WHERE AIR SPACE ENDS AND OUTER SPACE BEGINS

*Stanley B. Rosenfield**

I. *Introduction*

The question of where air space ends and outer space begins has been debated for more than twenty years. Considerable discussion and study of the question were centered at the beginning of the space era, and even predated the flight of Sputnik I. It was the principal subject of a Conference held in The Hague in 1958.[1] Since then substantial progress has been made on agreements concerning outer space. Currently there are four treaties concerning outer space in force, and a fifth, the Moon Treaty, is under consideration.[2] As of January 1, 1979, there were 76 adherences to the Outer Space Treaty, and 73 adherences to the Astronaut Rescue Agreement.[3] These figures indicate not only agreement, but agreement by a substantial portion of the world community.

While these conventions give answers to some of the questions raised concerning the status and use of outer space, no answer has been provided to the basic question of where air space ends and outer space begins. The 1967 Outer Space Treaty made this question more acute, because under the Chicago Convention, each state has complete and exclusive sovereignty over the air space above its territory.[4] Under the Outer Space

---

*Professor of Law, New England School of Law.

[1]Proc. 1st Colloquium on the Law of Outer Space (1958).

[2]Treaty on Principles Governing the Activities of States in Exploration and Use of Outer Space, including the Moon and other Celestial Bodies, January 27, 1967, 18 U.S.T. 2410, T.I.A.S. 6347, 610 U.N.T.S. 205 (effective October 10, 1967) [hereinafter referred to as Outer Space Treaty]; Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched into Outer Space, 1968, 19 U.S.T. 7570, T.I.A.S. 6599, 672 U.N.T.S. 119, (effective December 3, 1968) [hereinafter referred to as the Rescue Agreement];Convention on the International Liability for Damage Caused by Space Objects, March 29, 1972, 24 U.S.T. 2389, T.I.A.S. 7762, (effective October 9, 1973), hereinafter referred to as International Liability Convention; and, Convention on Registration of Objects Launched into Outer Space, January 14, 1975. T.I.A.S. 8480, (effective September 15, 1976) [hereinafter referred to as the Registration Convention]. The draft Moon Treaty, U.N. GAOR, Supplt. No. 20 (A/34/20), Annex II.

[3]Treaties in Force 241, 333 (1979).

[4]Convention on International Civil Aviation of December 7, 1944 (referred to as Chicago Convention), 15 U.N.T.S. 295, Art. 1.

Treaty, outer space is free for exploration and use by all states,[5] and is not subject to national appropriation by any means.[6]

Thus, the question still remains: Where does sovereign air space end and free outer space begin? As the question has been debated for more than twenty years without reaching a solution, it may well be asked whether there is a solution, or why it is now important. Recent events make it important to reassess the question, and at least determine whether it is now time to reach a decision.

The Soviet Union has recently asked the United Nations to consider its proposal that the line between air space and outer space be established at 100(110) km. above sea level. In addition there are two current events which could put to a test, in a substantive manner, the question of a dividing line. One is the imminent use of the space shuttle, which will provide a vehicle for use in outer space, and which will return to earth in at least somewhat the fashion of an airplane. The second event is the claim of the equatorial states to sovereignty over the geostationary orbit.[7]

II. *Definition of Outer Space*

On March 28, 1979, the USSR proposed that the boundary line between air space and outer space be established at 100 (110) km. and that space objects should have the right to fly through the sovereign air space below 100 (110) km. for the purpose of reaching orbit or returning to earth.[8]

Scholars around the world have offered a wide variety of definitions of outer space based on a horizontal line drawn anywhere from a few hundred thousand feet above the earth to several thousands of miles. Each is justified by some scientific evidence. One of the most common bases is the limitation of the earth's atmosphere or air.

Space has been defined as the point of the universe lying outside the limits of the earth's atmosphere.[9] The difficulty with this terminology is agreeing to the limits of the earth's atmosphere. A variety of heights ranging from 30 miles to several hundred or several thousand miles, each purportedly based on the limit of the atmosphere, or lack

---

[5]Outer Space Treaty, Art. I.

[6]*Id.*, Art. II.

[7]That point, approximately 22, 300 miles above the earth, at which an object in orbit will remain over the same relatively fixed spot on earth as the earth rotates on its axis.

[8]U.N. Doc. A/AC. 105/C.2/L. at 121 (March 28, 1979).

[9]N.A.S.A., Dictionary of Technical Terms for Aerospace Use 258 (1st ed., 1965).

thereof, have been proposed, indicating the difficulty of a definition merely based on height.[10]

Another approach was that taken by ICAO[11] which defined air space as "only that space in which an aircraft can operate," while it defined an aircraft as "any machine that can derive a support in that atmosphere from the reaction of the air other than the reaction of the air surface."[12] This definition has the same problem as many of the other definitions in that it is subject to change, as the state of aerospace art advances.[13]

One of the most complete reviews of the literature suggests that spatial approaches may be grouped into nine separate categories, with each category having an infinite number of variations.[14] These categories include:

1. The line based upon the concept of atmosphere, which has already been noted.[15]

2. A line based on the division of the atmosphere into four layers, the troposphere, the stratosphere, the mesophere and the ionosphere. Each division has its own scientific characteristics and each has given rise to a variety of different proposals, ranging from 31 miles above the earth to as high as 500 miles.[16]

3. The ICAO theory previously noted, based on the maximum altitude of aircraft flight.[17]

4. The von Kármán line, by which the line would be established at the point where aerodynamic lift yields to centrifugal force, which would put the line at approximately 275,000 feet.[18]

---

[10]Lipson and Katzenbach, Report to National Aeronautics and Space Administration on the Law of Outer Space, 14 (1961).

[11]The International Civil Aviation Organization.

[12]Chicago Convention, Annex 7.

[13]An example is the X-15 experimental aircraft of the United States which has been flown at heights in excess of 60 miles. Its pilots have received astronaut wings for piloting it at 50 miles, the altitude administratively established as the basis for qualifying for such. NASA, F light Research Center Release 2-66 (Feb. 7, 1966).

[14]U.N. Doc. A/AC.105/C.2/7 (May 7, 1970).

[15]*Id.* at 36.

[16]*Id.* at 37.

[17]*Id.* at 40.

[18]*Id.* at 43.

5. The line based on the lowest perigee of an orbiting satellite. This is based on the fact that when the earth's atmosphere is too dense, an artificial satellite cannot remain in orbit.[19]

6. The line based on the point where the gravitational pull of the earth ceases. This theory arises from the basic assumption that for state security, the extent of sovereignty should extend beyond the point from which any object may be dropped.[20]

7. The line between sovereign air space and outer space should be drawn at the limit of the underlying state's capacity to effectively apply its authority. This would provide a different limit on sovereign air space for different states.[21]

8. The zonal theory under which air space would be divided into sovereign air space, based upon either the height at which aircraft can operate or some other line of demarcation; a contiguous zone, through which all non-military flights would have a right of free passage; and all that above contiguous space which would be free space.[22]

9. Drawing the line between air space and outer space by a combination of one or more of the previously mentioned proposals.[23]

The major problem with all of these approaches is that no one proposal sets a defined, unchanging line, and each is subject to change with advancing science.

While there has been no general agreement, the closest to an agreement would probably be the resolution passed by the International Law Association in 1968.[24] This resolution provided that the term outer space should be interpreted to include all space at and above the lowest perigee achieved by January 27, 1967, when the Outer Space Treaty was opened for signature. At the same time, this resolution kept open the question of whether it might later be determined that the perigee might be reduced at a later time.[25] This is subject to considerable support on the basis that states accept

---

[19] *Id.* at 45.

[20] *Id.* at 48.

[21] *Id.* at 49.

[22] *Id.* at 52.

[23] *Id.* at 54.

[24] 53 ILA Conference Proc., xxii (1968).

[25] *Id.*

artificial satellites orbiting around the earth as being in outer space, and to accept a higher limit would require excluding from outer space, a significant portion of activity currently taking place.

A major problem with the Soviet proposal is the lack of consensus. The basic reason that no agreement has been reached during the more than 20 years of discussion is the failure of any proposal to receive acceptance by any substantial number of states. Is there some critical function currently under consideration which would make the Soviet proposal, or any proposed definition more attractive today? The answer must be in the negative. However, the claim to the geostationary orbit and the flight of the space shuttle are the types of activity that could eventually make a definition of outer space acute.

III. *Geostationary Orbit*

On December 3, 1976, the Declaration of Bogota was issued by the equatorial states of the world,[26] declaring the geostationary orbit, 22,300 miles above the earth, to be part of the sovereign territory of the state whose territory is below on earth.[27] The scientific basis for such declaration was that

> The geostationary synchronous orbit is a physical fact linked to the reality of our planet because its existence depends exclusively on its relation to gravitational phenomena generated by the earth. . .[28]

The legal bases of such claim are two-fold. First, the 1967 Outer Space Treaty does not define outer space. The geostationary orbit is not specifically included in outer space, and therefore, there is nothing in the Outer Space Treaty to prevent the geostationary orbit from being private property. Secondly, it is argued that when the 1967 Outer Space Treaty was enacted, the equatorial states

> could not count on adequate scientific advice and were thus not able to observe and evaluate the omissions, contradictions and consequences of the proposals which were prepared with great ability by the industrialized powers for their own benefit.[29]

---

[26]Those states of the world traversed by the equator.

[27]Signatories were: Colombia, Congo, Equador, Indonesia, Kenya, Uganda and Zaire. In addition, Brazil was present as an observer.

[28]Declaration of Bogota, December 3, 1976. For a text, see 6 J. Space L. 169 (1978).

[29]*Id.* par. 4. Brazil, Equador and Uganda are parties to the Outer Space Treaty. Colombia, Congo, Indonesia, Kenya and Zaire have not ratified this treaty.

In regard to the scientific basis for such claim, it has been noted that gravity is not the exclusive force acting on a satellite in geostationary orbit.[30] The geosynchronous orbit, like all other orbits, involves continuous motion around the earth. While a satellite in such orbit appears to be relatively stationary, in fact it is not so. The satellite's path through space is affected by a combination of factors, including the energy imparted by the launch vehicle, the mass of the spacecraft, the attitude at which it moves above the earth, the forces of gravity of the earth, the moon and the sun, and the radiation pressure of the sun. A geosynchronous orbit can be maintained by a satellite only with constant monitoring and adjustment to maintain its position. There is clear scientific basis for recognizing that this orbit derives its main characteristics from the properties of the entire earth, without regard to national or political boundaries.[31]

There can be no validity in a claim based on the law of gravity, since it is the gravity of the whole earth which keeps satellites in orbit, and any attempt to subdivide gravity would be scientifically absurd.[32] No non-equatorial states have supported the claim of the equatorial states.

The answer to the legal claim is no less clear than the answer to the scientific claim. The legal space of the geostationary orbit is inseparable from outer space and is covered by all relevant provisions of the 1967 Outer Space Treaty. Under the 1967 Treaty, the geostationary orbit, like outer space as a whole, was exempted from national appropriation by any means whatsoever.[33] The weakness of the equatorial states legal position is emphasized by Brazil, itself an equatorial state, which, while it attended the Bogota Meeting as an observer, has refused to adopt the equatorial states position.[34]

If no definition of outer space has been agreed upon by the states of the world, why cannot the geostationary orbit, that area 22,300 miles from the earth, be excluded from outer space? While the exact scope of outer space, its precise limits and the point of its beginning, have not been agreed upon, there is general agreement that certain things, such as the flight of a commercial aircraft, are in air space, and certain other things, such as a space vehicle in orbit around the earth, are in outer space. Such agreements do not require definition of the point at which air space ends and outer space begins. It is only the definition which causes disagreement among states of the world.

---

[30]U.N. Doc. A/AC.105/C.2/SR.281, at 2 (April 6, 1977)

[31]*Id.*

[32]U.N. Doc. A/AC.105/C.2/SR.269, at 9 (March 17, 1977)

[33]U.N. Doc. A/AC.105/C.2/SR.281, p. 6 (April 6, 1977). Statement of the representative of the U.S.S.R. *See also,* statements of representatives of Canada and Australia, p. 5; Statements of Sweden, Japan and Federal Republic of Germany, p. 7.

[34]*Id.* at 7.

While there is no agreement on the height at which airspace ends and outer space begins, the foregoing discussion indicates that there does seem to be substantial agreement that outer space begins somewhere less than 22,300 miles from earth. The legal status of the geostationary orbit at the current stage of development of space technology and space law should be governed by the principle that geostationary orbit is inseparable from outer space, and is covered by all relevant provisions of the 1967 Outer Space Treaty.[35] Furthermore, regardless of the definition of outer space, the geostationary orbit would be included within the term outer space.[36]

The effect of accepting the proposal of the equatorial states would be to have a sea of private property in the middle of outer space. The alternative would be that outer space would not begin less than 22,300 miles from earth. The vast majority of states would not accept such a proposition. It would open the door to claims of sovereignty over the area in which a large majority of the space missions have been made to the present time. This is not a principle that could or would be accepted by the vast majority of states.

There is no unanimity or even general agreement on where air space ends and outer space begins. Nevertheless, there is general agreement that the geostationary orbit, 22,300 miles from earth, is within the limit of outer space.

One further question might be asked. If a line separating air space from outer space had been drawn previous to the claim of the equatorial states, whether such would have affected the claim of equatorial states. Based on the reasoning of these states the answer to this question would be no. If these equatorial states were not aware of the scientific implications of the treaty when it was entered into, and this were in fact a valid basis for their present claim, then whether a specific point were defined in this treaty or at a later date, would make no difference to their claim.

The original question was whether the claim of the equatorial states would require a definition of where air space ends and outer space begins. The answer is in the negative. As there is general agreement that the geostationary orbit is within outer space, regardless of what the definition of outer space may be, this claim would make no critical demand for such a definition.

IV. *The Space Shuttle*

On September 13, 1977, the United States space shuttle orbiter Enterprise was released from the back of a 747 for the second time, and approximately five minutes

---

[35]U.N. Doc. A/AC.105/C.2/SR.281, at 5 (April 6, 1977). Statement of representatives of U.S.S.R. *See also,* statements of representatives of Canada and Australia. *Ibid.*

[36]*Id.* at 7, statements of the representatives of Japan and the Federal Republic of Germany.

later, under the manual control of an American astronaut, touched down on a dry lake bed in California. The ultimate test will come when Orbiter 102 is sent into space, followed by the first manned orbiter flight and landing on Earth. This was originally scheduled for the fall of 1979, but delays have pushed this date into 1980. The major advance the space shuttle offers over previous space shots is that it can be controlled by the pilot in a limited fashion and guided back to Earth. While it does not have the control and discretion of an aircraft, it will be a considerable advance over previous manned space capsules which had no manual control in the earth's atmosphere.

Does the orbiter operation in somewhat the fashion of an aircraft require as an imperative, a definition of where air space ends and outer space begins? While the questions raised by the space shuttle are entirely different from those involved with the geostationary orbit, they both present problems relating to the definition of outer space which have not previously been answered. The space shuttle raises the question of whether the limited ability to control such craft is sufficiently novel to require a definition of when such craft is in free outer space and when it is in airspace, subject to the limitations of the sovereign state through whose territory it is passing.

Such inquiry requires examination of the current treaties relating to outer space. The first convention in time was the 1967 Outer Space Treaty [37] which has become the constitution for outer space. It is the foundation by which all activity in outer space is governed. It declares that outer space will be free for exploration and use by all states,[38] and that outer space shall not be subject to appropriation or claim of sovereignty.[39] Once outer space is reached, rules of conduct are set out but nowhere in the treaty is a clue given to when outer space is reached. Where air space ends and outer space begins is omitted, but once outer space is reached, this treaty becomes effective.

The next outer space treaty is the Rescue Agreement.[40] This convention recites as its purpose the rendering of aid to astronauts in the event of distress or emergency, without reference to the place where such emergency may occur.[41] The convention applies to distress in the territory of a contracting party, on the high seas, or any other place not within a state's jurisdiction.[42] The convention is based on the desire to promote aid in the peaceful exploration and use of outer space. There is no requirement that the distress occur in outer space. The purpose is to provide protection to an astronaut who

---

[37]Outer Space Treaty, *supra* note 2.

[38]*Id.* Art. I.

[39]*Id.* Art. II.

[40]Rescue Agreement, *supra* note 2.

[41]*Id.* Preamble.

[42]*Id.* Art. I.

does not land in the territory of the launching state. It is based on the provision of the Outer Space Treaty making all astronauts "envoys of mankind in outer space",[43] which entitles them to special treatment in the case of distress, regardless of where such distress occurs. A definition of the line between air space and outer space is unnecessary to the operation of this treaty.

The International Liability Convention,[44] provides that a state launching a space object shall be liable for damages caused by such space object. The launching state is liable whether damage occurs on the surface of the Earth, to aircraft in flight,[45] or elsewhere than on the Earth's surface, to a space object, or to persons or property on board the space object of another state.[46]

The Liability Convention applies to damage to property or injury or death to persons, caused by a space object, regardless of where damage or injury occurred. The obligations of this convention are equally applicable to an aborted space shot which never left air space; the damage caused while proceeding through air space; the damage caused while in outer space; or, the damage on Earth while returning from a space mission. The basis of liability is that the damages or injury is caused by a space object.[47] The launching state[48] or states[49] bears the liability.[50] Thus, it is similar to the Rescue Agreement in that neither depends on a definition of outer space or a determination of air space or outer space for its operation.

Two recent examples of the application of the Liability Convention would include the Soviet Cosmos 954 satellite which landed in Canada in January, 1978, and the United States Skylab which landed in Australia in July, 1979. Both the Soviet Union and the United States are parties to this Convention and both states have acknowledged liability for damages caused by these incidents under this Convention.

---

[43]Outer Space Treaty, Art. V.

[44]International Liability Convention, *supra* note 2.

[45]*Id.* Art. II.

[46]*Id.* Art. III.

[47]*Id.* Art. I(d).

[48]*Id.* Art. I(c).

[49]*Id.* Art. V.

[50]*Id.* Arts. II, V.

The final treaty relating to outer space is the Registration Treaty which went into force in 1976.[51] This convention requires registration of any object launched into "Earth orbit or beyond."[52] It does not regulate activity of space objects. Its purpose is to provide information on Earth regarding activity in outer space. While such treaty would be applicable to the space shuttle, it would not require a definition of outer space.

None of these treaties relating to outer space requires a definition of where air space ends and outer space begins. With the exception of the Outer Space treaty, each is based on the purpose of the regulation rather than on the place where such activity takes place.

The treaties are not inclusive of all possible needs, however. There are two possible areas, neither specifically covered by these treaties, which could require definition of outer space in relation to the space shuttle. The first would be the right to use sovereign air space to reach outer space. This problem is no more acute with the space shuttle than with any other space vehicle. It is likely that the space shuttle will be the forerunner of completely maneuverable craft which will pose the legal problems of both aircraft and spacecraft. But such craft are not yet available. Until such time, the problem will only be one of transit to and from outer space. Even this problem has not previously arisen, because to date, launching states have been able to utilize their own territory or the high seas for launching and recovery of space craft. This may change when the space shuttle, or some other type of vehicle, becomes available to other than the largest and most scientifically sophisticated states of the world.

When we reach such point, will it then be necessary to require a determination of where air space ends and outer space begins? Undoubtedly, some limitation would be necessary, simply from a point of safety to avoid the same course at exactly the same time as that of a craft from another state. What will be required will be the right of such state to take off to and return from outer space. The needs of such state will be similar to the needs of a landlocked nation to access to the oceans of the earth. It is submitted, however, that such need would not require drawing a distinction between sovereign air space and free outer space. The needs of the launching state would be within that area clearly defined as sovereign air space.

The second area of possible concern is state security. Security is given as the principal reason for requiring a definitive point where sovereign air space ends and outer space begins. Certainly no state must countenance hostile foreign aircraft or spacecraft in its air space. There is nothing about the present space shuttle to pose a greater security threat than any other spacecraft. Even if the space shuttle had the maneuverability of an aircraft it would still be necessary to ask the height which would be sufficient to protect a state's sovereignty. Would a determination that sovereign air space ends at a specific point, no matter what that point might be, protect the security of a state?.

---

[51]Registration Convention, *supra* note 2.

[52]*Id.* Art. II(1).

The current laws of air space guarantee sovereignty of air space to the height ordinary aircraft fly. What greater height is necessary to a state's protection? As science advances, the question may become critical. The main concern of a state must be either surveillance or attack. As science is refined, the exact height of operation becomes less critical. Today, better surveillance can be obtained from craft in outer space than could be obtained by aircraft at considerably lower altitudes just a few years ago. Merely setting a high outer limit to air space would be little advantage to the security of the state if other states could accomplish the same results from outer space. Every state is entitled to be secure on both its horizontal and vertical borders. Nevertheless, it does not appear that under the current state of development of the space shuttle, a definition of where sovereign airspace ends and outer space begins will increase such security.

V. *Conclusion*

After more than 20 years of ever increasing space activity there is still no requirement for a specific line distinguishing air space from outer space. No problem raised in the past, nor the current problems relating to the claim to the geostationary orbit or the space shuttle make imperative an immediate definition. The Soviet proposal to define outer space as above 100 (110) km. above sea level does not present a problem without solution for lack of a definition. Neither are there any current problems that lack solution for failure of a definition of where air space ends and outer space begins. The Soviet proposal is premature.

After more than twenty years of ever-increasing space activity, there is still no necessity for a specific line distinguishing air space from outer space. The future may be otherwise, but to date, the states of the world have avoided putting a precise definition on where air space ends and outer space begins. Because of the current state of the art, any such line would be indefinite. In addition, once a definition is agreed upon, it will be as difficult to change such definition as it was to develop. Yet, future advances in science may point the way toward a simple and relatively easily identified line. At the same time, problems to date have been shown capable of solution without a definite line between air and space.

Solutions without a definitive line have been aided by the language of the treaties currently in force. No treaty has attempted to define where sovereign air space ends and free outer space begins. Either the subject has been avoided entirely, as in the case of the Outer Space Treaty of 1967, or a different approach is adopted. The approach adopted has been the functional approach, based on the purpose of the activity, rather than where it takes place.

In the Rescue Agreement the purpose is defined as rendering aid to astronauts in the event of distress or emergency, without reference to where the incident took place. The Convention will apply, assuming it involves an astronaut or an object launched into outer space, whether such distress occurs in the territory of a contracting party, on the

high seas, or in any other place not within a state's jurisdiction.[53] The same approach is taken in the Liability Convention, which provides for the liability of a launching state for any damage caused, whether such damage occurs on the surface of the earth or to aircraft in flight, or in outer space.[54] If a space object is involved, it is not a question of where the damage took place, but that it took place. The activity is connected with outer space, yet a definition of where outer space begins is not required.

The acceptance to date of this functional approach does not prevent a different approach in the future. It does suggest that this approach is currently being successfully used and should be continued so long as it is of value. Future advances such as the space shuttle, may require a definition of the line between sovereign air space and outer space, but such line should not be arbitrarily drawn when it will regulate that which is today unknown and which cannot today be foreseen.

A definition of the geographic point where sovereign air space ends and free outer space begins may never need to be developed. If the need should arise, there must be, either a clearly defined scientific point upon which the states of the world can agree, or a specific problem that needs solution and which cannot be solved except through such a definition. When either of these conditions may arise cannot be predicted. However, it is clear that neither situation is present today.

---

[53]Rescue Agreement, *supra* n. 2, Art. 1.

[54]International Liability Convention, *supra* note 2, Arts. II, III.