CHAPTER II

CONCEPTS OF THE AIR SPACE AND THE OUTER SPACE

In common usage there are no difficulties in comprehending the meaning of the concepts of the 'air space' and the 'outer space'. Problems, however, arise when one attempts to define these concepts in scientific and legal terms. The absence of a commonly acceptable terminology in science and law, in regard to the regions of the atmosphere and beyond it, makes it difficult to formulate the concepts of the 'air space' and the 'outer space' equally applicable in scientific and legal fields.¹

Divergent opinions have been expressed as to the legal and scientific terminology of the atmosphere and its upper regions. Space, outer space and even air space are often used interchangeably though each may have different scientific, legal and other meanings.²

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1. It is interesting to note that both in air law and aerospace law invariably all problems relate to the concepts of the 'air space' and the 'outer space' respectively but in these branches of international law the concepts of the 'air space' and the 'outer space' lack generally accepted explanatory definitions.

One of the reasons for the absence of the accepted legal and scientific terms for the upper regions of the atmosphere and regions beyond it, is that 'aeronautics' and 'astronautics' are comparatively a new field of law.  

1. Though 'aeronautics' and 'astronautics' are considered to be relatively new in the vast dimensions of the scientific achievements of the modern world, there are ample instances of their mention in ancient literature of India. For example, Maharishi Bhardwaj in his book on the art of aeronautics, 'Yantraserversva' has defined an aeroplane as "that thing which can move like birds on earth, water and sky". The Rishi has explained 32 secrets on the art of aeronautics. The third secret named 'Kritak' explains the science of making an aeroplane. The fifth secret named 'goolr' explains how an aeroplane can be made hidden. The ninth secret named 'oproksah' explains about a particular kind of electricity acquired from the solar energy which makes all objects visible before the aeroplane. The twenty-second secret, named 'Sarpagaman', explains that by collecting sun rays and seven types of gases in one of the pipes in the aeroplane and then by pushing a button the aeroplane can be made to move in the air like a snake (in a zig-zag way). The twenty-fifth secret, named 'Sodamaniart', explains that how persons in the aeroplane can talk on an apparatus to persons on another aeroplane. The twenty-eighth secret named 'Dicdarapan', explains that how with the help of a needle fitted in an instrument, the direction of the aeroplane can be known. And thirty-first and thirty-second secrets, named 'Satabhdak' and 'Karshan', explain that how by throwing a particular type of gas (through a pipe on the left side of the aeroplane) on another aeroplane, it can be destroyed. See Shridamodharji, Jha, "Hamari Pracheen Vamanik Kala", Kalyan, (Hindu Sanskriti Ank), Vol. 24, 1950, 736-38. (For Sanskrit text see Appendix III) In Shrimad Valmikeeya Ramayanam an elaborate description of 'Pushpak Viman' (an aerial vehicle) is given as: (every part of the aeroplane was gold plated. It had secret chambers. The whole of the aeroplane shed luster like silver. It was decorated with white and yellow flags. It was also decorated with lotus made of gold. The frills with small bells were producing musical notes. The frames of the windows of the plane were studded with precious stones and pearls.)

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This nascent field raises some basic but vital questions germane to the legal implications of the concepts of the air space and the outer space, the scientific divisions of the higher sectors of the atmosphere above the earth and the difference between 'space', 'world space', 'territorial...
space’, ‘contiguous space’, ‘outer space’, etc. These are some of the terms in current use employed by different scholars on the subject to denote different expressions which further add to the confusion. It is, therefore, imperative to have a cognizance of the concepts of the air space and

*...See ‘Abhigyan Shankuntalam, ‘in Sita Ram Chaturvedi, ed., Kalidasa Granthavali, (Aligarh: Bharat Parkashan Mandir, (Vikrami Samvat 2019), pp. 129-130; (For text in Sanskrit see Appendix V); In Meghdoot of Kalidasa an air route’s angle from Vidishi to Ujayni is described. Ibid., p. 398; In the Harshcharita of Banabhatta a reference is made to an aeroplane made by some Greek engineer in India:

"आस्थर्य कूटुंबी व क्षीयासार्वभौतब्रह्मणविन नवमतापानात् वन्रयात्सनागीयत यस्यि।"

(Chandipati, being curious of marvels, was carried away, no one knows where, on an aerial car made by a yavana (Greek) who was made prisoner by his soldiers), see P.V. Kane., ed., The Harshcharita of Banabhatta (Delhi: Motilal Banarsidass, 1965), p. 50; also see K.V. Sharma, ed., Maha-Subhasita Samgraha (Complied by Ludwic Sternback), Vol, V. (Hoshiarpur: Vishveshvaranand Vedic Research Institute, 1981), p.2280. Similarly ‘space’ is also frequently mentioned and defined in the Vedic literature. In Rigveda Samhita it is written:

"अनिरीवेश वोतीत विवा स्पार्स्स्स्स्स्स्।"

(The Muni flies through the firmament, illuminating all objects), see Shripada Domodar Satvaleker, ed., Rigveda Samhita (Surat: Paradi, 1957), p.744; for more such mentions also see pp. 713,759; Yask, the renowned etymologist of 7th Century B.C. has defined ‘space’ (outer space) in different ways like:

"अन्तराख्तं वर्णितं। अन्तर दयेद्वारत ता।"

Contd...*
the outer space before attempting to discuss their legal and political status. And the true implications of the air space can be better understood if, at the very outset, nature of the 'air' and the 'air space' is known.

Air is a gaseous fluid of which the atmosphere is composed. It is transparent, perfectly elastic and highly compressible. Though extremely light, it exerts definite weight and pressure. The atmosphere or air space\(^1\) enveloping the earth may be considered as a gaseous sea at the bottom of which we live and which extends upwards to a considerable height constantly diminishing in density with the increase in altitude. This density of atmosphere contributes to a great degree to aerodynamic lift to maintain flights, sustains

*...(Since it is situated in between sky and earth it is said to be Space 'antariksha')
or
(Since it resides in the intermediate region between sky and the earth, it is said to be space, 'antariksha')
or
(Since it is unperishable or undestructible in the bodies and not destructible like the earth; it is said to be space 'antariksha'), See V.K. Rajvade, ed. Yaska's *Nirukta* (Poona: Bhandarker Oriental Research Institute, 1940), p. 34.

1. The terms 'air space' and 'atmosphere' have been interchangeably used in various expositions of air law. The French version of the Paris Convention used the term atmospheric space which was translated in English as air space. Again a U.S. Federal Act (NASA) has used the term atmosphere. See N.M. Matte, *Aerospace Law* (London: Sweet and Maxwell Ltd. 1969), pp. 21-22.
the cosmic engines and renders fatal a satellite's orbit within dense air space. In fact, atmosphere ends where it begins to lose its character of continuous medium, and aero­dynamic displacement ceases there.\(^1\) These are universally admitted geophysical realities.

Air is a gaseous substance breathed by all and as such cannot be the object of exclusive right on the part of an individual or the states.\(^2\) Like air, space has never been considered as commercial property. It cannot be considered as an object in strict legal terminology. Infact, property, according to Windscheid means "any singularised object (stuck) belonging to irrational nature."\(^3\) As per this definitive criterion, all property should be individualised as a phenomenon or object whereas the air space is neither finite nor defined as an object or phenomenon; it is an objective reality. This, however, necessitates philosophical and metalegal research.\(^4\)

Space and time exist a priori as objects of empirical perception. Therefore, air space is not the quality of the

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3. This is the German view of the concept of property. See Matte, op. cit., p. 14.
4. Ibid.
air, but rather a necessary manner of conceiving it. Nature and objects exist in space, which leads to the inference that space can neither have an objective nature nor be made objective. Thus, the air space cannot be classified in legal categories like *res nullius* or *res communes*. The air space is an ariel medium which systematically covers the whole universe on an infinite scale. Therefore, it follows that the air space is *extra commercium* and *communes omnium* without necessarily being a *res*.

Roman law, however, makes a distinction between the 'air' and the 'air space'. To Romans, *aer* was *res communes omnium* as one of the divisions of *res extra commercium*, and incapable of private ownership. McNair has cited Gond's opinion that it would be an erroneous assumption that *aer* and *coelum* meant the same thing. It was the *aer*, the omnipresent medium -- so necessary for all forms of life and incapable of appropriation that was *res communes*. But, in contrast the *coelum* was *res soli* more or less capable of appropriation by the owner of the soil as *spatium* or *regio aeris*.¹ It may be seen that from the very beginning, unlike the air, the space above the land has been considered more or less capable of appropriation by the owner of the land though it cannot be termed as a *res* (thing).

Since space cannot be termed as a *res*, it becomes diffi-

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cult to define the ‘air space’. However, attempts have been made to explain the implications of the concept of the ‘air space’ both from scientific as well as legal points of view. The scientific meaning of the air space refers to the atmospheric space above the earth and the physical composition of its different sectors, whereas the legal meaning refers to navigable and non-navigable air space.

It may be of interest to note here that there is no unanimity among the scientists in regard to the structure of atmosphere of the earth. In order to describe the different sectors of the atmosphere of the earth physical scientists employ two systems of terminology. The first system takes into cognizance variations in temperature with reference to altitude, whereas the second refers to variations in electron density with altitude. It is pertinent to go through the physical composition of the different sectors of the atmosphere in order to understand the scientific meaning of the air space.

Bearing in mind that the atmospheric layers merge gradu-

1. According to some, there are three recognised general divisions of the atmosphere, viz., the troposphere, the stratosphere and the ionosphere. There are others who divide the area beginning with the surface of the earth and extending to infinity into four divisions viz., the troposphere, the stratosphere, the ionosphere and the exosphere. Still others who make the five-fold division of the earth’s atmosphere viz., the troposphere, the stratosphere, the mesosphere, the thermosphere and the exosphere. See Hogan, op. cit., p. 368.
ally into each other the physical composition of the atmosphere starting from the surface of the earth skywards is to be found as under:¹

**Troposphere** is nearest to the earth and as such is the lower most layer of the atmosphere of the earth. Its height extends upto 10 kilometres. It is in this region that modern aircrafts, both jet and conventional, fly. It is the zone of weather and is characterised by the falling of the temperature with the rising of the altitude. It is the zone of clouds and storms and is composed of air mass which is approximately three-fourths of the volume of the earth. As stated, it is in this region that modern aircrafts including the piston-powered, operate. So, this sector is quite important in both municipal and international laws.

**Stratosphere** is the next higher region. It extends from 10 to 25 kms. It is the sector with essentially similar physical features as that of troposphere. The main difference between the two is that it is more or less free from clouds of water. Temperature changes with altitude but little. It has been discovered that ozone is generated in the higher

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¹. But the scientists have not actually reached any agreement on the actual upper and lower limits in regard to some of these layers or areas and these divisions based on temperature vary with variations in latitudes, seasons and even from day to day. Ibid. Also see for details, John E. Naugle, *Unmanned Space Flight* (New York: Holt, Rinehart and Winston, Inc.,1965), pp. 57-94; N.M. Matte, ed., *Space Activities and Emerging International Law* (Montreal: CRASL-McGill University, 1984), pp. 361-372.
segment of stratosphere. It is also often called the isothermal region. Man has penetrated into this region through balloons, air planes and Bell X-2 rocket planes.

Mesosphere extends from 30 to 80 kms. The physical phenomenon of this region does not differ much from that of the underlying atmosphere. This region is the seat of transformation of the primary into secondary radiation. The highest limit of this region has been placed at 375 to 500 kilometres. The aerodynamic force of lift required for heavier than air winged type aircraft ceases to exist at its extremity. This sector has also been called 'the aeropause' or a point where the pilot and his airship leaves the atmosphere of the earth and enters the outer space. At this point the pilot undergoes such physiological pressures and his airship vehicle is subject to such an aerodynamic force, as the problem is not one that can be classed as another phase of conventional flight but which, indeed, is an entirely new problem.

Ionosphere extends to an altitude of 640 kms in an air

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1. The exact level of this region is still not known. Hogan, op. cit., p. 368.
mass which is absolutely different from that of the earth. In ionosphere there is a steady rise in temperature believed to be approximately $2,200^\circ$C. It is an electrically charged region created by bombardment of sun’s ultraviolet radiation upon the atmosphere. Ionosphere makes possible transmission of all long distance radio communications using high frequency waves since it reflects the signals back to the earth, preventing them from being lost in space.¹

**Exosphere** consists of an area beyond ionosphere. In this region the density of the gaseous atmosphere is even less than in ionosphere. The gravitational pull of the earth is very slight and this region is characterised by a uniform temperature of $2,200^\circ$C.²

On the basis of the latest scientific discoveries the region contiguous to exosphere has been found to possess different properties and has been named as **Magnetosphere**. It begins at about 400 miles (600 kms.) above the surface of the earth and extends outward about 40,000 miles (60,000 kms.). The United States National Aeronautics and Space

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2. It is commonly believed that a point is reached in the earth’s atmosphere where the gravitational force of the earth ceases but it has been found that this is not the case and the gravity of the earth never ceases though it goes on decreasing with elevation. It is now known that it extends to about 1,61,000 miles at which point the gravitational force of the moon begins to predominate. See Cooper, op. cit., pp. 411-416.
Administration (N.A.S.A.) announced on January 19, 1962 that the earth was surrounded not by two radiation belts, as had been hitherto believed, but by one large band of radiation named magnetosphere.

Beyond magnetosphere exists a turbulent region about 12,000 miles thick with fluctuating magnetic fields and solar winds, merging into interplanetary space.

The scientific concept of the air space refers to the atmospheric space above the earth and the physical composition of its different sectors. But even after defining the various sectors of the atmosphere, answer to this question is not to be found easily. It is pointed out that the word 'air' possesses no definite meaning and is often used where 'atmosphere' would be more appropriate. The atmosphere of the earth as such has no limit, it gradually goes on thinning till it becomes imperceptible. Moreover, in order

1. The discovery of a belt radiation, subsequently believed by the scientists to consist of two separate belts, was first announced in May 1958 by Dr. James Van Allen as a result of the data obtained from the first two Explorer Satellites. Later, in the same month N.A.S.A. announced another important discovery from the data obtained by the Explorer VIII Satellite launched in November 1960, the existence of a 900 miles thick layer of helium gas in the upper atmosphere beginning at an altitude of 600 miles and extending outward about 1500 miles. See I.D. Sharma, *Outer Space: A Problem in Politics* (Agra: Luxmi Narain Aggarwal, 1964), p. 26. Also see for details, Naugle, op. cit., pp. 57-94.

2. It was announced on the basis of the the data obtained from Satellite Explorer XII launched on August 15, 1961. Ibid.
to determine the upper limit of the atmosphere, many factors are considered by the scientists, each leading to varied heights ranging between a few kilometres above the surface of the earth up to 96,000 kilometres. Further, according to the scientists, about one half of the entire mass of the atmosphere does not go beyond 3.6 miles and 97 percent of it is to be found below 18 miles.

In order to determine the upper limit of the atmosphere, the factors considered by the scientists are: the duration of the twilight which depends on the scattering of the sun’s rays produced by cosmic particles at a very high altitude, the height at which meteors become luminous and the observation of the rays of aurora borealis.

So far as the duration of twilight is concerned, it has been observed that until the sun is about 18 degree below the horizon, which, at a latitude of 54 degrees, indicate the existence of sufficient atmospheric particles to scatter the sun’s light at a height of over 600 kilometres.

1. For example, Fasan arrived at a conclusion that the upper limit of the atmosphere can be in between 80 to 20,000 miles. See Gyula Gal, *Space Law* (Dobbs ferry. N.Y.: Oceana Publication Inc, 1969), p.78; Aaronson believes that the scientifically agreed 'outside' limit of the atmosphere is 60,000 miles (96,000 kms), M. Aaronson, "Space Law", *Legal Problems 1961*, op. cit., p. 225, P.K. Roy also spoke 60,000 miles as the upper limit, Ibid., p. 74, Also see L. Lipson, et al., Ibid., p. 882; Hogan, op. cit., p. 362.

As far as the second factor is concerned, meteors become luminous at about 300 kilometres.

In case of the third factor, the rays of aurora borealis extend up to the height of 1,100 kilometres.¹

However, on the basis of the temperature, pressure and density of the earth's atmosphere at extreme altitudes, the upper limit of the atmosphere was described in a study as:

A limit for the height of a planetary atmosphere may be defined in a number of ways, each according to the concept used and each leading to a difficult result. In fact, if one can imagine an isothermal atmosphere on a non-rotating planet for which there is no variation of gravity with distance, it is found... mathematically at least, that the atmosphere would extend to infinity. If, on the other hand, an atmosphere be maintained with an adiabatic temperature distribution, it is found that gas must have a definite upper limit. If an isothermal atmosphere rotates as a solid with a rotating planet, in which gravity obeys the inverse square law, it is found... that there is a limiting distance where the gravity and centrifugal forces exactly balance producing a minimum in density distribution. For equatorial plane this distance is found to be 21,836 miles above sea level, and this value might be regarded as an indication of the order of magnitude of limiting height of the atmosphere. ²

In view of the preceding data, it seems evident that in science the meaning of the air space is synonymous with the atmospheric space, but the scientists hardly agree on the

¹. Ibid.
². G. Grimminger, quoted in Hogan, op. cit., p. 372.
upper limit of the atmosphere. The reason being that the scientists have used different bases such as pressure, density or temperature for determining the upper limit of the atmosphere; each leading to a difference in altitude, varying with time as well as being different at different altitudes over various points on the earth's surface, ranging from a few kilometres above the earth to infinity.

Like the scientists, there is no unanimity among the scholars of law as to what is the meaning of the concept of the air space, though it has been often used in municipal courts' decisions in dealing with cases involving flyers and land owners. In International Law, the expression 'air space' has been used in international air conventions governing mutual rights of nations to fly over each other's territory. Two such major international conventions are: the Paris Convention of 1919 and the Chicago Convention of 1944. Article 1 of both of these Conventions declares that every state has complete and exclusive sovereignty over the air space above its territory. But no where in the said conventions the air space is defined. However, for the purpose of

1. The Paris Convention 1919, Article 1, "The High Contracting Parties recognise that every Power has complete and exclusive sovereignty over the air space above its territory," The Chicago Convention 1944, Article 1, "The Contracting States recognise that every state has complete and exclusive sovereignty over the air space above its territory."
its functional nature, in international law, attempts have
been made to define the concepts of the air space in terms
of navigable and non-navigable air space.

The concept of the air space can be interpreted after
taking into consideration the close relationship between the
concepts of the 'air space' and the 'aircraft'. This func­
tional approach considers only that part of the space as 'air
space' in the sense of the national laws and international
conventions, which contains enough air to maintain aerody­
namic balloons, helicopters and ordinary airplanes. This
approach holds that 'territorial' air space could be called
'navigable air space' or 'effective air space'. The possible
maximum height of this is about 30-35 kilometres. It is
argued:

The Chicago Convention contains no defi­
nition of the 'air space' but it may
well be argued that, as it was adopted
from the Paris Convention, it deals with
no areas of space after those parts of
the atmosphere where the gaseous air is
sufficiently dense to support balloons
and airplanes. 2

Further, both the said conventions deal only with those
flight instrumentalities which derive support in the atmos­

1. Matte, op. cit., pp. 23-24; H. Oppikofer has called
this zone the "territorial belt" whereas A.N. Zarges in
his aeronautical theory has called it "aeronautic zone".
Ibid.

2. J.C. Cooper, "The Legal Problems of Upper Space", AJIL
Proceedings, 50th Annual Meeting, April 25-28, 1956,
Washington (Washington D.C.: American Society of Inter­
phere from the reactions of the air, such as the balloons or airplanes, and have not dealt with such instrumentalities as rockets, satellites, and other spacecrafts which are designed to move through space without atmospheric support. Moreover, there was no basis on which any rule of customary international law can be applied to such higher regions of atmosphere. Therefore, the Paris and the Chicago Conventions were concerned with aircraft flying in the navigable air space, (the atmosphere which can be used for flights based on the reaction of the air).

The above viewpoint found support from scholars like Lipson and Katzenbach, Schachter, McDoughal, Lasswell, Vlasic and Goedhuis.

1. Ibid.
2. The Paris Convention of 1919, devoted special attention to aircraft in which it is provided, "the word aircraft shall include all machines which can derive support in atmosphere from the reaction of the air like free balloon, captive balloon, airship, glider, kite, airplanes, helicopter, ornithopter... the word 'aircraft' shall comprise all machines which can derive support in the atmosphere from the reaction of the air," See Matte, op. cit., pp. 24-25; similarly, the definition of an aircraft, according to the Chicago Convention, is "Any machine that can derive support in the atmosphere from the reaction of the air other than the reaction of the air surface," The Chicago Convention (1944), Annex 7.
3. The drafters of the Chicago Convention had in mind only 'effective' air when submitting Article 1 to the delegates. See L. Lipson, et al., Legal Problems 1961, op. cit., p. 882 (point 515); "There is reasonably broad consensus of expert opinion that the territorial air space, as mentioned in the Paris and the Chicago Convention, does not extend outside the limits of the atmosp-
The same conclusion, as drawn from the Paris and the Chicago Conventions, can be found in some national legislative acts in which the concept of a navigable air space seems inherent even if it is not expressly mentioned.\footnote{...here contributing to the life or support of aircraft.}

This approach is considered important for three reasons; firstly, the national law and the international conventions reveal that the term 'air space' (atmospheric space) is used with reference to that space which is navigable; secondly, it avoids uncertainty in the determination of the upper limit of state sovereignty; and finally, according to this approach, the limit of the national sovereignty is set at a reasonably low height to regulate atmospheric layer covering its territory.\footnote{For example Peru had, in 1921, prescribed three kilometres as boundary of its territorial air space and declared the air space above this height as free. See B. Cheng, \textit{The Law of International Air Transport} (London: Stevens and Sons Ltd., 1962), p. 120; similar provisions were contained in the Air Navigation Orders of Estonia and Lativa; Section 8 of Decree on Air Navigation of Estonia of May 20, 1926, and section 28 of the Law on Air Traffic of Lativa of June 7, 1926 prescribed a limit of 2.5 kilometres, quoted in Matte, op. cit., p. 26.}

\footnote{Matte, Ibid., p.24
However, the above viewpoint, that both the Paris and the Chicago Conventions could be used to determine the upper limit of the air space, is not shared by many. Roy observes:

> If one were to construe the expression 'air space' one might first inquire as to the understanding which existed as to the air space among the delegates at Chicago who drew up this Convention, one would have to fall back upon the ordinary dictionary or scientific meaning of the word air space and in that instance you would find it to extend to a height of 60,000 miles above the surface of the globe...1

It is also expressed that Article 1 of the Chicago Convention was of no significance so far as the determination of upper limit of the state's sovereignty in the air is concerned.2

Horseford, referring to the above conventions, said that these regulations are not only inadequate but largely inapplicable to the new and vast medium into which our studies are directed.3 Similarly, Shawcross and Beaumont are of the opinion:

> according to Article 1 of the Chicago Convention, every state has 'complete and exclusive' sovereignty over the air

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space of its territory. But nowhere in the Convention the air space is defined. It may be pointed out that the terms 'complete' and 'exclusive' in the Convention are repetitions and mean one and the same thing and that an international tribunal would interpret 'complete' as meaning —'without limit', and therefore, there is no limit of height. 1

It may be seen that the above analysed interpretation may help to define aircraft, but the air space is not limited to the use of aircraft since it includes all space where any whisp of air is found, even if it is insufficient to give support to an aircraft.

The air space may be construed to extend further upward to include all areas where the atmosphere is sufficiently dense to contribute in any degree to aerodynamic lift, or even higher to include all areas where the atmosphere is sufficiently dense to prevent a satellite's orbit.2 This space can be termed as non-navigable air space. On the basis of non-navigable air space, the upper limit of the air space is placed up to 70 kilometres because there is sufficient air up to this height to carry out the glide of winged rockets returning to the earth. Major White of the U.S. Air Force suggested in 1962, that it would be practical to consider 50 miles above the altitude as boundary, because firstly, it is well above the altitude where aerodynamic lift is genera-

2. Cooper, op. cit., p. 428
ted to control a vehicle; secondly, above this altitude even at speed approaching satellite velocities, much of a vehicle's capabilities are received from dynamic lift compared to aerodynamic lift; and thirdly, at 50 mile-altitude the density is such a small fraction of one percent of the atmosphere that it should be acceptable to consider that all useful qualities of the atmosphere are below that level.¹

In the same year in the Draft Code of the David Davis Institute, London, the 'air space' was defined as "the volume of space between the surface of the earth at the sea level and an altitude of 80,000 metres above it."² This definition is based on the lower effective limit of the perigee of an artificial satellite. It was recognised that the lower effective limit of perigee was in the region of the altitude of 100 miles, since below that the life of the satellite was too short to be useful. It was possible that an altitude of about 70 miles would be the limit for effective orbiting, in as much below that friction would become too great.

However, three considerations which favoured a definition of the air space yielding a more extended sovereignty


than 25 miles were recalled: first, the fact that the air space begins to lose its character as continuous medium only when a height of 50-55 miles is reached; second, the likely range of effective control of objects from the ground; and third, the logic of the frontier between the air space and the outer space as being at or near orbiting altitude. ¹

In the final sentence the authors of the said Document admit that any particular altitude chosen as the limit of national sovereignty over the air space might appear arbitrary and controversial, but for the avoidance of excessive claims and in view of the above mentioned considerations the relatively low altitude of about 50 miles is suggested. ²

It is evident from the above discussion that the interpretation of the 'air space' in terms of navigable and non-navigable air space has some relevance from its functional point of view. But the altitude (50-70 miles) which it suggests as the upper limit of the air space is yet to find a place in formal international agreement.

Like the air space, the outer space too, has no definition which is universally accepted in scientific or legal terms. However, attempts have been made both in science and law to explain the meaning of the concept of the 'outer

1. Ibid.
2. Ibid.
In science the outer space is generally understood as the point of the universe lying outside the limits of the earth's atmosphere. But the scientists do not agree with regard to the upper limit of the atmosphere. Moreover, there is also no accepted terminology for the regions beyond the atmosphere.

As stated earlier, even after defining various layers of the earth's atmosphere and higher regions beyond the atmosphere, the question remains unsolved, as to what is the limit of the atmosphere. According to the scientists a series of heights ranging from a few kilometres to several thousand kilometres each purportedly based on the limit of the atmosphere, or lack thereof, have been proposed, indicating the difficulty of a definition merely based on height. For the region between the atmosphere and the outer space also a number of terms have been used by the scientists some of which are 'aeropause', 'prespace', 'pseudo-atmosphere' etc.

In regard to the area beyond the atmosphere, some other terms have also been used to refer to outer space as 'cosmic space', 'extra territorial space', 'interstellar space', 'extra atmospheric space', 'upper space', 'outer space' and so on. Some of these terms are scientific, while others are

2. See Supra, note 1, p. 25.
not.1

Schachter refers to the area as outer space which lies above the area which has the atmospheric elements necessary to "lift an aircraft" and below the regions of moon and other heavenly bodies.2 Jacobini holds:

the term 'extra-territorium space' should be used in a strict sense 'to designate the area beyond the limit of national sovereignty, and points out, that the expression 'outer space', though used by Schachter in the sense of extra-territorium space, would seem to be more applicable to the section of space which falls beyond the limit of earth's attraction. 3

Danier proposes 1,000 kms, as a point of division between the air space and the outer space, but describes the lower region as the 'terrestrial atmosphere stratum' and the upper region as 'cosmic space'.4

Hogan has suggested three terms for the upper regions beyond the earth's atmosphere. These terms based on nomenclature of astronomy can also be used in law.5 The first term such as Solar space (Interplanetary Space) applies to the

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3. Jacobini, op. cit., p. 681. Also see Hogan op. cit., p. 373.

4. Quoted in Hogan, op. cit., p. 373.

5. Ibid. p. 374.
sun and those bodies which revolve around it. In law this term would refer to the area of the 'Solar System' as understood in astronomy. The suggested areas which might be important from the legal point of view are the orbit of the moon which has an average radius of about 2,38,000 miles and the ecliptic that is, the orbit of the earth around the sun. The term falling under the category **Galactic space** (interstellar space) applies to the system of the 'Milky Way'. Just as the earth and the other planets are a part of the planetary system of the sun, so the sun and many thousand million other stars are a part of the galactic system. This system is spiral in form, and its diameter is about 1,00,000 light years. According to Hogan, this term in law would refer to the areas beyond the solar space and would apply to the whole of area which is described in astronomy as the 'galactic system'. The vast spaces intervening between the stars which make up the 'galactic system', and those spaces which are not entirely empty, but contain dust and gas, are known as 'interstellar space' in astronomy. And yet another term, **Extragalactic space**, in law, would apply to the entire region beyond the one included in the galactic system.\(^1\)

It may be inferred that in science the area beyond the atmosphere is considered synonymous with outer space. But there is no consensus upon the upper limit of the atmosphe-

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1. Ibid., p. 375.
ric space. There is also no accepted terminology for the regions beyond the atmosphere as well, making it difficult to comprehend the concept of the outer space in scientific field.

In International Law some scholars started using the expression 'outer space' to denote the 'entire space' beyond which the subjacent State exercises 'complete' and 'exclusive' control, no matter whether it starts from within or above the atmosphere. However, it was only after the United Nations General Assembly had unanimously passed the resolutions on establishing the Ad Hoc Committee on the Peaceful Uses of Outer space in 1958, and the present 'Committee on Peaceful Uses of Outer Space' (COPUOS), as a permanent body in 1959, that the term 'outer space' began to appear frequently and to be used officially.

In aerospace law a wide variety of definitions of the outer space has been offered. These definitions are 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 and each having an infinite number of variations. One of the complete reviews of the literature suggests that these proposals for the purpose of defining outer space are: i) Line based on the concept of atmosphere; ii) Line based on the aerodynamic lift; iii) Von Karman line; iv) Line based on the earth's gravitation; v) Line based on the lowest perigee of
The major problem with all the above proposals is that no proposal sets well-defined and unchanging line, and each is subject to change with advance in science.

Though there has been no general agreement, developments in the recent years show that there is a trend to accept the criterion of lowest perigee at which space objects are still able to continue effectively in their orbiting round around the earth for a longer period of time as the basis for the lowest limit of outer space.

On the basis of the state practice during the last thirty years a great majority of space law scholars believe that a customary law rule has gradually emerged according to which the inner limit of the outer space lies at the lowest effective perigee of an artificial satellite.  

Moreover, the above said criterion as a basis for defining and delimiting the outer space is supported by the major-

1. A detailed and critical analysis of these proposals has been made in Chapter V of this study. See Chapter V, pp. 163-195.

2. For a detailed discussion see Ibid., pp. 231-237.
rity of the states represented before the COPUOS and its Legal Sub-Committee in the United Nations.¹ Now majority of the states consider the area beyond lowest effective perigee of space objects as the 'outer space'. This is subject to a considerable support on the basis that the states accept artificial satellites orbiting round around the earth as being in the outer space, and to accept a higher limit would require excluding from the outer space, a significant portion of activities currently taking place including those with highly practical results.² Indeed, the lowest perigee of artificial earth satellites is and will remain constant for many years to come, not withstanding the rapid progress in space technology.³ Such criterion meets the requirements of the suitable applicability because the measuring of distance of any object in space can be made quickly with equipment which is not exceedingly expensive. Further, the space objects themselves could, in principle, make such determinations.⁴

1. For details see Ibid., pp. 222-230.
In order to determine the exact height of the lowest perigee several studies are available. In a thorough paper, titled "Study of Altitudes of Artificial Earth Satellites" prepared on the request of the COPUOS by the Working Group I of the Committee on Space Research (COSPAR), it is concluded that the lowest atmospherical depth to which an artificial satellite of the earth has penetrated is, with good precision, the height of 90 kilometres.¹

On the basis of past experience with satellites launched into the orbit, it is sufficiently comprehensive to suggest a specific region between 90 and 100 kms altitude which has the property that almost all satellite orbits lie above it.² Moreover, during the recent years, various proposals for setting the lower limit of the outer space at an altitude of 90 and 100 kms put forward in the Legal Sub-Committee of the COPUOS have received support from the majority of the states represented in the COPUOS and also from the scholars of space law.³

The proposal of demarcating the lower limit of the outer space at an altitude of 90/110 kilometres seems to have gained ground. Yet it lacks consensus because countries like the United States, the United Kingdom and the Federal Repub-

2. Perek, op. cit., p. 123.
3. For a detailed discussion see Chapter V, pp. 222-228.
lic of Germany have firmly opposed it. Some scholars of aerospace law have also disfavoured such a proposal because they feel that time for it is not yet ripe, and the lack of definition has hardly caused any problem.

It is evident that the problem of the legal definition of the concept of the outer space is quite knotty and remains unsolved. Perhaps, the most important reason for this is that all the states have agreed neither on a particular criterion for the definition of the outer space, nor on the necessity to adopt such a definition, at least, for the present time. Moreover, the international community is in the stage of stating opinions and it may take more time to formulate common elements in various opinions. The lack of communication gap between the experts in aerospace law and the scientists working in relevant areas such as geophysics and astronomy can be considered another hurdle in the way of arriving at a commonly acceptable definition of the outer space.

On the basis of above discussion, it may be inferred that concepts of the 'air space' and the 'outer space' have no accepted definitions both in science and law. The problem of defining these concepts is quite tedious. However, from the foregoing discussion the following conclusions regarding

1. Ibid., pp. 228-239.
2. Ibid., pp. 213-216.
the meaning of the concepts of the air space and the outer space may be drawn:

The scientific meaning of the 'air space' is synonymous with that of the atmospheric space, but the scientists differ on the upper limit of the atmosphere. The 'air space', in international law, is synonymous with 'space' above the territory of a state, i.e. territorial air space.

There is no formal agreement among the states about the upper limit of the air space. It is assumed on the basis of its functional nature and various airlaw instruments that the air space includes at least entire area above the territory of a state, where atmosphere is sufficiently dense to contribute, to any degree, to the aerodynamic lift.

In spite of the fact that there is no consensus on the upper limit of the territorial air space on the basis of the attitude of the majority of the states, it is assumed that there exists a tacit understanding that the air space does not include the region beyond the lowest effective perigee of space objects at which these objects are able to continue effectively in their orbiting round around the earth for a larger period of time.

It is true that there is no agreed limit at which the outer space begins but majority of the states and the space law scholars agree that 'orbiting' space objects are 'in' outer space.