *The Race for Space* (visited May 25, 2005) <http://media.dsc.discovery.com/convergence/raceforspace/videogallery/videoplayer2.html>.
[159] Dornheim, *SpaceShipWon*, *supra* note 154.
[160] *Id.*
[161] *See* WILLIAM L. SPACY II, *Does the U.S. Need Space-Based Weapons?* 79 & n.18 (1999). *See also* Robert Zubrin & Mitchell Burnside Clapp, *Aviation's Next Great Leap; Rocket-Powered Aircraft that can Travel at Hypersonic Speeds*, TECH. REV., Jan. 11, 1998, at 30.

> Space launch vehicles are typically *staged* to reduce overhead costs. . . . [M]ost of the size of a space launch vehicle is set by fuel needs, which are enormous for *any* launch vehicle. Once the fuel is exhausted, there's no need to drag along the big empty tanks to orbit, so a space launch vehicle stacks several rockets on top of one another. Each rocket stage falls away when it burns out, reducing the structure that is carried into space.

SIMON P. WORDEN AND JOHN E. SHAW, WHITHER SPACE POWER? FORGING A STRATEGY FOR THE NEW CENTURY 76 (2002), *available at* <http://www.maxwell.af.mil/au/aul/aupress/catalog/fairchild_papers/Worden_Shaw_P26.htm>.
[162] Dornheim, *SpaceShipWon*, *supra* note 154.
[163] *Id.*
[164] "X Prize rules require that the craft carry 270 kg. (595 lb.) of payload, including the pilot." *Id.*

passengers and crew for commercial space flights.[165] The Mojave Airport in Palmdale California, the launch site for SpaceShipOne, has been licensed by the U.S. FAA to be a space launch facility.[166] The successful flights of SpaceShipOne have helped to lower the threshold of space, at least to the public—many people now think that space begins at an altitude of 62 miles (100 km).[167] Many legal scholars would also agree that this altitude is above the vertical limit of a State's sovereign air space.[168] Although SpaceShipOne is probably the most publicly known of the commercial space tourist applications, several other companies are also trying to develop vehicles for space tourism.[169]

HyperSoar

HyperSoar is a concept developed by the Lawrence Livermore National Laboratory.[170] It would be powered by rocket-based combined-cycle (RBCC) engines,[171] one component of which is a supersonic combustion ramjet

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[165] Michael A. Dornheim, *Sir Space Tourist; Virgin Galactic Eyes Follow-on Generation Going to Orbit and Around the Moon*, AV. WK. & SPACE TECH., Oct. 4, 2004, at 30.

[166] *See* OFFICE OF COMMERCIAL SPACE TRANSPORTATION, FEDERAL AVIATION ADMINISTRATION, 2005 U.S. COMMERCIAL SPACE TRANSPORTATION DEVELOPMENTS AND CONCEPTS: VEHICLES, TECHNOLOGIES, AND SPACEPORTS 37 (2005), *available at* <http://ast.faa.gov/files/pdf/2005_dev_con.pdf>; Alan Boyle, *Amazon Founder Unveils Space Center Plans*, MSNBC.Com, Jan. 13, 2005, *available at* <http://www.msnbc.msn.com/id/6822763/>.

[167] *See* Peter Pae, *Rocket Takes 1st Prize of a New Space Race*, L.A. TIMES, Oct. 5, 2004, at A1 (noting SpaceShipOne climbed "well past the 62-mile-high boundary that is widely considered the frontier between the Earth's atmosphere and outer space").

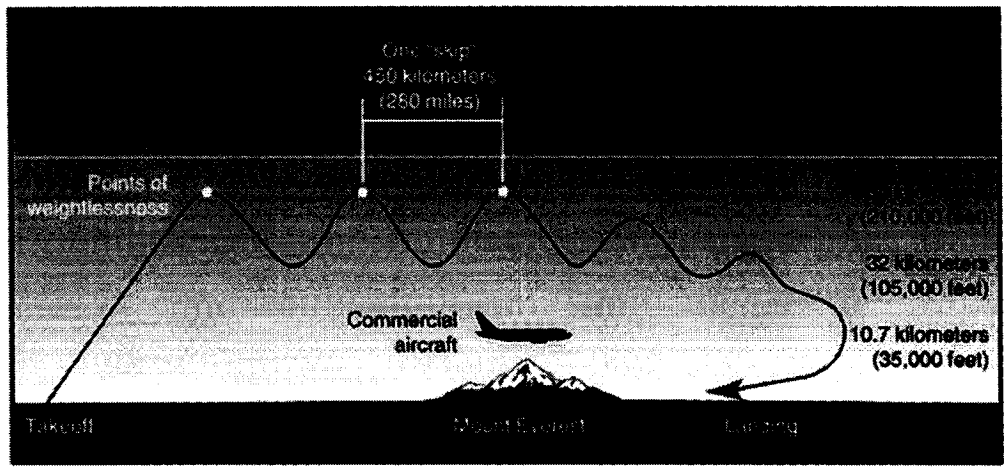
[168] *See, e.g.*, Bin Cheng, *The Legal Regime of Airspace and Outer Space: The Boundary Problem*, V ANNALS OF AIR & SPACE L. 323 (1980) [Cheng, *The Boundary Problem*], *reprinted in* BIN CHENG, STUDIES IN INTERNATIONAL SPACE LAW 425, 451 (1997) [hereinafter CHENG, SPACE LAW]. While not precisely defining the limit of national sovereignty, Professor Bin Cheng writes that above 68 miles (110 km), "one is definitely in outer space, according to *lex lata*." *See id.*

[169] *See* OFFICE OF COMMERCIAL SPACE TRANSPORTATION, *supra* note 166, at 18–22; Max Boot, *Commentary; Space, the Final Free Market*, L.A. TIMES, Oct. 7, 2004, at B13; Boyle, *supra* note 166.

[170] Jefferson Morris, *Space Plane "Dream" Still Alive at DARPA, Tether Says*, AEROSPACE DAILY, Oct. 24, 2003, at 5 [hereinafter Morris, *Space Plane*].

[171] *See* William B. Scott, *Airbreathing HyperSoar Would "Bounce" on Upper Atmosphere*, AV. WK. & SPACE TECH., Sept. 7, 1998, at 126 [hereafter Scott, *HyperSoar*].

(scramjet).[172] It would take off horizontally from a standard 10,000 foot (3 km) runway.[173] After accelerating to Mach 10 and climbing to about 130,000 feet (25 miles or 40 km)[174] its engines would be turned off and it would coast up to an altitude of 40 miles (64 km) or more.[175] The vehicle would then descend back into denser air, to an altitude of around 20 miles (32 km), where aerodynamic lift is possible.[176] It would then restart its engines to start the process over and continue doing this repeatedly to "skip" along the upper atmosphere.[177] About 2.5 cycles would cover approximately 620 miles (1,000 km).[178] A flight from Chicago to Toyko, approximately 6,290 miles (10,100 km), could be completed in 18 cycles and only 72 minutes.[179]



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Although the idea behind HyperSoar, also called "periodic hypersonic cruise," has been around for over 40 years,[181] the design of HyperSoar is unique according

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[172] On November 16, 2004 NASA successfully tested the X-43A which was designed to test a scramjet engine. *Hypersonic Plane Breaks Speed Record*, Reuters, Nov. 16, 2004, *available at* <http://www.msnbc.msn.com/id/6504898/>.
[173] *See* Scott, *HyperSoar*, *supra* note 171.
[174] *Id.*
[175] Christian Lowe & Nathaniel Levine, *Corps Has its Sights Set on Space; Hypersonic Aircraft Offers New Deployment Possibilities*, MARINE CORPS TIMES, Aug. 25, 2003, at 18.
[176] *Id.*
[177] *See id.*
[178] Scott, *HyperSoar*, *supra* note 171.
[179] Ann Parker, *Bringing Hypersonic Flight Down to Earth*, SCI. & TECH. REV., Jan.–Feb. 2000, at 20, 21, *available at* <http://www.llnl.gov/str/pdfs/01_00.3.pdf>.
[180] *Id.*

to its developer.[182] He claims "better performance, lower g-loads, efficient heat management and reduced technical risk."[183] Accordingly, this makes the design more practical than other "transatmospheric" vehicle concepts, "Germany's Sanger, the U.S. X-20B DynaSoar, X-30 National Aero Space Plane and the Air Force's Boost Glide Vehicle and military spaceplane."[184] One problem avoided by periodic hypersonic cruise is the extreme head generated by friction during high-speed flight in the atmosphere.[185] Heat buildup killed most earlier designs for hypersonic travel.[186] For example, during NASAs recent test of the X-43A, the test vehicle flew at approximately 110,000 feet (20.8 miles or 33.5 km) at a maximum speed of Mach 9.6 for only 20 seconds and reached a temperature of about 3,000 degrees Fahrenheit (1,650 degrees Celsius).[187] HyperSoar would avoid this problem because when coasting during its ballistic arcs it will be able to radiate most of the heat generated during flight in the atmosphere into space.[188]

Research on the HyperSoar concept is being funded by the U.S. Defense Advanced Research Projects Agency (DARPA) under a program called "Force Application and Launch from the Continental U.S.," or FALCON.[189] The FALCON program is split into two parts: a hypersonic cruise vehicle (HCV) (a version of the HyperSoar concept) and the common aero vehicle (CAV) (an unpowered, maneuverable, hypersonic glide vehicle capable of carrying about 1,000 pounds of munitions or other payload).[190] Although funding was decreased

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[181] Apparently the idea of skipping along the upper atmosphere has existed since the dawn of space flight. *See* Spencer M. Beresford, *Surveillance Aircraft and Satellites: A Problem of International Law*, 27 J. AIR L. & COM. 107, 109 (1960) (*describing* a "skip rocket" that would "alternately descend from outer space into the atmosphere, and then turn upward into outer space, like a flat stone skipping over the surface of a pond").
[182] *See* Scott, *HyperSoar*, *supra* note 171.
[183] *Id.*
[184] *Id.*
[185] *See* Parker, *supra* note 179, at 21.
[186] *See* Scott, *HyperSoar*, *supra* note 171.
[187] *See Hypersonic Plane Breaks Speed Record*, *supra* note 172.
[188] *See* Scott, *HyperSoar*, *supra* note 171.
[189] Morris, *Space Plane*, *supra* note 170; *Defense Watch*, DEF. DAILY, Oct. 27, 2003.
[190] *See* DEFENSE ADVANCED RESEARCH PROJECTS AGENCY, FORCE APPLICATION AND LAUNCH FROM CONUS (FALCON) BROAD AGENCY ANNOUNCEMENT 1 (Jul. 29, 2003), *available at* <http://www.darpa.mil/tto/falcon/FALCON_PIP_FINAL.pdf>; Morris, *Space Plane*, *supra* note 170.

for the CAV portion of the program in 2004,[191] first flight of the HCV is scheduled for 2009.[192] The U.S. Air Force and DARPA awarded $8.3 million to Lockheed Martin Aeronautics for prototypes for the 6-month second phase of the HCV program.[193] Lockheed could receive an additional $97 million during a 30-month phase IIb to complete detailed design, fabrication, and flight-test of a hypersonic technology test vehicle.[194]

The U.S. Air Force is preparing an environmental study for a proposed hypersonic cruise corridor to test a hypersonic vehicle.[195] The study examines the environmental impacts associated with the proposed establishment of flight corridors for testing an air-launched, hypersonic vehicle that would land at Edwards Air Force Base in California.[196]

If HyperSoar, or something like it, works and is available for commercial transport, it could be highly profitable.

> An Aviation Industries Assn. modeling standard predicted a HyperSoar-type vehicle would generate 10 times the daily revenue of a subsonic aircraft, but would cost twice as much to operate, primarily due to the handling and consumption of liquid hydrogen fuel. Theoretically, that would still yield a profit five times higher than the subsonic alternative, once a mature HyperSoar infrastructure was in place. However, few, if any, commercial firms could afford the necessary development costs, proponents admitted.[197]

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[191] Jefferson Morris, *Analyst: Space Weapon Proponents Need to Make Better Case*, AEROSPACE DAILY & DEF. REP., Aug. 5, 2004, at 1.
[192] *See* DEFENSE ADVANCED RESEARCH PROJECTS AGENCY, *supra* note 190, at 6 fig.2.1; Morris, *Space Plane*, *supra* note 170.
[193] *See* DEFENSE ADVANCED RESEARCH PROJECTS AGENCY, DARPA AND AIR FORCE AWARD FALCON PHASE II TASK 2 EFFORT (Aug. 5, 2004), *available at* <http://www.darpa.mil/body/newsitems/pdf/falcon_ph2_t2.pdf>.
[194] *See id.*
[195] *See* Christopher Smith, *Secret Dugway Role May Expand*, SALT LAKE TRIBUNE, Jan. 18, 2005.
[196] AIR FORCE FLIGHT TEST CTR, U.S. AIR FORCE, DRAFT ENVIRONMENTAL ASSESSMENT FOR HYPERSONIC CORRIDORS AT EDWARDS AIR FORCE BASE 1 (Nov. 2004) (on file with author). The environmental assessment is being extensively redrafted based on comments received. Email from Larry Hagenauer, TYBRIN Corporation (Feb. 23, 2005) (on file with author).
[197] Scott, *HyperSoar*, *supra* note 171.

However, past predictions about operational costs in this realm have proven unreliable: the cost per launch of the space shuttle was expected to be $10 - $12 million but is now more than $450 million.[198] Mission turnaround time for the space shuttle was expected to be a few days but is now a few months.[199]

Other High Altitude Vehicles

Balloons provided the first means of human air travel. They also were an early driving force behind the development of air law. In WWI, rigid airships called zeppelins which could travel at what was then considered to be high altitude were used by Germany to launch attacks on the United Kingdom.[200]

During WWII, Japan demonstrated a surprisingly advanced understanding of the jet stream by launching balloons against the U.S. mainland.[201] The balloons were constructed of mulberry paper and had barometers to sense their altitude and trigger the release of ballast when the balloons dropped below the proper altitude during their drift to the U.S. Traveling between 30 to 35 thousand feet (9.1 to 10.7 km), the balloons could cross the Pacific Ocean and reach North America in about 70 hours. They carried relatively small incendiary bombs and high explosive bombs and were expected to start forest fires and cause fear in the U.S. More than 9,000 of the balloons were released and six people in the U.S. were killed by them.[202]

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[198] *See* Boot, *supra* note 169.
[199] *See id.*
[200] *See* U.S. Centennial of Flight Commission, *The Zeppelin* (visited June 8, 2005) <http://www.centennialofflight.gov/essay/Lighter_than_air/zeppelin/LTA8.htm>. The first zeppelin raid on London occurred on May 31, 1915 and the zeppelin was able to fly higher than U.K. and French fighter aircraft. *See id.* One article reported that zeppelins were able to reach an altitude of 13,000 feet. *See French Airmen's Exploits: Fight With a Zeppelin at 13,000 Feet*, TIMES (London), Apr. 27, 1916, at 6.
[201] *See* Cecilia Rasmussen, *Los Angeles, Then and Now*, L.A. TIMES, Nov. 3, 2002, at 2.
[202] *See* Friends of the Canadian War Museum, *Fact Sheet: The Japanese Fire Balloons* (visited June 14, 2005) <http://www.friends-amis.org/fireballoons_e.html>; Greg Goebel, *The Fire Balloons* (visited Feb. 17, 2005) <http://www.faqs.org/docs/air/avfusen.html>.

In the 1950s the U.S. military had several programs that worked on high altitude manned balloons.[203] These were used to gain knowledge of the affects of high altitude flight on humans, information that proved very valuable for manned space flight.[204]

The U.S. Air Force also began a program of releasing unmanned high altitude balloons in 1956.[205] The balloons were launched from various locations around the world to conduct atmospheric research.[206] However, at the same time the U.S. Air Force was launching similar balloons over the U.S.S.R. in an attempt to gain intelligence.[207] The intelligence gathering efforts were not very successful.[208] The weather research cover story was blown in early 1956 when the U.S.S.R. recovered one of the balloons and developed the film it carried—the pictures showed Soviet territory.[209] President Eisenhower terminated further launches by the U.S. Air Force of high altitude balloons in mid-March 1956.[210]

Research conducted by high altitude balloons has continued.[211] NASA is currently developing an ultra-long duration balloon (ULDB) that is being

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[203] *See* Linda Voss, *Balloons as Forerunners of Spaceflight and Exploration* (visited Feb. 17, 2005) <http://www.centennialofflight.gov/essay/Lighter_than_air/Balloons_and_Space/LTA17.htm>.
[204] *See id.*
[205] TERRILL, *supra* note 136, at 5. In one operation, "Project Genetrix," 516 balloons were launched from locations in Europe. The balloons carried automatic cameras and tracking beacons so that they could be recovered. *See id.* In operation "Moby Dick," the U.S. Air Force released "some two thousand balloons from various sites around the earth." *Id.*
[206] *Id.* at 14 n.25 (*noting* that although some balloons were used for intelligence gathering, some were actually only used for weather research).
[207] *Id.* at 5–6.
[208] *Id.* at 5.
[209] *See* U.S.S.R. Note to the U.S. of Feb. 18, 1956, *reprinted in* 34 DEP'T ST. BULL. 427, 428 (1956). The U.S.S.R. also asserted that the captured balloons did not carry any instruments to measure basic meteorological elements. *See id. See also Russians Display Balloons of U.S.*, N.Y. TIMES, Feb. 10, 1956, at 1. Interestingly, while the U.S.S.R. was protesting U.S. balloon flights, one of its meteorological balloons landed in Japan. *See* Waldemar Kaempffert, *Science in Review: Weather Balloons, to Which Russia Objects, Yield Data Useful to All Nations*, N.Y. TIMES, Feb. 12, 1956, at E11.
[210] TERRILL, *supra* note 136, at 7.
[211] *See* Linda Voss, *Scientific Use of Balloons in the Second Half of the Twentieth Century* (visited Feb. 17, 2005) <http://www.centennialofflight.gov/essay/Lighter_than_air/Science_Missions-20th-Part_II/LTA15.htm>.

designed to achieve flights of up to 100 days.[212] The ULDB reached an altitude of 115,000 feet (21.8 miles or 35.1 km) during tests in Australia in 2001.[213] In May and June 2005, NASA plans to further test its ULDB.[214] The balloons are designed to lift a large telescope to an altitude of about 25 miles (40 km).[215] The balloons will be launched from Sweden and travel to Alaska but will not cross Russia, which, demonstrating a claim of sovereignty reminiscent of cold-war politics, has not granted permission for the balloons to cross its territory.[216]

Another NASA balloon, carrying the cosmic ray energetics and mass (CREAM) experiment, traveled for 41 days and 22 hours after its launch in Antarctica on December 16, 2004.[217] The balloon lifted the two-ton CREAM experiment to a height of 125,000 feet (23.7 miles or 38.1 km).[218]

After balloons, the U.S. used high altitude aircraft to gather intelligence on other countries. Besides the well-known X-15, in the 1950s and 1960s the U.S. Air Force experimented with many other high altitude vehicles. Using the Lockheed U-2, the U.S. flew missions over the U.S.S.R. beginning in late 1956.[219] These missions provided very useful intelligence but after the U-2 flown by Gary Powers was brought down over the U.S.S.R. on 1 May 1960, the U.S. stopped these missions as well.[220]

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[212] *See NASA to Launch Balloons from Sweden*, MSNBC.COM, Feb. 16, 2005, *available in* <http://www.msnbc.msn.com/id/6981227/>.
[213] *See* Voss, *supra* note 211.
[214] *See Spectacular Balloon Flights from Esrange to Alaska This Spring*, SPACE DAILY, Feb. 15, 2005.
[215] *See NASA to Launch Balloons from Sweden*, *supra* note 212; *Spectacular Balloon Flights from Esrange to Alaska This Spring*, *supra* note 214.
[216] *See NASA to Launch Balloons from Sweden*, *supra* note 212.
[217] *See NASA Balloon Makes Record-Breaking Flight*, SPACE DAILY, Jan. 31, 2005.
[218] *See id.*
[219] TERRILL, *supra* note 136, at 6.
[220] *Id.* at 73 n.7. Even a year after the U.S.S.R. downed the U-2, some senior leaders in the U.S. military did not think the U.S. had violated international law by flying the aircraft over U.S.S.R. territory. *See id.* 66. According to Terrill, in 1961, U.S. Air Force Lieutenant General Richard M. Montgomery, the Assistant Vice Chief of Staff of the U.S. Air Force, stated that then Colonel Martin Menter "didn't know what he was talking about" when Colonel Menter said the U.S. had violated international law when Francis Gary Powers flew over the U.S.S.R. in his U-2. *See id.* Colonel Menter was later promoted to Brigadier General and became a founding member of the International Institute of Space Law (IISL), served as President of the U.S. Association of the

As mentioned in the introduction, the U.S. Air Force has recently expressed renewed interest in operating vehicles for various missions at high altitudes. The U.S. Air Force thinks operating in this area will be less expensive than the cost of current unmanned aerial vehicles or satellites and can cover gaps in satellite coverage.[221] The vehicles under development are lighter-than-air vehicles, glider-like vehicles, and hybrids (a blend of airship and traditional aircraft).[222] One concept includes launching a surveillance glider from a high altitude balloon.[223] One Air Force officer implied that the glider could be used to fly over other States.[224] However, one U.S. Air Force attorney recently said "we recognize fully that the existing laws and treaties will apply in near space. At the altitudes that

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IISL, and served as the Vice President of the IISL for six years. Some contemporary writers also expressed the opinion that the U.S. had not violated the sovereignty of the U.S.S.R. One, Spencer M. Beresford, expressed several reasons why the U-2 flight did not violate U.S.S.R. sovereignty: because the U.S.S.R. never ratified the Chicago Convention, other States were not bound to recognize U.S.S.R. air sovereignty (this ignores the fact that article 1 of the Chicago Convention recognizes all States have sovereignty over their air space, even the U.S.S.R. despite the fact that in 1960 it was not a party to the Chicago Convention); the U-2 flights couldn't violate U.S.S.R. air sovereignty because the term had not been defined (again, this ignores that even under the Paris Convention definition, the U-2 is an aircraft and it flies by generating lift over its wings); the U-2 is a State aircraft so U-2 flights are not regulated by the Chicago Convention (this again ignores the article 1 declaration that all States have sovereignty over their air space); finally, he argues that sovereignty should be based on effective control. *See* Beresford, *supra* note 181, at 109–13. Mr. Beresford was special counsel for the U.S. House of Representatives Select Committee on Astronautics and Space Exploration and drafted the Committee's report, *Survey of Space Law*. *See* SELECT COMMITTEE ON ASTRONAUTICS AND SPACE EXPLORATION, SURVEY OF SPACE LAW, H.R. Doc. No. 86-89, at v (1959).

[221] *See* William B. Scott, *Near-Space Frontier; Vehicles Roaming the Edge of Earth's Atmosphere Offer Military Potential*, AV. WK. & SPACE TECH., Feb. 14, 2005, at 71 [hereinafter Scott, *Near-Space Frontier*]; *Air Force May Spread Wings in Near Space*, Reuters, Jan. 19, 2005, *available at* <http://www.cnn.com/2005/TECH/space/01/19/arms.space.reut/index.html>.

[222] *See* Scott, *Near-Space Frontier*, *supra* note 221; *Air Force May Spread Wings in Near Space*, *supra* note 221; Jefferson Morris, *Near-Space Free-Floating Balloons a Candidate for Quick Deployment*, AEROSPACE DAILY & DEFENSE REP., Nov. 8, 2004, at 3; Andrea Shalal-Esa, *Air Force War Game Aims to Test Space Technologies*, Reuters, Feb. 5, 2005, *available at* <http://www.msnbc.msn.com/id/6919754/>.

[223] Morris, *supra* note 222.

[224] *See id.* The article quotes a U.S. Air Force officer as saying:

> The balloon floats "over to your area of interest, and then once they've gotten [there], they release the glider and the glider goes in a lazy circle[."] "The beauty of it is, you can recover the glider in friendly territory, so if you have a high-value payload, you don't lose it, like you do with these other free-floater concepts."

Id. (first alteration in original) (emphasis added).

we are talking about today for these specific technologies, it is air law that will apply."[225] Several different vehicles have already been tested and the operational altitude ultimately may reach 100,000 feet (19 miles or 30.5 km),[226] well above the current limit for conventional flight. In one test, the U.S. Air Force used a balloon to carry a standard U.S. Army radio to an altitude of 65,000 feet (12.3 miles or 19.8 km), increasing the radio's range by almost 250 nm (288 miles or 463 km).[227] The U.S. Air Force may begin operating some of the vehicles by the end of 2006.[228]

Other States are also working on high altitude vehicles. The U.K. Ministry of Defence is testing a high altitude aircraft called the Zephyr 3. It is expected to fly to 132,000 feet (25 miles or 40.2 km), higher than any other unmanned aircraft.[229]

Some civilian businesses are also considering the use of high altitude vehicles. One potential use for them is as communications relay stations. High altitude communication networks based on lighter than air vehicles or aircraft operating in relatively fixed locations at approximately 65,000 feet (12 miles or 20 km) or higher are known as high altitude platform stations (HAPS). At this altitude the HAPS are above the jet stream[230] so winds are relatively calm and it is easier to keep the platform in a stable location horizontally. HAPS offer several advantages over satellite networks. They are potentially less expensive to field; they operate much lower than geostationary communications satellites so there is

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[225] Michael Sirak, *US Air Force Sees Promise in 'Near Space'*, JANE'S DEF. WKLY, Oct. 13, 2004, *available at* <http://www.spacedata.net/news101304.htm> (*quoting* Major Elizabeth Waldrop, Chief of Space and International Law for U.S. Air Force Space Command).
[226] *See* Scott, *Near-Space Frontier*, *supra* note 221.
[227] *See* Jefferson Morris, *Lord Briefs Jumper on Near-Space; Deployment Could be Upcoming*, AEROSPACE DAILY & DEFENSE REP., May 25, 2005.
[228] *See* Shalal-Esa, *supra* note 222.
[229] Peter Almond, *British Solar Spy Plane Rises To A Record Challenge*, SUNDAY TIMES (London), Feb. 27, 2005.
[230] *See* Sanswire Networks, *What is a Stratellite?* (visited May 25, 2005) <http://www.sanswire.com/stratellites.htm>.

no transmission delay; and they can be brought back down to earth for repair or equipment upgrades.[231]

To take advantage of the communications potential of these vehicles, HAPS must have access to the radio spectrum without interference. The International Telecommunications Union (ITU), a UN affiliated international organization that coordinates radio spectrum use to ensure radio frequency users do not interfere with each other,[232] has a long history of allocating frequencies for use by vehicles in the atmosphere. The need for coordination was demonstrated with the orbiting of the first man-made satellite: Sputnik reportedly caused radio interference in at least three States.[233] The frequency used by Sputnik had been assigned to a station in the Netherlands.[234] The first ITU regulations relating to space telecommunications became effective on May 1, 1961.[235] In the 1990s, the ITU began allocating frequencies for high altitude platforms. In 1997, the ITU allocated the 47 and 48 gigahertz (GHz) bands for use by HAPS.[236] In May 1997, the U.S. Federal Communications Commission allocated the 47 gigahertz band for HAPS.[237] In 2000, the ITU allocated the 31/28 GHz and 2 GHz bands for use by HAPS.[238]

Several concepts for HAPS based communications networks have been proposed. In the late 1990s, Sky Station planned to launch up to 250 balloons that

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[231] *See* Mike Mills, *Haig Floats A High-Tech Trial Balloon*, WASH. POST, Apr. 13, 1998, at F5.
[232] More specifically, "the ITU through its periodic conferences effects allocation of the radio frequency spectrum and registration of radio frequency assignments, coordinates efforts to eliminate harmful interference between radio stations of different countries, and establishes general standards for equipment and broadcasting techniques." *See* MCDOUGAL ET AL., *supra* note 15, at 633.
[233] *See* Nandasiri Jasentuliyana, *Regulatory Functions of I.T.U. in the Field of Space Telecommunications*, 34 J. AIR L. & COM. 62, 65 (1968).
[234] *See id.*
[235] *See* MCDOUGAL ET AL., *supra* note 15, at 634.
[236] *See* Masayuki Oodo & Ryu Miura, *A Study of Frequency Sharing and Contribution to ITU for Wireless Communication Systems Using Stratospheric Platforms*, J. COMM. RES. LAB., Dec. 2001, at 49, 60 tbl.3, *available at* <http://www2.nict.go.jp/kk/e414/shuppan/kihou-journal/journal1.htm>.
[237] *See* Use of Radio Frequencies Above 40 GHz for New Radio Applications, 60 Fed. Reg. 43,116 (1997).
[238] Oodo & Miura, *supra* note 236, at 60 tbl.3.

would hover at an altitude of approximately 65,600 feet (12.4 miles or 20 km) to transmit internet, video, and phone calls.[239] One HAPS concept currently being designed and nearing testing is the airship platform called a Stratellite which is being developed by GlobeTel Communications Corporation.[240] The Stratellite is a rigid airship.[241] It is being designed to stay aloft for long periods of time, up to 18 months.[242] Other concepts are discussed by Ryszard Struzak in his paper *Mobile Telecommunications via the Stratosphere*.[243]

Freedom of Access to Space

Mr. Johnson, after initially opposing delineation, quickly changed his mind and advocated for delineation. In 1959, he was cited asking for delineation as soon as possible and suggesting the altitude of 25 miles (40.2 km) as a limit for vertical sovereignty.[244] He pointed out the problems States would have accessing space if vertical sovereignty was set too high. In 1961, he said:

> Regardless of the status of outer space, spacecraft must first move through the territorial airspace to get there, and must move back through the territorial airspace if they are to return to earth. . . .
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> . . . .
>
> Now, the U.S. is fortunately situated geographically so that the flight profile of Project Mercury presents no real problem. . . . Inevitably, it will become necessary to know in advance whether the launch phase or the re-entry phase violates the territorial airspace of another state. . . .
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> I do not suggest that agreement on the upward limit of territorial space will assist in distinguishing between what space activities should be permitted and what should be prohibited in non-

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[239] *See* Mills, *supra* note 231.
[240] *See* Sanswire Networks, *supra* note 230.
[241] *See id.*
[242] *See id.*
[243] *See* Ryszard Struzak, *Mobile Telecommunications via the Stratosphere* (visited June 9, 2005) <http://www.intercomms.net/AUG03/content/struzak1.php>.
[244] *See* Monroe W. Karmin, *Up in the Air*, WALL ST. J., Nov. 25, 1959, at 1.

> territorial space. This is not the point. The point, rather, is that it seems desirable that there be a clearly-defined limit to the power of an individual state to declare unilaterally that certain activities are impermissible in the space above it and, by so doing, to engender an international legal dispute.[245]

In 1962, Mr. Johnson said "[t]he area within which the underlying State possesses the right to 'veto' the activity of another State must not be permitted to extend to altitudes which would hamper the freedom of space exploration. It is of little value to speak of the freedom of outer space if man cannot travel freely to that realm and freely back to earth."[246] Finally, in 1964 Mr. Johnson said:

> It might be argued that the freedom of outer space "for exploration and use by all States in conformity with international law," as affirmed by the General Assembly resolution, necessarily implies freedom of access to outer space and, in the case of manned space exploration, freedom of return from outer space, and that there should therefore be no legal basis for protesting, merely on grounds of unpermitted presence, the overflight of national territory by ascending and descending spacecraft, regardless of altitude. In other words, no individual State, by assertion of exclusive control, would have the right to preclude access by another State to outer space or return to earth from outer space even at altitudes universally regarded as being within the territorial air space. It seems most doubtful, however, that such an unqualified principle will ever gain general acceptance. Exclusive control of the air space is so well-established that it is not likely, in the absence of effective pre-launch inspection disclosing the nature and capabilities of the craft involved, that an unlimited right of passage will be accorded craft at altitudes where aircraft may operate only with the prior permission of the underlying State. But if the exclusive control of the territorial sovereign may be invoked at altitudes of 10, 15, and 20 miles to exclude spacecraft not having prior permission, then at what altitude may one invoke a right of free access to outer space and free return from outer space so as not to require prior consent for the overflight of national territory?[247]

In the words of Professor Cooper,

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[245] Johnson, PROCEEDINGS, *supra* note 2, at 168–69.
[246] Carl Q. Christol, *"Innocent Passage" in the International Law of Outer Space*, 7 A.F. L. REV. 22 (1965), *reprinted in* CARL Q. CHRISTOL, SPACE LAW: PAST, PRESENT, AND FUTURE 329, 331 (1991) (*quoting* Mr. Johnson in a NASA News Release).
[247] Johnson, *Freedom and Control*, *supra* note 7, at 141.

> Unless [the upper boundary of national airspace] is fairly close to the earth's surface, few States will be able to put a satellite into orbit . . . without passing through the national airspace of other States. In other words, few States will be free of a political veto by other States in planning orbital flights.[248]

This is because spacecraft are not launched straight up.

> [T]he creation of absolute sovereignty up to [60 miles or 90 km] places unnecessary constraint on trajectories of space mission launchings or landings. Before achieving a desired orbit the launch vehicle must pass at a slanting trajectory over substantial segments of the earth. The amount of energy required for a 'vertical' launch in order to protect 'boundaries' would be exorbitant and practically insupportable.[249]

The 1998 launch by the Democratic People's Republic of Korea (North Korea) of a long-range rocket highlighted the access to space issue. On August 31, 1998, North Korea launched a rocket from its Hawdaegun Missile Test Facility that flew "over" Japan.[250] North Korea gave no advance notice or

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[248] Cooper, *Legal Problems of Spacecraft in Airspace, reprinted in* COOPER, EXPLORATIONS IN AEROSPACE LAW, *supra* note 18, at 305, 311 (first printed in 1964). In 1965, Professor Cooper said:

> If the complete preventive jurisdiction of a State above its lands and waters extends upward even fifty miles, future intercontinental and orbital outer space flight will be seriously handicapped. Until the time arrives when flight instrumentalities are available with almost vertical take-off into and subsequent descent from outer space it will continue [to be] necessary to plan outer space flight with gradual ascent and even more gradual descent. Few States are geographically located so that they can, without difficulty, plan outer space flight without assuming descent from outer space at altitudes less than fifty miles above the surface territories of other States.

Cooper, *Contiguous Zones*, *supra* note 140, at 325. However, as mentioned above, space tourist vehicles modeled after SpaceShipOne may operate within a very narrow horizontal space, so transiting over another State's territory may not be an issue for them. *See supra* text accompanying note 157.

[249] S. Mishra & T. Pavlasek, *On the Lack of Physical Bases for Defining a Boundary Between Air Space and Outer Space*, VII ANNALS AIR & SPACE L. 399, 403 (1982).

[250] *See* Joseph C. Anselmo et al., *Missile Test Extends North Korea's Reach*, AV. WK. & SPACE TECH., Sept. 7, 1998, at 56; Paul Mann, *Missile Defense Boosted, Despite Weak Management*, AV. WK. & SPACE TECH., Oct. 26, 1998, at 34. The launch site is also called "Nodong" and is located at 40 degrees, 51 minutes, and 17 seconds North Latitude, 129 degrees, 39 minutes, and 58 seconds East Longitude. *See* Federation of American Scientist, *No-dong* (last modified Mar. 25,

warnings of the launch.[251] There is some disagreement over whether this was a two-stage or three-stage rocket.[252] It may have been a Taepo Dong 1 ballistic missile.[253] North Korea asserted the launch successfully orbited a satellite, a claim supported by Russia.[254] The first stage landed in the sea 157 miles (253 km) downrange.[255] Apparently, the second stage (or possibly the heat shield) flew "over" Japan and landed in the Pacific Ocean 1,023 miles (1,646 km) downrange from its launch point and approximately 348 miles (560 km) from Japan.[256] This area is near international airway A590 where at the time 180 aircraft flew every day.[257] These downrange distances somewhat mirror the chart produced by Marietta Benkö which predicted a downrange impact for components of a three-stage rocket of approximately 250 miles (400 km) for the first stage, approximately 870 miles (1400 km) for the heat shield, and approximately 1,400 miles (2,250 km) for the second stage.[258] Although I have been unable to find any information on the height of the rocket during its ascent, using the chart of Benkö, the rocket would have been above 62 miles (100 km) well before reaching Japanese territory.

2000) (visited Mar. 23, 2005) <http://www.fas.org/nuke/guide/dprk/facility/nodong.htm> [hereinafter Federation of American Scientist, *No-dong*].

[251] *See* Kazuhiro Nakatani, *The Taepodong Missile Incident and Emerging Issues of Interpretation and Application of Space Treaties*, *in* INTERNATIONAL INSTITUTE OF SPACE LAW OF THE INTERNATIONAL ASTRONAUTICAL FEDERATION, PROCEEDINGS OF THE FORTY-FOURTH COLLOQUIUM ON THE LAW OF OUTER SPACE 144, 144 (2002).

[252] *Compare* Graham Warwick, *Phantom Satellite*, FLIGHT INT'L, Oct. 7, 1998, at 37 (claiming that the rocket had three-stages), *with* Anselmo et al., *supra* note 250 (claiming the rocket had two-stages).

[253] *See* Nakatani, *supra* note 251, at 144; Warwick, *supra* note 252; Federation of American Scientist, *No-dong*, *supra* note 250.

[254] *See North Korea Claims Taepo Dong I Orbited a Satellite*, AEROSPACE DAILY, Sep. 8, 1998, at 377.

[255] *See* Warwick, *supra* note 252. It landed at 40 degrees, 54 minutes North Latitude, 134 degrees, 3 minutes East Longitude. *See* Anselmo et al., *supra* note 250.

[256] *See* Warwick, *supra* note 252. It landed at 40 degrees, 11 minutes North Latitude, 147 degrees, 50 minutes East Longitude. *See* Anselmo et al., *supra* note 250. North Korea reported slightly different coordinates for the impact locations of the two stages. *See* Phillip Clark, *North Korea's First Satellite: Fact and Fiction*, 15 SPACE POL'Y 141, 141 (1999).

[257] *See Safety of Navigation*, ICAO Ass. Res. A32-6 (Oct. 2, 1998), *available at* <http://www.icao.int/icao/en/res/a32_6.htm>.

[258] *See* MARIETTA BENKÖ ET AL., SPACE LAW IN THE UNITED NATIONS 125 fig.1 (1985).

Although North Korea is not a party to the Outer Space Treaty, the Treaty recognizes that outer space is free for "all States."[259] Although North Korea may not be an ideologically good example of a State with access to space, geographically it is the perfect example because it is a coastal State, the launch took place from its coast, and yet it still had geographic problems accessing space. As recently as 1999, Elizabeth Kelly said

> [t]o date, as far as is known, space objects have not had to traverse the airspace of foreign states en route to outer space. Currently, objects are launched vertically, either from launch sites in states with large territories or from launch sites on or near the high seas, substantially decreasing the possibility that a foreign State's national airspace will be crossed.[260]

Of course, North Korea's launch over Japan highlights the security concerns of other States. The Republic of Korea (South Korea) called the launch an "invasion of Japanese Air Space."[261] This may have been a short-sighted statement on its part because South Korea is now in a similar position. In 2003, South Korea broke ground on its own space center.[262] The center is being built near the town of Kohung on Oenaro Island off South Korea's southern coast and was planned to be completed in 2005.[263] Japan is concerned about the trajectory of the launches from the South Korean launch site because the launches will go near (or over) some Japanese islands.[264] Based on its location, the South Korean launch site would have only limited launch azimuths available without launching over Japanese territory. If South Korea cannot launch toward the East, its launch vehicles will not be able to take advantage of the velocity of the Earth's rotation.[265] Therefore, to launch a satellite into orbit South Korea's launch

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[259] *See* Outer Space Treaty, *supra* note 6, art. I.
[260] Kelly, *supra* note 153, at 37.
[261] *Analysis – E. Asia Anxious About Japan Response To N Korea*, ASIA PULSE, Sept. 4, 1998.
[262] *See Ground Broken Today for Korea's First Space Center*, KOREA HERALD, Aug. 8, 2003.
[263] *See id.*
[264] Interview with Professor Ram Jakhu, Associate Professor, McGill University, in Montreal, Can. (May 10, 2005).
[265] *See* WRIGHT ET AL., *supra* note 4, at 80.

> The rotation of the Earth gives a rocket an eastward velocity even before it is launched. If the rocket is launched to the east, it can use this velocity to increase

vehicles will have to be more powerful (and therefore more costly) than vehicles launching the same satellite from other locations that can launch East. North Korea's launch site means it has even more limitations on its launch azimuths unless it continues to launch its rockets "over" its neighbors.

Putting aside sovereignty issues, a more practical problem may be safety downrange from the launch site. One former U.S. expendable heavy launch vehicle, the Titan IVB, had two solid propellant rocket motors and a two-stage liquid propellant rocket core.[266] The first stage of the liquid core weighed approximately 17,600 lbs (8,000 kg) empty, and the second stage weighed approximately 9,900 lbs (4,500 kg) empty.[267] Each solid rocket motor weighed approximately 95,000 lbs (43,100 kg) empty.[268] At least some parts of these expendable boosters fall back to the surface of the earth during the launch process.[269]

Besides the danger posed by the falling spent boosters causing damage by impact alone, the spent boosters may still contain toxic chemicals. For example, the SS-18 intercontinental ballistic missile, which the Russian Federation is marketing as a commercial space launch vehicle, has an expendable first stage

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> its speed. Since the speed of the Earth's surface is greatest at the equator (0.456 km/s), launching from a location at low latitudes (near the equator) increases the rocket's speed and therefore increases its launch capability. . . .
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> . . . .
>
> Similarly, if the rocket is not able to launch eastward, it cannot take full advantage of the speed of the Earth's rotation, and this reduces its launch capability. This can happen, for example, if the satellite is being launched into a polar orbit, in which case the rocket is launched toward the north or south. Or the launch directions may be restricted so that the rocket does not fly over populated areas early in flight.

Id. (footnote omitted).

[266] *See* U.S. AIR FORCE, TITAN IV FACT SHEET (1995), *available at* <http://www.losangeles.af.mil/SMC/PA/Fact_Sheets/ttn4_fs.htm>.

[267] *See Titan IVB Specifications* (visited May 11, 2005) <http://www.spaceandtech.com/spacedata/elvs/titan4b_specs.shtml>.

[268] *See* GlobalSecurity.org, *Titan IV Solid Rocket Motor (SRM)* (visited May 11, 2005) <http://www.globalsecurity.org/space/systems/t4-config-5.htm>.

[269] *See* Dene Moore, *Oil Rigs Fear Hit From U.S. Space Junk*, VANCOUVER SUN, Apr. 7, 2005, at A10 [hereinafter Moore, *Space Junk*].

that contains up to a ton of unburned toxic fuel when it hits the ground.[270] One version of the SS-18 is fueled by 376,000 lbs (171,000 kg) of nitrogen tetroxide (N_2O_4) and an unsymmetrical dimethylhydrazine compound.[271] The Titan IV liquid core stages are both fueled by Aerozine-50 (a mixture of hydrazine and unsymmetrical dimethylhydrazine (UDMH)) and nitrogen tetroxide (N_2O_4).[272] The first stage carried 342,000 lbs (155,000 kg) of propellant and the second stage carried 77,000 lbs (35,000 kg) of propellant.[273] Presumably some of the propellant would be present in the spent stages. These propellants are highly toxic; in August 2003 a leak of only 40 gallons (152 lit) of N_2O_4 during the fueling of a Titan IVB caused the evacuation of the entire launch complex.[274]

The Russian Federation recently obtained permission from Turkmenistan for spent rocket stages from SS-18 intercontinental ballistic missiles converted to civilian use and launched in Southern Russia (near Orenburg) to land in Turkmenistan.[275] However, for Russia's main launch site, Baikonur in Kazakhstan, the permissible launch azimuths are limited to prevent spent rocket stages from impacting in populated areas or within foreign States.[276] For example, launches due east are not possible from Baikonur because lower rocket stages would fall on Chinese territory.[277] "For those launch corridors which are used, tens of thousands of tons of spent boosters, many with toxic residual propellants still on board, now litter the countryside."[278]

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[270] *See* James Oberg, *Russians Harness Cold War Demons for Space*, MSNBC.COM, Dec. 17, 2004, *available at* <http://www.msnbc.msn.com/id/6729146/>.
[271] *See* Federation of American Scientist, *R-36M / SS-18 SATAN* (last modified Jul. 29, 2000) (visited May 11, 2005) <http://www.fas.org/nuke/guide/russia/icbm/r-36m.htm>.
[272] *See* GlobalSecurity.org, *Titan IV Liquid Rocket Engine (LRE)* (visited May 11, 2005) <http://www.globalsecurity.org/space/systems/t4-config-4.htm>.
[273] *See Titan IVB Specifications*, *supra* note 267.
[274] *See* U.S. Air Force Print News Today, *Rocket-Propellant Leak Cleaned* (last modified Aug. 14, 2003) <http://www.af.mil/news/story_print.asp?storyID=123005425>.
[275] *See* Oberg, *supra* note 270.
[276] *See* Federation of American Scientist, Baikonur Cosmodrome (visited May 11, 2005) <http://www.fas.org/spp/guide/russia/facility/baikonur.htm>.
[277] *See id.*
[278] *Id.*

Although ground safety may not be as much of a problem for some of the vehicles discussed previously that do not drop expended components (such as single-stage to orbit vehicles or reusable launch vehicles), it will continue to be a problem for more conventional vehicle. In January 1995, six people were killed and 23 injured on the ground in China after the failure of a Chinese Long March rocket.[279] In February 1996, another Long March rocket failed seconds after launch and at least six more died and 57 were injured.[280]

In the North Korea example, Japan could rightly express concern due to spent boosters falling near its territory. Again looking at the Benkö chart, the rocket component that came down near Japan would most likely have descended below 62 miles (100 km) while above the territory of Japan.[281] Obviously,

> [s]erious problems might arise from the possible impact of spent rocket parts on foreign territory, if a State whose territory does not include any suitable location satisfying the safety regulations normally imposed on launching sites should nevertheless wish to construct its own facility and to launch its own satellites. In this case, the co-operation of any State potentially affected by such an enterprise has to be ensured, since safety measures will have to be taken by this State, e.g. evacuation of certain areas, or arrangements to clear the flight path below the space object from international aviation.[282]

Professor Kazuhiro Nakatani argued that the launch by North Korea violated provisions of several international conventions. However, Professor Nakatani did not reach a conclusion on whether or not the rocket's flight violated Japan's territorial sovereignty because "there is no clear-cut delimitation between airspace and outer space."[283] Because North Korea provided no prior warning of the launch, Professor Nakatani wrote the launch violated Annex 11 of the Chicago Convention and International Maritime Organization (IMO) Assembly Resolution

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[279] *See* MARCIA S. SMITH, CONG. RESEARCH SERVICE, PUB. NO. IB93062, SPACE LAUNCH VEHICLES: GOVERNMENT ACTIVITIES, COMMERCIAL COMPETITION, AND SATELLITE EXPORTS 11 (2003), *available at* <http://fpc.state.gov/documents/organization/17353.pdf>.
[280] *See id.*
[281] *See* BENKÖ ET AL., *Supra* note 258, at 125 fig.1.
[282] *Id.* at 125.
[283] Nakatani, *supra* note 251, at 150.

706.[284] As Professor Nakatani pointed out,[285] Annex 11 of the Chicago Convention was violated because North Korea failed to provide prior warning of the launch to air traffic service authorities as required by Standard 2.17.1.[286] The ICAO Assembly also considered the launch without notice a violation of the Standards and Recommended Practices of the Chicago Convention.[287] North Korea deposited its notice of adherence to the Chicago Convention on August 16, 1977.[288]

The launch violated IMO Assembly Resolution 706 because member States are required to provide navigational warnings for various reasons, including "missile firings, [or] space missions" which might affect the safety of shipping, not less than five days before the event.[289] The IMO's Maritime Safety Committee reviewed the August 1998 launch by North Korea because the rocket parts fell into major maritime trade routes and fishing grounds and "had the potential of posing a serious threat to the safety of navigation."[290] The Committee invited member States to strictly comply with recommendations contained in IMO Assembly Resolution A.706(17).[291] North Korea joined the IMO in 1986.[292]

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[284] *See id.* at 144.
[285] *See id.* at 145.
[286] *See Air Traffic Services, Annex 11 to the Convention on International Civil Aviation* (13th ed. 2001). Standard 2.17.1 provides:

> The arrangements for activities potentially hazardous to civil aircraft, whether over the territory of a State or over the high seas, shall be coordinated with the appropriate air traffic services authorities. The coordination shall be effected early enough to permit timely promulgation of information regarding the activities in accordance with the provisions of Annex 15.

Id.
[287] *See Safety of Navigation, supra* note 257.
[288] *See Status of Chicago Convention, supra* note 59.
[289] *See World-Wide Navigational Warning Service*, Annex 1 para. 4.2.1.3.12, IMO Assembly Res. A.706(17), *reprinted in Adoption of the Revised NAVTEX Manual*, Annex 4, IMO MSC/Circ. 1122 (May 24, 2004), *available at* <http://www.imo.org/includes/blastData.asp/doc_id=3770/1122.pdf>.
[290] *Navigational Warning Concerning Operations Endangering the Safety of Navigation*, IMO Maritime Safety Committee circular MSC/Circ.893 (Dec. 21, 1998), *available at* <http://www.imo.org/includes/blastData.asp/doc_id=821/893.PDF>.
[291] *See id.*
[292] *See* International Maritime Organization, *IMO Member States with Year of Joining* (visited May 2, 2005) <http://www.imo.org/About/mainframe.asp?topic_id=315&doc_id=840>.

The U.S. is not immune from having its freedom of access to space questioned. First, "launches made from current [intercontinental ballistic missile] silos drop expended booster stages on the U.S. and Canada."[293] The Liability Convention imposes absolute liability on the launching State for damage caused on the surface of the earth or to aircraft in flight by the State's "space object" or the "launch vehicle and parts thereof."[294] However, it isn't clear if the Liability Convention would cover damage caused by spent ICBM boosters because the Convention does not specify when an object becomes a "space object" and ballistic missiles do not go into orbit. Professor Cheng concludes, however, that any object, including an ICBM, launched to an altitude above 81 miles (130 km) is a space object[295] and so the Liability Convention applies.[296] The same conclusion was earlier reached by the U.S. Department of State. While the U.S. Senate was conducting hearings on the Liability Convention, the Assistant Secretary of State for Congressional Relations wrote a letter to Senator J.W. Fulbright, the Chairman of the U.S. Senate Committee on Foreign Relations, and said, "[i]t would therefore appear that any unintentional damage caused by an ICBM would be covered by the Liability Convention just as it is already covered by article VII of the Outer Space Treaty. We believe the general tendency in case of doubt would be to say that an object is a 'space object' within the meaning of the Convention."[297]

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[293] *See* SPACY, *supra* note 161, at 77.
[294] Liability Convention, *supra* note 11, arts. I, II.
[295] *See* Bin Cheng, *Definitional Issues in Space Law: 'Space Objects', 'Astronauts', and Related Expressions*, 34 SPACE L. COLLOQUIUM 17 (1991), *reprinted in* CHENG, SPACE LAW, *supra* note 168, at 492, 498.
[296] *See* Bin Cheng, *International Responsibility and Liability for Launch Activities*, 20 AIR & SPACE L. 297 (1995), *reprinted in* CHENG, SPACE LAW, *supra* note 168, at 599, 602.
[297] Letter from David M. Abshire, Assistant Secretary of State for Congressional Relations, to Senator J.W. Fulbright, Chairman, U.S. Senate Committee on Foreign Relations (Sept. 6, 1972), *in* SENATE COMM. ON FOREIGN RELATIONS, CONVENTION ON INTERNATIONAL LIABILITY FOR DAMAGE CAUSED BY SPACE OBJECTS, S. EXEC. REP. NO. 92-38, app. at 8, para. 3 (1972). Assistant Secretary Abshire continued,

> Furthermore, damage caused by the intentional launching of a missile against a foreign target would be a hostile act and under most circumstances an act of war. As a general rule of international law, subject to exceptions that need not

I've been unable to find any agreement between U.S. and Canada discussing this issue or granting the U.S. authority to have spent rocket boosters fall into Canadian territory. However, the U.S. signed an agreement with the U.K. in 1950 establishing a missile test range covering portions of the Bahama Islands.[298] This agreement covers the area generally downrange from the launch area of the Kennedy Space Center in Florida[299] and it was amended several times.[300]

The access to space issue is broader than merely cases where launch trajectories pass over foreign territory or booster debris falls in foreign territory. As oceans become more and more economically important and exploited, the issue will continue to grow.

In April 2005, Canada expressed concern that spent boosters from a Titan IV planned to be launched from Cape Canaveral in Florida would fall near a deep sea oil platform near Newfoundland.[301] The booster would weigh 22,000 lbs (10,000 kg) after the fuel was expended and was projected to fall within 15.5 miles (25 km) of the Hibernia oil platform.[302] The Hibernia platform is about 196 miles (315 km) southeast of Saint John's, Newfoundland,[303] well outside of Canada's

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concern us here, a multilateral treaty such as the Liability Convention does not apply to conditions of war or hostilities.

Id. para. 4.

[298] *See* Agreement Between the Government of the U.S. of America and the Government of the United Kingdom of Great Britain and Northern Ireland Concerning a Long Range Proving Ground for Guided Missiles to be Known as "The Bahamas Long Range Proving Ground", July 21, 1950, U.S.–U.K., 1 U.S.T. 545, 97 UNTS 1351.

[299] As noted above, the agreement created the Bahamas Long Range Proving Ground and was in the vicinity of Cape Canaveral, Florida. *See id.* pmbl.

[300] *See, e.g.*, Tracking Station on Grand Bahama, Apr. 26–May 3, 1968, U.S.–U.K., 19 U.S.T. 4832; Bahamas Long Range Proving Ground: Extension of Flight Testing Range, Apr. 1, 1957, U.S.–U.K., 8 U.S.T. 493.

[301] *See* Moore, *Space Junk*, *supra* note 269.

[302] *See id.*

[303] *See No Rocket Risk Acceptable, Williams Says*, HALIFAX DAILY NEWS (Nova Scotia), April 11, 2005, at 7; *Hibernia Off-Shore Oil Platform* (visited May 1, 2005) <http://www.foothills-sar.ab.ca/photos/Hibernia.html>. Depending on the exact location of the platform, it might even fall outside of Canada's exclusive economic zone (EEZ) which is 200 nm wide. *See* Law of the Sea Convention, *supra* note 90, art. 57. One article puts the platform at "350 kilometers east of St.

territorial waters. The booster's projected impact site is approximately 2,300 miles (3,700 km) downrange from the Titan IV's launch site. A U.S. Air Force spokesperson said for all launches the U.S. Air Force Space Command devises an impact "box" and there is only a one in one trillion chance of impact outside of the planned box.[304] The Hibernia platform was 1 mile (1.6 km) outside the box projected for the spent booster.[305] However, the Newfoundland government and the offshore oil industry initially planned to evacuate the drilling platform.[306] Evacuating the platform would have included removing all oil from the platform, capping all wells, and flushing lines—this could have taken the platform out of production for up to two weeks and would have meant a loss of $250 million.[307] Although evacuating the platform might be prudent to avoid potential (but apparently unlikely) loss of life, the cost of evacuation and loss of profit would not be compensable under the Liability Convention.[308] Ironically, if the booster hit the platform and killed someone, the loss of life and property damage would be compensable. Newfoundland's Premier, Danny Williams, said the U.S. should offer compensation if "a shutdown is necessary."[309] Canada's Defence Minister, Bill Graham, said "We strongly urge the U.S. government not to follow this trajectory but to choose a trajectory which will take their rocket further away from these very important installations."[310] However, a U.S. Air Force spokesperson said that changing the trajectory would mean more risk for mainland Canada and

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John's," or approximately 189 nm (217 miles). *See* CBC News, *Missile Test Delayed After Sparking Scare at Oil Platforms* (last modified Apr. 8, 2005) <http://www.cbc.ca/story/canada/national/2005/04/07/nfld-oil-050407.html>.

[304] *See* Moore, *Space Junk*, *supra* note 269.

[305] *See id.*

[306] *See id.*

[307] *See id.*

[308] *See* Liability Convention, *supra* note 11, arts. I, II.

> The term "damage" means loss of life, personal injury or other impairment of health; or loss of or damage to property of States or of persons, natural or juridical, or property of international intergovernmental organizations.

Id. art. I(a).

[309] Moore, *Space Junk*, *supra* note 269.

[310] Dene Moore, *U.S. Delays Atlantic Rocket Launch*, LONDON FREE PRESS (Ontario), Apr. 8, 2005, at A3.

the U.S.[311] The U.S. Air Force decided not to change the trajectory and Premier Williams said he had been assured that the rocket would be destroyed if it veered off course and threatened the oil platforms.[312] The satellite was launched on April 29, 2005 and the spent booster caused no damage.[313]

One space analyst thought the plan to evacuate the oil platform was unusual because similar rockets had been launched along the same trajectory for years without incident.[314] However, the issue will probably arise again as the area becomes more congested. At the time of the April 2005 Titan launch, other oil platforms were in the general area besides the Hibernia platform.[315] The floating Terra Nova platform was approximately 217 miles (350 km) east of St. John's.[316]

Domestically, access to space within the U.S. is also becoming an issue. Several new spaceports are under development, several of which are situated away from coastal areas.[317] However, the inland spaceports under development appear to be aiming toward reusable launch vehicles and the suborbital tourist market, so damage caused by expended boosters should not be a problem. Coordination with air traffic is the major concern.

Of course, agreeing on a vertical limit of State sovereignty will not alleviate the safety issues discussed above. States will still have to adopt and comply with international safety standards when conducting space launches. But a treaty delimitating vertical sovereignty could also contain provisions on launch safety and launch notification.

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[311] *See* Dene Moore, *Rocket Risk to Nfld. Offshore Not New, Not Likely a Problem: Space Analyst*, CANADIAN PRESS, Apr. 12, 2005 [hereinafter Moore, *Rocket Risk*].
[312] *See* Dene Moore, *Nfld. Has Assurances About U.S. Missile Launch; Rigs Won't Be Evacuated*, CANADIAN PRESS, Apr. 14, 2005.
[313] *See Rocket Launch No Problem*, LONDON FREE PRESS (ONTARIO), May 1, 2005, at 7.
[314] *See* Moore, *Rocket Risk*, *supra* note 311.
[315] *See* Moore, *Space Junk*, *supra* note 269.
[316] *See* Dene Moore, *Proposed Rocket Launch Spurs More Concern For Nfld. Offshore Platforms*, CANADIAN PRESS, Apr. 8, 2005.
[317] *See* OFFICE OF COMMERCIAL SPACE TRANSPORTATION, *supra* note 166, at 32–49.

CHAPTER III: POSSIBLE DEMARCATION

Past Proposals

There are many different proposals for a demarcation between air and space and many different thoughts on whether or not there is a need for demarcation. Much of the problem stems from the fact that there is no clear physical boundary between air and space. The Earth's atmosphere thins as altitude increases. Although after only a few miles it would be difficult for humans to survive without artificial support, traces of gases can still be measured even at altitudes as high as 10,000 miles (16,000 km).[318]

The U.N. Committee on the Peaceful Uses of Outer Space (COPUOS) has been formally considering the definition and delimitation of outer space since 1967.[319] Several States, including the U.S., do not think there is a pressing need for demarcation. These States think that because the lack of a definite boundary has not caused a problem to this point, demarcation should wait until there is a pressing need.[320] Other reasons against delimitation include:

- the possibility that any attempt at a treaty delimitating air and space will encourage some States to make excessive sovereignty claims;
- fears that the boundary may be established so high that some space activities could be hampered;
- an understanding that fixing the boundary at a lower altitude will not lessen the fear of some States that their security interests are threatened;
- a fear that setting a boundary now may make it impossible to change the boundary in the future, especially if the boundary has to be lowered;

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[318] *See* GRIEF, *supra* note 22, at 40.
[319] *See Historical Summary on the Consideration of the Question on the Definition and Delimitation of Outer Space*, U.N. Committee on the Peaceful Uses of Outer Space, 41st Sess., Provisional Agenda Item 6(a) ¶ 1, U.N. DOC A/AC.105/769 (2002).
[320] *Id.* ¶¶ 9, 12, and 23.

- a hope that it will be possible to establish a lower boundary in the future than is conceivable now.[321]

One of the oldest proposals for delineating air and space is to limit a State's vertical sovereignty at the physical point where space begins. However, this is not a practical proposal because, as mentioned above, there is no sudden natural dividing line between air and space.[322] Another idea would be to extend State sovereignty to the uppermost altitude at which an aircraft is capable of flying.[323] This altitude has been estimated by Dr. Theodore von Kármán to be 275,000 feet (52 miles or 83 km).[324] However, I do not think this is a practical solution because advances in technology could change the maximum altitude over time unless the definition of aircraft was very specific. I also do not think this is a practical solution because it extends State sovereignty too high.[325]

One traditional view was that in order to exercise sovereignty over an area a State must effectively control it. So a State's vertical sovereignty would extend as high (or as low) as that State could exercise its control. However, the idea of applying this rule to vertical sovereignty claims was criticized by Professor Cooper, who instead sought a uniform limit on sovereignty:

> Certain jurists have insisted that the territory of a State is limited by the ability of that State to make its law effective. This is a harsh rule when applied to sovereignty in space. The richest and most powerful States now have means through high altitude rockets to control more or less effectively the "airspace" over their surface territories. But the weaker States have no such power. Can we be said to live in such a world where the physical power at any one time of any particular State determines its *international right* to consider the region above its surface territories as part of its

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[321] *See* ROBERT F.A. GOEDHART, THE NEVER ENDING DISPUTE: DELIMITATION OF AIR SPACE AND OUTER SPACE, *in* 4 FORUM FOR AIR AND SPACE LAW 6–7 (Marietta Benkö & Willem de Graaff, eds., 1996).
[322] *See id.* at 31–34.
[323] *See id.* at 55–64.
[324] *Id.* at 61.
[325] Professor Cooper would have agreed that this proposal set the limit of State sovereignty too high; in 1965 he said that a limit of 50 miles was too high. *See supra* note 248.

> national territory? . . . [T]he rule should be that every State, no matter how small or how weak, as a State of equal sovereignty with every other State, has and should be admitted to have territorial rights upwards above its surface territories as high as the rights of every other State no matter how powerful.[326]

I agree with Professor Cooper's rejection of this theory of demarcation.

Another proposal is a multi-level sovereignty regime first suggested by Professor Cooper. He suggested a low limit of territorial airspace, a free outer space zone above, and a "contiguous zone" in between.

> The lower boundary of this contiguous zone might be the point where normal airplane flight is practical and the upper boundary just below the point where unpowered orbital flight can be made effective. In such contiguous zone a subjacent State could exercise the same preventive and protective jurisdiction as against foreign flight instrumentalities as it has in the airspace zone except that rights of passage would be permitted for nonmilitary flight instrumentalities when ascending toward or descending from outer space above.[327]

I disagree with this proposal because it basically only creates a limited right of passage. I think more freedom should be allowed and therefore do not support this idea.

Shortly after the launch of Sputnik in 1957, Dr. G. Zadorozhni, a Soviet lawyer, proposed "freedom of the air, like freedom of the high seas, should be declared for the region beyond 20 or 30 kilometres (12 to 18 miles) above the earth."[328] I agree with the low limit in Dr. Zadorozhni's proposal and think it

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[326] Cooper, *High Altitude Flight*, *supra* note 24, at 263–64.

[327] Cooper, *Contiguous Zones*, *supra* note 140, at 325. Professor Cooper's proposal is reviewed and criticized by Robert F.A. Goedhart who concludes:

> Cooper's three-zone theory is anything but a meaningful tool to find a boundary between air space and outer space: at first Cooper's numerical proposals were confusing and arbitrary, and finally they have proved to be untenable for scientific and technological reasons.

GOEDHART, *supra* note 321, at 71.

[328] *200th Circuit By Satellite To-Day*, TIMES (London), Oct. 18, 1957, at 7.

should have been pursued. In 1960 another Soviet lawyer, Gennady P. Zhukov, wrote that if an agreement banning military activities in space could be negotiated, a separate agreement limiting the vertical sovereignty of States to "a relatively low limit" could be achieved.[329] Although the proposal was not too specific, I agree that a low limit on State sovereignty is the best solution.

Unfortunately, the U.S.S.R. did not press forward with the two proposals of Dr. Zadorozhni and G.P. Zhukov. In June 1978, the U.S.S.R. permanent representative to the United Nations proposed an agreement that outer space begins at 100 to 110 km (62.1 to 68.4 miles) above sea level.[330] This altitude corresponds roughly to the lowest perigee of satellites up to the time of the proposal. The theory behind the proposal is that because no State can make claims of sovereignty in space and most satellites have had a minimum perigee of approximately 100 km or higher, then 100 km is the highest altitude that States can claim as their sovereign territory. Although the 100/110 km (62/68 miles) altitude was not meant to be the final demarcation line, I think by proposing that altitude the U.S.S.R. precluded any discussion of a lower demarcation line. The U.S.S.R. presented a working paper outlining its proposal in June 1979.[331] The first three proposals of the working paper were:

> 1. The region above 100/110 km altitude from the sea level of the earth is outer space.
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> 2. The boundary between air space and outer space shall be subject to agreement among States and shall subsequently be established by a treaty at an altitude not exceeding 100/110 km above sea level.

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[329] *See* Harry Schwartz, *U.S. Plan to Put a Man in Space Is Ridiculed by Soviet Scientist*, N.Y. TIMES, Jan. 11, 1960, at 25. Mr. Zhukov was the Executive Secretary of the Space Law Committee of the U.S.S.R. Academy of Sciences at the time he made the statement. *See* Robert D. Crane, *Soviet Attitude Toward International Space Law*, 56 AM. J. INT'L L. 685, 687 n.6 (1962).
[330] *See Verbatim Record of the One Hundred and Eighty-Third Meeting*, U.N. Committee on the Peaceful Uses of Outer Space, at 48–50, U.N. Doc. A/AC.105/PV.183 (1978).
[331] *See Draft Basic Provisions of the General Assembly Resolution on the Delineation of Air Space and Outer Space and on the Legal Status of the Geostationary Satellites' Orbital Space*, U.N. Committee on the Peaceful Uses of Outer Space, 22d Sess., Agenda Item 4(c), U.N. Doc. A/AC.105/L.112 (1979).

> 3. Space objects of States shall retain the right to fly over the territory of other States at altitudes lower than 100 (110) km above sea level for the purpose of reaching orbit or returning to earth in the territory of the launching State.[332]

The proposal showed that the U.S.S.R. thought that a right of innocent passage had already been established because the proposal said space objects of States "shall *retain* the right to fly over the territory of other States."[333] As recently as 1996 the Russian Federation still supported this proposal.[334] Martin Menter agreed that a right of innocent passage existed.[335] However, others argue there is no customary right of innocent passage for access to space.[336] The ICAO observer to the legal subcommittee of the COPUOS presented a paper in 1986 stating that the right of innocent passage was a proposal that did not reflect existing law.[337] Professor Chistol noted in 1965, "[t]he major argument against the development of a rule of international law permitting innocent passage of

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[332] *Id.*

[333] *Id.* ¶ 3 (emphasis added).

[334] *See Questionnaire on Possible Legal Issues with Regard to Aerospace Objects: Replies from Member States*, U.N. Committee on the Peaceful Uses of Outer Space, A/AC.105/635/Add.1, at 6 (1996), *available at* <http://www.oosa.unvienna.org/Reports/AC105_635Add1E.pdf>.

[335] *See* Martin Menter, *Status of International Space Flight*, *in* INTERNATIONAL INSTITUTE OF SPACE LAW OF THE INTERNATIONAL ASTRONAUTICAL FEDERATION, PROCEEDINGS OF THE TWENTY-SECOND COLLOQUIUM ON THE LAW OF OUTER SPACE 67, 72 (1980).

> The third paragraph of the USSR proposal at the COPUOS 1979 meeting recites a right to overfly other States' territory below 100/110 km in going into orbit and in returning to the launching State. This would codify what I believe is currently customary international law—a State having a right of onward passage in transiting a nearby State's airspace in traveling to and returning from outer space.

Id. Professor Carl Q. Christol also thought that a right of innocent passage existed, arguing that the U.N. General Assembly resolutions and the lack of formal protests by States against

> the orbiting of space vehicles for peaceful purposes at whatever altitude, very strongly suggest that just as there has developed a principle of customary international law that such orbiting is lawful, this principle must carry with it the practical corollary that innocent passage through the air space following launch and during return must be a permitted use of sovereign airspace.

Christol, *supra* note 246, at 338.

[336] *See* Kelly, *supra* note 153, at 41.

[337] *See* Ram Jakhu, *International Law Governing the Acquisition and Dissemination of Satellite Imagery*, 29 J. SPACE L. 65, 77 n.38 (2003) (*quoting* from ICAO Doc. C-WP/8158).

spacecraft is that the practical dangers to the subjacent state are too profound to permit such close approach by transiting vehicles."[338]

One reason Russia may be trying to obtain international recognition of the right of innocent passage of space vehicles is that the geographic location of its principal launch site, Baikonur cosmodrome in Kazakstan, limits its potential launch azimuths.[339] The Russian Federation, however, has taken a few actions somewhat contradicting its claim of a right of innocent passage. First, the Russian Federal allows other States innocent passage through Russian airspace to enter outer space and to return to Earth *if given prior notice*.[340] If a right of innocent passage already existed in international law, there would be no necessity of including it in Russian domestic law. Also, the Russian limitation that the right only exists if Russia is given prior notice would appear to contradict the norm Russia advocates, although from a safety perspective this makes sense. Second, as mentioned above, the Russian Federation recently obtained permission from Turkmenistan for spent rocket stages to land in Turkmenistan.[341] Again, if a right of innocent passage already exists, there may be no need for such an agreement. However, from a safety perspective this also makes sense.

To enable vehicles such as Hypersoar to operate freely, both the 1979 U.S.S.R. proposal and Professor Cooper's proposal would need to be modified to allow unlimited nonmilitary (or non-State) activity rather than only for vehicles

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[338] Christol, *supra* note 246, at 338.
[339] *See supra* notes 276–278 and accompanying text.
[340] *See* Act on Space Activity, Decree No. 5663-1 of the Russian House of Soviets, art. 19(4) (R.F.), *translated at* <http://www.oosa.unvienna.org/SpaceLaw/national/russian_federation/decree_5663-1_E.html>. The provision states:

> The space object of a foreign state can execute a single innocent flight through the air space of the Russian Federation with the purpose to insert such an object into an orbit around the Earth or further in outer space, as well as with the purpose to return it to the Earth under the condition of advance noting of appropriate services of the Russian Federation about time, place, trajectory and other conditions of such flight.

Id.
[341] *See supra* text accompanying note 275.

ascending or descending from orbit. This is required because a Hypersoar type vehicle would never go into an orbit. Also, for the descent phase, the 1979 U.S.S.R. proposal only allows innocent passage for space objects returning to the territory of the launching State.[342] So vehicles involved in inter-State transport would not be entitled to innocent passage. Therefore I do not support either Professor Cooper's multi-level sovereignty proposal or the 1979 U.S.S.R. proposal.

In 2002 a member of the U.S. House of Representatives, Congressman Dennis Kucinich of Ohio, introduced H.R. 3616 which would have prohibited the U.S. from using or developing space weapons.[343] The bill also defined space as the area starting at an altitude of 37 miles (60 km).[344] The bill did not pass.

Dr. Gbenga Oduntan recently provided a detailed review of many different demarcation theories.[345] Dr. Oduntan proposes a multi-level sovereignty theory similar to Professor Cooper's, with a limit of State sovereignty at an altitude of approximately 55 miles (88.5 km).[346] For the reasons discussed above, I do not support this proposal. One of Dr. Oduntan's conclusions is "the demarcation line must not be too low; as this would put a Space vehicle launcher at the mercy of surrounding states through whose airspace its vehicle must pass, on its way to or from outer space. Thus, all the low demarcation line theories must be rejected."[347] Similarly, Dr. Oduntan reaches the conclusion that to ensure a State's security, the demarcation line "must not be too high."[348] I also do not

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[342] *See supra* text accompanying note 332, para. 3.
[343] *See* H.R. 3616, 107th Cong. (2002), *available at* <http://frwebgate.access.gpo.gov/cgi-bin/useftp.cgi?IPaddress=162.140.64.89&filename=h3616ih.pdf&directory=/disk2/wais/data/107_cong_bills>.
[344] *See id.* § 7.
[345] *See* Dr. Gbenga Oduntan, *The Never Ending Dispute: Legal Theories on the Spatial Demarcation Boundary Plane between Airspace and Outer Space*, 1 HERTFORDSHIRE L. J. 64 (2003), *available at* <http://perseus.herts.ac.uk/uhinfo/library/i89918_3.pdf>.
[346] *See id.* at 82.
[347] *See id.*
[348] *See id.*

agree with these conclusions and think a low demarcation line would provide greater freedom to launching States.

Functionalism and Spatialism

Some States and scholars subscribe to the functionalist view. "The essence of the functionalists' argument is that the *locus* of an act need be of no moment to its legality or illegality, which can be determined solely by reference to its nature."[349] This view takes the position that objects in space should be governed by space law, and objects not in space should be governed by air law.[350] The existing space law treaties were written in a functionalist way to avoid the boundary problem. For instance, the Outer Space Treaty does not define space.[351] As discussed above, the Liability Convention does not define the term space object.[352] Finally, the Convention on Registration of Objects Launched into Outer Space [the Registration Convention][353] does not explicitly define the term "space objects," but specifies that certain information about objects launched "into earth orbit or beyond" must be provided to the Secretary General of the United Nations.[354]

Mr. Menter frequently expressed a functionalist view and argued against the need to delineate a boundary between air and space. Writing shortly after the signing of the Outer Space Treaty, he said:

> Space law writers, it is to be hoped, may agree that the proposed treaty—in declaring outer space free for use by all states, and in declaring that the exploration and use of outer space is to be guided by the principle of cooperation and mutual assistance with

[349] Cheng, *The Boundary Problem*, *supra* note 168, at 445.
[350] *See* GRIEF, *supra* note 22, at 40.
[351] *See* Outer Space Treaty, *supra* note 6.
[352] *See supra* text accompanying notes 294–295.
[353] Convention on Registration of Objects Launched into Outer Space, Jan. 14, 1975, 28 U.S.T. 695, 1023 U.N.T.S. 15.
[354] *See id.* arts. I–IV.

> due regard for the corresponding interest of other states—should abate past pressures for determining just where sovereignty ends and free outer space begins. Those pressures should be further abated by the functional approach. For example, the treaty's prohibition against the orbiting of weapons of mass destruction applies to any vehicle in orbit, regardless of the distance of the orbit from the surface of the earth. Protection of the state was what led historically to firm claims of sovereignty over the territorial sea and to a nation's superadjacent air space. Protection of the subjacent state will argue against agreement to any fixed distance so long as equal danger may exist from above such a point.[355]

The opposing perspective is the spatialist view. Those subscribing to this view think that a definitive demarcation line should be drawn between air and space.[356] This would impose a vertical limit on State sovereignty. Professor Cheng discussed the interplay of the functional and spatial views:

> It will be readily perceived . . . that the functional classification of activities of States into those that are lawful and those that are unlawful *follows*—and *not precedes*—spatial delimitation. Contrary to the view of some functionalists, spatialism does not mean doing away with a functional classification of what is a lawful activity and what is not, but to apply a functional test without regard to where an activity takes place is not only to put the cart before the horse, but to dispense with the horse. Under general international law, there are in fact few activities of States that are either universally lawful or universally unlawful. Most of the time, it depends on where an activity is carried out. Thus the answer to the question, for instance, whether a State may arrest a foreign vessel or not for monitoring its electronic defence [sic] installations will depend not on the nature of such actions but primarily on the *locus*, i.e., on whether the act of intelligence-gathering and the arrest are carried out in a State's own territory, in the territory of another State, on the high seas, in no man's land, or in an area which is the common heritage of mankind; and secondarily on the relationship between the State and the vessel, i.e., on whether the ship has the nationality of the State, has no nationality or has a foreign nationality.[357]

Later in the same article he wrote:

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[355] Martin Menter, *The Developing Law for Outer Space*, 53 A.B.A. J. 703, 705 (1967).
[356] *See Historical Summary on the Consideration of the Question on the Definition and Delimitation of Outer Space*, *supra* note 319, ¶ 11.
[357] Cheng, *The Boundary Problem*, *supra* note 168, at 437.

> To say that spatialism should give way to functionalism in international law or in international space law would be like saying, in a nominally federal State, that everything should be treated as a federal matter to be governed directly by federal law. This would eliminate at a stroke all the rights and laws of the constituent states or provinces which after all are only a form of spatialism. In the same way, functionalism in the matter of defining outer space, by asserting that, insofar as 'lawful' space activities (their 'lawfulness' being no doubt defined in the end by the mere sayso of the major space powers) are concerned, they may be conducted anywhere in the world without spatial restriction, is in effect implying that such activities may be carried on even in the national airspace of other States. Under functionalism, States would, therefore, lose the right which they have by reason of their sovereignty, to control or in any way interfere with self-styled 'lawful' foreign space activities in their national airspace.[358]

I agree with Professor Cheng.

One concern with any spatial approach would be how to establish a uniform vertical limit: what happens over mountain ranges or deep valleys? This same problem was examined in 1910 by Dr. J. F. Lycklama à Nijeholt:

> Were the surface of the earth smooth and even, the airfrontier would be at the same height up in the air all over the globe, smooth and even also. The earth's surface, however, being far from smooth, we are faced with the alternative, must the limit of sovereignty be measured from some certain, recognized, universal mark, or must it follow all the ups and downs of the soil?
>
> A strong argument against the first solution would be that one would be obliged to place the limit at a very great height to make sure that the highest parts of the soil do not tower above the sphere of sovereignty. This solution is, moreover, unjust towards high lands, these getting the limit of their authority much nearer their territory than low lands do.
>
> The second solution, making the airfrontier follow every unevenness of the soil, seems to be much more reasonable. But there are sound objections also against this one. For assuming

[358] *Id.* at 443–44.

> such a limit of the authority in the air, means taking a measure which will be a great nuisance for everyone who has to reckon with it, a measure, moreover, that is very unjust towards low lands, as the atmosphere certainly does not follow all the ups and downs. The air being much thinner on the top of a high mountain than at is [sic] base, the addition of a sphere of sovereignty of the same extent above high lands and above low lands, will put these two categories of countries in a different position towards aerial navigation. For the high land an airdomain of considerably little height will be sufficient to bring almost all aerial traffic below its air boundary. For the low land on the contrary an airdomain of the same height will be of little value, aerial navigation being able to remain without much difficulty beyond the airboarders of such a state. At any rate, aeronauts find above the airfrontier of the low land a zone that is far more favourable for breathing and for aerial navigation than the zone they find above the airdomain of high lands. Accordingly it will be much easier to keep or get out of the way of the authority of the low land than of the high land.
>
> Both solutions are unequal and unsatisfactory. The objections against the horizontal limit, it seems to us, are unable to be removed.[359]

This problem is similar to that encountered during the debates about how to determine historic bays and "baselines" for the territorial seas. Unfortunately those rules became very complicated[360] and many international incidents have occurred because of differing interpretations of the Law of the Sea Convention.[361]

Filling a Gap in the Law

Although as mentioned above many people think that from a legal perspective space "begins" at 100 km, not everyone agrees. Referring to HyperSoar, the authors of one article wrote "[T]he space plane's high altitudes would make

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[359] NIJEHOLT, *supra* note 29, at 31–32. Dr. Nijeholt went on to argue against a vertical limit on State sovereignty. *See id.* at 32–33.
[360] *See supra* notes 91–101 and accompanying text.
[361] *See infra* notes 368–381 and accompanying text.

foreign airspace restrictions irrelevant"[362] although HyperSoar would never ascend above 100 km.

In the 1970s as the U.S. space shuttle neared operation, many legal experts thought that its deployment would necessitate delineation of air and space. Mr. Menter, however, wrote that the space shuttle should not change the conclusion he made about delineation in 1967 because the space shuttle cannot maneuver in the atmosphere like a traditional aircraft and therefore is not a threat.[363] "I believe a subjacent State's tolerance of the flight of a future aerospacecraft above it will continue to depend on whether such craft constitutes a present danger rather than whether it is plus or minus a few miles of a fluctuating demarcation line whose height above it is dependent upon its terrain elevation."[364] However, in 1964, Mr. Johnson rejected a similar argument.

> Resorting again to the analogy of the sea, it is obvious that the ability of the same vessel to sail close to shore and in the middle of the ocean, utilizing with equal facility the territorial waters and the high seas, has never suggested that there should be no definable limit to the exclusive power of the littoral State, even though agreement on such a limit is difficult to achieve. . . .
>
> Similarly, the prospect that a single craft may eventually operate at all altitudes in the air-space continuum does not mean that there is no need to limit with precision the exclusive power of the underlying State. In fact, it probably emphasizes the need for an eventual solution.[365]

Elizabeth Kelly discussed the impact of "spaceplanes;" and although she did not propose a specific boundary, she argued against extending State sovereignty up to 100 km.

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[362] Lowe & Levine, *supra* note 175.
[363] *See* Martin Menter, *Legal Regime of International Space Flight*, *in* INTERNATIONAL INSTITUTE OF SPACE LAW OF THE INTERNATIONAL ASTRONAUTICAL FEDERATION, PROCEEDINGS OF THE TWENTY-FIRST COLLOQUIUM ON THE LAW OF OUTER SPACE 126, 134 (Mortimer D. Schwartz ed., 1979) [hereinafter Menter, *Legal Regime*].
[364] *Id.*
[365] Johnson, *Freedom and Control*, *supra* note 7, at 141–42.

> Spaceplanes able to fly freely through airspace and outer space are a very real reason for maintaining flexibility as regards demarcation between airspace and outer space. They bespeak the imprudence in advocating that states establish a boundary at 100 km, customarily or conventionally. Such a boundary might leave enough of a cushion of airspace for conventional aircraft, but it might not be low enough for spaceplanes to operate efficiently and escape claims of violation of airspace sovereignty.[366]

While pointing out the necessity of defining the limit of vertical sovereignty Professor Cheng pointed out that States claiming territorial seas of various widths never caused a problem because each State knew how much the other States claimed.

> The statement has sometimes also been made that no great harm has arisen out of the lack of a general agreement on the precise outer limit of the territorial sea and the same should be true of territorial space, but this ignores the fact that, although there is no general agreement, the precise limit of the territorial sea claimed by the coastal State is always known.[367]

Professor Cooper made a similar argument.

> It has been said that there is no general agreement as to the outer boundary of territorial waters and this fact has been used as an argument to support delay in reaching agreement as to the boundary between the airspace and outer space. The argument is unsound so far as it applies to our national action. It overlooks the fact that every State which has maritime boundaries has formally asserted a fixed outer boundary for its territorial waters so that no other State can question its position.[368]

Unfortunately, although it may be possible to determine the claim made by States, both of these statements miss the point. Although States frequently published their maritime claims, these claims are not always understood, uniformly interpreted, or recognized by other States and many problems have arisen. Professor Cheng discussed an incident in which a U.S. radio frequency

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[366] Kelly, *supra* note 153, at 111.
[367] Cheng, *The Boundary Problem*, *supra* note 168, at 446.
[368] John Cobb Cooper, *The Boundary Between Territorial Airspace and International Outer Space*, *reprinted in* COOPER, EXPLORATIONS IN AEROSPACE LAW, *supra* note 18, at 298, 300.

intelligence ship, the U.S.S. Pueblo, was seized in 1968 and its crew held for almost 11 months by North Korea.[369] The U.S. said the ship was in international waters about 25 miles (40 km) off the coast of North Korea when it was boarded although North Korea claimed it had intruded into its territorial waters.[370]

Incidents of this nature are not uncommon. One infamous example of the dangers involved occurred in the Corfu Channel. On October 22, 1946, two U.K. destroyers were severely damaged and many sailors died after the ships struck sea mines while steaming through the Corfu Channel.[371] The channel is between Albania and Corfu Island and is within Albania's territorial waters. The mines that damaged the U.K. destroyers were placed in the channel by Albania. Albania acknowledged the existence of the strait, but denied that it was an international waterway and asserted that foreign warships required prior authorization to use the strait. The International Court of Justice found Albania responsible for placing the mines in violation of international law.[372] As recently as the year 2000 Albania still required prior authorization for foreign warships to enter its territorial sea.[373] In the early and mid 1980s, the U.S. and Libya clashed several times over Libya's claims to the Gulf of Sidra.[374] In 2001, Libya still claimed the Gulf of Sidra as internal waters.[375] More recently, in 1992 a U.S. Navy submarine collided with a Russian Navy submarine apparently because the two States did not recognize the Russian territorial claims uniformly.[376] The U.S. claimed the

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[369] *See* Cheng, *The Boundary Problem*, *supra* note 168, at 446.
[370] *See* Neil Sheehan, *North Korea Seizes Navy Ship, Holds 83 on Board as U.S. Spies*, N.Y. TIMES, Jan 24, 1968, at 1. The U.S. said the ship was located at 39 degrees, 25 minutes North Latitude and 127 degrees, 54.3 minutes East Longitude. *See id.* U.S. Rear Admiral John V. Smith said the ship was 16 nm (18.4 miles or 29.6 km) from the coast when the confrontation began. *Id.* However, the U.S.S.R. delegate to the U.N. Security Council said the ship intruded into North Korea waters at 39 degrees, 17 minutes, and 4 seconds North Latitude and 127 degrees, 46 minutes, and 9 seconds East Longitude. *See Excerpts From U.S. and Soviet Statements in U.N. Council*, N.Y. TIMES, Jan 27, 1968, at 6.
[371] *See Mines in Corfu Channel*, TIMES (London), Nov. 13, 1946, at 6.
[372] *See* Corfu Channel (U.K. v. Alb.), 1949 I.C.J. 4 (Apr. 9).
[373] *See* COHEN, 2000 REPORT, *supra* note 99, app. H.
[374] *See* GRIEF, *supra* note 22, at 18.
[375] *See* COHEN, 2001 REPORT, *supra* note 107, app. H.
[376] *See* Astley & Schmitt, *supra* note 88, at 128.

submarine was 14 miles (22.5 km) offshore at the time of the incident,[377] although Russia claimed the submarine was 4.7 miles (7.6 km) within its territorial waters.[378] The collision apparently occurred because Russian claimed a straight baseline across the Kola Bay.[379] "[B]ecause of the differing baseline calculations, part of the claimed Russian territorial sea lay in what the U.S. considered to be international waters."[380] At the time, retired U.S. Navy Rear Admiral Robert Long said that in the past "the Russians have made extravagant claims for their territorial waters."[381] Recall the greatly exaggerated maritime claims of the U.S.S.R. discussed above.

Similar incidents may be avoided in the future in the air by explicitly defining the extent of a State's vertical sovereignty.

Proposing a Boundary

> The ultimate goal, when reasonable security needs are met, should be of course, after the model of the oceans, the fullest inclusive use of airspace. Economic considerations strongly suggest that with respect to airspace, as with respect to the oceans, outer space, and other sharable resources, the greatest production of values can be secured through the fullest inclusive use.[382]

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[377] *See* David Evans, *Insider to Probe Collision of Subs*, CHICAGO TRIBUNE, Feb. 20, 1992, at 5.
[378] *See Izvestia: CIS and US Sub Collision Was in Russian Waters*, ITAR-TASS, Feb. 20, 1992.
[379] *See* Astley & Schmitt, *supra* note 88, at 128 fig.7 (depicting the territorial sea boundaries as determined by Russia and the U.S.).
[380] *Id.* at 128.
[381] Evans, *supra* note 377.
[382] MCDOUGAL ET AL., *supra* note 15, at 279 (footnotes omitted). Although they did not propose a specific altitude for a boundary, Professors McDougal, Lasswell, and Vlasic wrote later in their book that if a demarcation was established,

> the line separating the region of a comprehensive, exclusive competence from that of inclusive competence be drawn as low as states can be persuaded to agree. Such a temporary upper boundary could be set high enough to provide reasonable protection for traditional airspace uses, as long as this protection is generally demanded. The closer to the surface of the earth such a boundary could be fixed the greater of course would be the protection of the common interest in expanding inclusive use.

Id. at 356 (footnote omitted).

I agree that the territorial sea model should be adopted to define vertical sovereignty. A process similar to the evolution in the law of the sea's codification of territorial sea limits could occur in the atmosphere to define the vertical limits of State sovereignty. I propose a 12 nm limit. This equates to 72,912 feet (or 22 km). The area above 12 nm would not be subject to State sovereignty. It would be treated in a manner similar to airspace over international waters.[383] The standards and procedures adopted by ICAO would be mandatory. Vehicles operating above 12 nm would have to comply with ICAO standards.

Any rule delineating vertical sovereignty must be extremely simple to avoid the problems demonstrated in the territorial sea analogy. I think for vertical sovereignty a more uniform result could be achieved by ignoring mountain ranges and other geographic features. The limit could be set in a manner similar to aircraft "flight levels"[384] but by using satellite positioning (or some other accurate positioning system) to determine vertical position rather than barometric pressure. Although this solution produces the problem noted by Dr. Nijeholt above,[385] the 12 nm vertical limit is so high that it will include all current commercial aviation. Also, the simplicity of this rule will mean that States should not able to adopt different interpretations.

Setting the limit at this altitude would not interfere with current aviation. The limit would be well above the maximum altitude of current commercial aircraft.[386] In the U.S. the maximum altitude for commercial airliners is effectively limited to

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[383] *See* Chicago Convention, *supra* note 16, art. 12. This article provides in part, "[o]ver the high seas, the rules in force shall be those established under this Convention." This means the international standards and procedures adopted by the International Civil Aviation Organization (ICAO) are mandatory over the high seas. *See id.* art. 37.

[384] *See Flight Level* (visited June 14, 2005) <http://www.absoluteastronomy.com/encyclopedia/f/fl/flight_level.htm>.

[385] *See supra* text accompanying note 359.

[386] *See* GRIEF, *supra* note 22, at 42 (*asserting* that aircraft have a flight ceiling of "about 12 miles, [although] the upper limit of effective aerodynamic lift is considered to be about 25 miles above the earth" (footnotes omitted)).

40,000 feet (12 km) due to FAA regulations.[387] This is because it is impossible for airliners with wing-mounted engines to meet technical standards required by FAA regulations to operate at higher altitudes.[388]

However desirable a low vertical limit of State sovereignty is from either a freedom of access to space or a freedom of navigation in space perspective, it seems likely that many States will be reluctant to agree to a low limit. First of all, because under the functional perspective that exists in current treaties satellites in orbit operate beyond individual State's sovereignty, "States would be unlikely to accept 25 miles as the upper limit of their territorial sovereignty when they could claim considerably more than this without interfering with satellites in earth orbit."[389] Second, States will be reluctant to allow freedom of navigation if they are unable to immediately benefit from it. States with no ability or desire to operate vehicles in this region may be unwilling to enter into an agreement granting another State's vehicles landing rights or even the right of overflight, especially if the foreign carrier is competing with a domestic carrier. Professor Cheng elaborated on this issue:

> A solely functional approach of allowing the airlines to fly wherever there is traffic, while seemingly most rational can, in the present what economists would call conditions of very imperfect competition, lead easily to the entire industry being completely dominated, if not forever monopolized, by a few strong carrier nations. Interestingly enough, such nations have always been championing the cause of complete freedom of the air. The parallel between aeronautics and astronautics . . . should not be overlooked by those interested in the definition of outer space.[390]

Later in the same article Professor Cheng wrote:

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[387] *See* Andrew Doyle, *FAA Pressed on Altitude Limits*, FLIGHT INT'L, Feb. 8, 2005, at 17.
[388] *See id.* The applicable FAA rule is: Standards for Approval for High Altitude Operation of Subsonic Transport Airplanes (Amendment No. 25-87), 61 Fed. Reg. 28,684 (1996) (codified at 14 C.F.R. Part 25).
[389] GRIEF, *supra* note 22, at 43.
[390] Cheng, *The Boundary Problem*, *supra* note 168, at 443.

> While among space powers or near-space powers, [a right of transit], in the expectation of reciprocity, may be easily granted, the same can hardly be said of States which have no aspiration to go into space. The price the latter will exact will probably be proportionate to their strategic importance for the passage of space objects. In any event, if air law is anything to go by, it is most likely that States will wish to distinguish between military and non-military space objects, and, amongst the latter, possibly between commercial and non-commercial, and between nuclear and non-nuclear space objects.[391]

States may not want to give up the possibility of using their geographic location to gain economic benefits by demanding fees for overflight rights.[392] Writing of aircraft transit issues, Professor Peter P.C. Haanappel said "States with large territories are in the best political position to use overflight rights as a bargaining tool, commercial or political, in individual negotiations with other States. Often, large States have important commercial air routes crossing their territories."[393] Russia apparently already charges non-Russian airlines "royalties" for the right to fly over its territory in contradiction to the non-discrimination provision of article 15[394] of the Chicago Convention.[395] In addition to the royalties it charges, Russia has some of the highest air navigation charges in the world.[396]

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[391] *Id.* at 453.

[392] According to Professors McDougal, Lasswell, and Vlasic:

> Fear of competition, opportunities for unilateral grab, prospects of easy enrichment without concomitant investment or risk, and the like—the motives which have been for decades growing in the shadow of "exclusive and complete sovereignty" over territorial airspace—should not, of course, be allowed in the future to stand in the way of common interest.

MCDOUGAL ET AL., *supra* note 15, at 279 (footnotes omitted).

[393] Peter P.C. Haanappel, *Recent European Air Transport Developments: 1992–93*, XVIII:I ANNALS AIR & SPACE L. 133, 143 (1993).

[394] Article 15 of the Chicago Convention provides in part: "No fees, dues or other charges shall be imposed by any contracting State in respect solely of the right of transit over or entry into or exit from its territory of any aircraft of a contracting State or persons or property thereon." Chicago Convention, *supra* note 16, art. 15.

[395] *See* Michael Milde, *Some Question Marks About the Price of "Russian Air"*, 49 ZEITSCHRIFT FÜR LUFT- UND WELTRAUMRECHT [Z.L.W.] 147 (2000), *reprinted in* 2 DR. MICHAEL MILDE ET AL., PUBLIC INTERNATIONAL AIR LAW 226, 226 (2004).

[396] *See id.* at 229 (citing ICAO Doc. 7100 (1999)).

State security is also often cited as the major argument against a low limit on vertical sovereignty. For example, according to Professor Cheng,

> The foremost consideration that will influence the attitude of States in reaching a decision on [the exact height of national sovereignty] will be . . . that of national security. While it is true that in these days of reconnaissance earth satellites and intercontinental ballistic missiles with nuclear warheads, any system of national defence [sic] based purely on physical distance seems ruefully obsolete, yet if the history of air law offers any guide, States will most probably prefer to claim the greatest height practicable as the limit of their national space[.][397]

But security fears should be no greater than already exist today. States can already orbit weapons above other States and surveillance has long been accepted. A potential enemy at an altitude of 12 nm would be no closer than is already allowed by the law of the sea or across a land border. The ability to actually maneuver above 12 nm and remain there for any period of time is very difficult[398] so there should be few immediate threats posed by this proposal. Territorial seas as buffer areas for security are almost meaningless today because of bombers with intercontinental range, long-range carrier based attack aircraft, submarine launched ballistic missiles, cruise missiles, and various other weapons.[399] In addition, States have always had to contend with land borders that provide no security buffer.

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[397] Bin Cheng, *From Air Law to Space Law, reprinted in* CHENG, SPACE LAW, *supra* note 168, at 31, 35 (footnote omitted).

[398] According to M.V. Smith:

> Between the ceiling of aviation and the floor of astronautics, there is a region nearly 65 miles wide that divides air and space. This is the transverse region, wherein neither aerodynamic flight nor orbital rotation is possible. . . .
> . . . .
> Operations inside the transverse region are not practical because the energy expenditures required to maneuver there are too great. Vehicles can exploit neither Bernoulli's aerodynamic principles nor Kepler's astrodynamic principles to maneuver or conserve energy. Consequently, the transverse region lives up to its name as a boundary across which vehicles travel but in which they can do little else.

M. V. SMITH, TEN PROPOSITIONS REGARDING SPACEPOWER 5–6 (2002).

[399] *See* MURCHISON, *supra* note 77, at 55 (noting radars observing an attack at a range of 2,000 miles would only provide approximately 3 hours of warning time).

Finally, States have always had a right to take action outside their borders to protect their security,[400] and setting a low vertical limit on State sovereignty will not change this right. A 12 nm vertical limit of State sovereignty should not be objected to for security concerns. States should not be allowed to claim extensive vertical sovereignty based on outdated security concerns.

Some States have recently realized that they can enhance their security by allowing aircraft of other States to fly over them for surveillance. The Treaty on Open Skies establishes a regime for States to conduct observation flights over the territories of other States parties.[401] There are currently 30 parties to the treaty.[402] The U.S. and Russia have agreed to allow 42 annual observation flights by aircraft from other States over their territory.[403] Although this Treaty only grants a limited right to other States, it may be an indication that some States do not see overflight by foreign aircraft as a security threat and may allow a lower vertical sovereignty limit.

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[400] U.N. CHARTER art. 51. *See* Becker, *U.S. Foreign Policy*, *supra* note 74, at 6.

> Article 51 of the United Nations Charter reserves to each of the members of the United Nations an 'inherent right' of individual or collective self-defense against armed attack. It is immaterial whether the attack originates in or passes through outer space in order to reach a member state. In such a case, that state has the right to defend itself . . . .

Id. See also GOEDHART, *supra* note 321, at 74 ("Whenever a State finds itself threatened from outer space, it is still free, pursuant to article 51 of the U.N. Charter, to act in self-defence outside national air space."); Johnson, *Freedom and Control*, *supra* note 7, at 142 ("The extent of territorial sovereignty is not the test in [security] matters; the right of self-defense is not confined to actions within the defending nation's own territorial jurisdiction.").

[401] *See* Treaty on Open Skies, Mar. 24, 1992, art. I, S. Treaty Doc. No. 102-37.

[402] The 30 States Parties to the Treaty on Open Skies are: Belarus, Belgium, Bosnia-Herzegovina, Bulgaria, Canada, Czech Republic, Denmark, Finland, France, Georgia, Germany, Greece, Hungary, Iceland, Italy, Latvia, Luxembourg, Netherlands, Norway, Poland, Portugal, Romania, Russian Federation, Slovak Republic, Spain, Sweden, Turkey, United Kingdom, Ukraine, and U.S. Kyrgyzstan has signed but not yet ratified. *See* U.S. Dep't of Defense, *Fact Sheet: Open Skies Treaty* (June 4, 2004) (visited June 7, 2005) <http://www.state.gov/t/ac/rls/fs/2004/33147.htm>.

[403] *See* James A. Baker III, U.S. Dep't of State, Letter of Submittal (Aug. 12, 1992), *reprinted at* S. Treaty Doc. No. 102-37, at 6, 13.

As recently as the 1950s, unification of the territorial limits within the law of the sea looked difficult to achieve. However, although a few problems still exist, the limits of territorial claims by coastal States have been unified in a relatively short period of time. This shows that States recognized the value of the greatest possible freedom of navigation over the seas and were willing to limit their own security interests to obtain the corresponding benefits. Hopefully States will recognize the long-term benefits of setting a low vertical limit of State sovereignty. The economic drag created by extensive vertical State sovereignty will be a big hurdle to overcome. In this respect, the words of Professor Haanappel regarding sovereignty over air space apply:

> Even in 1944, when the Chicago Convention was drafted and opened for States' signatures, many States realized that the absence of the right of innocent passage in international civil aviation could hamper the development of international air transport. Frequently, international air routes cross a multitude of foreign territories. Negotiating overflight rights with each individual nation concerned may be extremely cumbersome and time-consuming.[404]

Even with overflight rights guaranteed by bilateral and multilateral agreements, airlines frequently find conditions placed on their entry into a foreign State's airspace. For example, the U.S. now requires commercial aircraft flights originating in foreign States destined to land in the U.S. or overflying U.S. territorial airspace without landing to provide names and other information on everyone on-board the aircraft.[405] If the vertical limit of State sovereignty continues up to the point where orbital mechanics are possible, obtaining the number of overflight rights through bilateral agreements required for a simple trip by a Hypersoar type vehicle could be very cumbersome and time-consuming. Existing bilateral agreements for aircraft would probably not be considered to apply to a Hypersoar type vehicle, so new agreements would have to be negotiated. Although bilateral agreements would still be required to allow a Hypersoar type vehicle to descend into a foreign State's territorial airspace to

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[404] Haanappel, *supra* note 393, at 142.

[405] *See* Electronic Transmission of Passenger and Crew Manifests for Vessels and Aircraft, 70 Fed. Reg. 17,820 (2005).

land, fewer would be required than if an agreement was needed for every State the vehicle passed over.

Mr. Becker, in his address to Congress in 1958 discussing the law of the sea, said the "U.S. Government believes that the 3-mile limit, which affords a maximum freedom of the seas, is in the best interests of all states—large and small, old and new."[406] The same holds true for vertical sovereignty. Although it is probably impossible to turn back the idea of total sovereignty over airspace, it may be possible for States to see the benefits of setting a low vertical limit to State sovereignty.

International Standards for Operations in Near Space

Whether or not my proposal on delineation is accepted, eventually vehicles of various types will begin operating in the near space area. It is important that international standards be developed to ensure these vehicles are designed to be safe and operate safely in harmony with existing air traffic. The question is who will develop the standards and when they will be developed.

In 1956, Professor Cooper argued that ICAO was the best international organization to regulate and control the "use of all areas of space for non-military purposes."[407] Professor Cooper had the general subject of outer space sovereignty placed on the agenda for the Tenth Session of the ICAO World Assembly in June 1956.[408] Although the issue was discussed at the meeting, the U.S. took the position that international discussion of space sovereignty was premature and Professor Cooper's proposal was tabled.[409] But, in its report, the ICAO legal commission wrote:

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[406] Becker, Political Problems, *supra* note 79, at 834.
[407] *See* Cooper, *Upper Space*, *supra* note 71, at 277.
[408] *See* TERRILL, *supra* note 136, at 20.
[409] *Id.* at 25.

> the Commission noted the growing interest among jurists in the problems concerning "Outer Space." It considers that these problems fall essentially within the province of the functions of the Organization and that, at a suitable time, they might be included in the general work program of the Legal Committee.[410]

After the flight of Sputnik, the ICAO President, Walter Binaghi, wrote to the U.S. ICAO Council Representative asking if it was time to consider the issue of sovereignty in outer space.[411] However, based partially on U.S. opposition, President Binaghi agreed to delay ICAO consideration of this issue, although some other States wanted ICAO to proceed on the subject.[412] One of the reasons the U.S. opposed ICAO authority over space after Sputnik was that the U.S.S.R. was not a party to the Chicago Convention.[413] Professor Cooper also admitted that once Sputnik was launched, ICAO lost its chance to coordinate space law for the same reason.[414] However, the U.S.S.R. became a party to the Chicago Convention on October 15, 1970, and Russia is a member now.[415]

Mr. Menter frequently argued that ICAO should have jurisdiction over space flight.[416] He argued in favor of giving ICAO responsibility for space activities as

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[410] *Legal Commission Final Report and Minutes, Assembly – Tenth Session*, at 6 para. 12, ICAO Doc. 7712, A10-LE/5 (1956), *available at* <http://www.icao.int/icao/en/assembl/a10/docs/a10_le02.djvu>.

[411] TERRILL, *supra* note 136, at 28.

[412] *Id.* at 29.

[413] *Id.* at 30.

[414] *See* John Cobb Cooper, *The Russian Satellite–Legal and Political Problems*, 24 J. AIR L. & COM. 379 (1957), *reprinted in* COOPER, EXPLORATIONS IN AEROSPACE LAW, *supra* note 18, at 279, 285.

> Until the Russian Satellite was launched, I had hoped that [international control of space] could be lodged in the International Civil Aviation Organization, created under the Chicago Convention. That is no longer practical. The U.S.S.R. has taken the lead. ICAO had an opportunity in 1956 to express its views about upper space when it was on the agenda at the Caracas Assembly. It failed to do so. The U.S.S.R. is not a member of ICAO. Only the United Nations itself can now serve as a forum for further discussion.

Id.

[415] *See Status of Chicago Convention*, *supra* note 59.

[416] *See* Martin Menter, *Legal Responsibility for Outer Space Activities*, *in* INTERNATIONAL INSTITUTE OF SPACE LAW OF THE INTERNATIONAL ASTRONAUTICAL FEDERATION, PROCEEDINGS OF THE TWENTY-SIXTH COLLOQUIUM ON THE LAW OF OUTER SPACE 121, 125 (1984) ("As to

well as air activities, writing "much governing regulation would tend to be similar."[417] Some may argue that COPUOS would be a better organization to coordinate international space activities, but "the ICAO approach need not remove UNCOPUOS of its responsibilities."[418] Professor Paul Larsen wrote

> It must be emphasized that ICAO cannot leave regulation of outer space activities to the U.N. Committee for Peaceful Uses of Outer Space because that committee is not concerned with aviation, only with outer space. Rockets and space vehicles in airspace will remain unregulated, unless ICAO enters the field or unless a new central space agency assumes this function.[419]

According to Professor Hamilton DeSaussure, "the implementation of the legal problems which will emerge from advanced use of Outer Space are far beyond the competence of COPUOS. Although a permanent committee with continuing staff assistance, COPUOS is best suited for creating hallmark principles, but not for detailed regulation and amplification."[420] However, Professor DeSaussure thought a new agency should be created and proposals for a "super ICAO style agency" were "too drastic, too unrealistic, and too costly."[421]

I think ICAO is the proper organization to help develop standards for operations in near space. Using ICAO to develop standards for near space activities would allow utilization of an efficient, established, international organization with almost universal membership.[422] ICAO has over 50 years of experience drafting standards that help ensure flight safety. ICAO has also

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international surveillant authority, I have long favored a long range expansion of the International Civil Aviation Organization (ICAO)'s responsibilities to include space flight.").

[417] Menter, *Legal Regime*, *supra* note 363, at 129.

[418] *Id.* at 132.

[419] Paul B. Larsen, *Space Activities and Their effect on International Civil Aviation*, *in* INTERNATIONAL INSTITUTE OF SPACE LAW OF THE INTERNATIONAL ASTRONAUTICAL FEDERATION, PROCEEDINGS OF THE NINTH COLLOQUIUM ON THE LAW OF OUTER SPACE 159, 164 (Mortimer D. Schwartz ed., 1967).

[420] Hamilton DeSaussure, *Evolution Toward an International Space Agency*, *in* INTERNATIONAL INSTITUTE OF SPACE LAW OF THE INTERNATIONAL ASTRONAUTICAL FEDERATION, PROCEEDINGS OF THE NINETEENTH COLLOQUIUM ON THE LAW OF OUTER SPACE 32, 35 (Mortimer D. Schwartz ed., 1977).

[421] *Id.* 37.

[422] There are currently 188 States that are parties to the Chicago Convention. *See Status of Chicago Convention*, *supra* note 59.

successfully drafted several treaties that have now been widely ratified. It could translate this experience into the near space realm. Giving this authority to ICAO would avoid: the large expense of creating a new international treaty organization; waiting for States to ratify the new treaty; waiting for the new organization to hire personnel and develop internal rules; the creation of a rivalry over jurisdiction, funding, and relevance between ICAO and the new organization that would be created if ICAO is not given authority for near space.

Standards should be written covering: crew licensing, crew composition, vehicle safety, range safety, publication of launches, coordination between launch sites and air traffic control, publication of notices to mariners, use of expendable boosters, hazardous residue remaining in spent boosters, operation of HAPS, orbit locations for HAPS, and many other areas. Although the Liability Convention could apply to near space operations if an international agreement delineating space is developed and ratified, for passenger travel in near space it may be better to modify the Montreal Convention[423] to apply. ICAO would be instrumental in doing this.

These standards will be needed sooner or later. I think it would be better to start working on them now when there is time to thoroughly think them through rather than rushing to fix a problem after something goes wrong. I think ICAO is the best organization to start developing these standards and ICAO could relatively quickly obtain the expertise needed to do this.

[423] Montreal Convention, *supra* note 12.

CONCLUSION

There is no international agreement on the vertical limit of State sovereignty. Today, the need to settle this gap in the law is growing in importance. It is time to delineate the vertical extent of a State's sovereignty. State sovereignty should be limited to a low altitude—I recommend 12 nm. Like the 12 nm limitation on territorial waters found in the Law of the Sea Convention, this low limit will allow the greatest freedom for all States to utilize the near space area. Although few States are in a position to make use of this freedom now, in the long term all States should benefit from setting a low limit on vertical sovereignty.

Space tourism and other vehicles capable of operating in the near space area are nearing commercial feasibility. Intercontinental hypersonic vehicles are being planned. A low limit on State sovereignty would allow these vehicles to operate freely without being obstructed by a political veto from the underlying State. Overflight rights would not be required which would save all the time an effort required to negotiate the web of air transit agreements now required to operate an international airline.

More and more States are developing their own domestic space launch capability. Few of these new space powers will be able to freely access space, or utilize the most efficient launch azimuths, if neighboring States can claim sovereignty up to even 62 miles (100 km). They will have even more difficulty returning objects to Earth if the boundary is set at that altitude. Even the U.S. and Russia are facing limitations on their ability to freely access space. Setting a low vertical limit on State sovereignty will ensure all States have equal access to space.

States should not be able to object to neighboring State's vehicles merely because of the vehicle's location. However, to ensure safety along with free access, uniform rules for operation of these vehicles are required. States should

work together to develop international standards for operation of these vehicles so that they are designed and operated safely. There may not be much activity in the near space area now, but there will be in the future. It is time to start working for the day when vehicles are routinely operating in this area. There is time now to thoroughly consider and implement appropriate rules. This is not something that will go away if ignored. The first step is defining the vertical limit of State sovereignty. Settling this will force States to get past their security concerns and focus on safety.

I recommend that ICAO be given authority to create Standards and Recommended Practices for vehicles operating in the near space area. ICAO has much experience drafting similar rules for operation of aircraft; rules for vehicles operating at higher altitudes should be similar. Using ICAO will speed up the process by avoiding the creation and staffing of a new international treaty organization. It will also save money because it should cost less to increase the staff of ICAO instead of creating a new organization from scratch.

Defining the boundary between a State's sovereign territory and free "outer space" will also add clarity to all of the treaties that are currently written in a functional manner without defining where "space" begins. Finally, defining the vertical extent of State should preclude future conflict among States that would arise if (or when) States begin making territorial claims up to different altitudes.

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