The sky's the limit? Establishing a legal delimitation of airspace and outer space

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Establishing a Legal Delimitation of Airspace and Outer Space

By

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'Man hath weaved out a net, and this net throwne upon the Heavens, and now they are his own.'

John Donne (1572-1631)

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a) Acknowledgements

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b) Abstract

The Sky's the Limit? Establishing a legal Delimitation of Airspace and Outer Space

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The debate over the legal delimitation between air and space has been argued for over half a century. In representing the positions of those concerned one can show the need for a boundary between airspace and outer space. This research seeks to examine all of the theories and approaches that have been proposed and explain the advantages and drawbacks of each. It takes note of the factors affecting the establishment of such a boundary, and why such considerations make delimitation a political, social, security and legal requirement.

c) The Garden World

Imagine a courtyard of gardens, enclosed from the universe and the pride of their owners, Colonel Sanders-States, Russ Federation, China Lee and Nig Eria[1]. The gardens occupy four quarters of the space and have a common path that intersects the gardens and allows movement to the other gardens[2]. Only Russ and China are adjoining without a divide and through the years have generally been good friends. In the past there have been arguments between Colonel Sanders and Russ Federation involving differences of opinion, shouting and occasionally throwing vegetables and as such they have built high fences[3]. As Russ and China are friends they have only planted bushes between their gardens. Nig Eria is the poorer of the community members and as such doesn't have a built up boundary. Although the members have had their disagreements, the United Neighbours[4] forum has allowed the group to resolve most of their problems before. There has been a status quo for many years and a cordial relationship has meant the group have been able to trade gardening tips and even have garden parties[5].

Several decades ago both Colonel Sanders and Russ had been the most competitive in their gardening, seeking the most creative challenges. Russ had planted a Spunik tree and it had grown well above the fences. Colonel Sanders in reply had grown a Moonkey tree that had risen over the rooftops. At the time there was some hysteria over the competition and ever since the Colonel's tree has dominated the courtyard[6]. As well as being the biggest tree, it offered an excellent platform to spy on his neighbours. Russ could tolerate this as long as the Colonel didn't affect his gardening or interfere with his tree above. One of the main reasons why he has not objected is due to his control of problems in his own back yard and the threat of being overwhelmed by the de Mocracy plant (originally from seeds sown by Colonel Sanders!)[7]. There has been some friction as Nig Eria has claimed that as the phone lines uniquely cross over his garden then the others should pay him for the privilege: the other neighbours dispute this[8].

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[1] Insert the United States, Russia, China and Nigeria
[2] International 'passageways' e.g. the high seas and international airspace
[3] Reference to the Cold War and advancement of air law, defence and technology
[4] Obviously the United Nations
[5] Conferences
[6] In regard to the Space Race and the dominance shown through US spending and technology as the remaining superpower
[7] The fall of communism and the emergence of democracy and capitalism
[8] Replace with the Geostationary orbit and the Bogata Declaration

In recent years the space above the gardens has been getting crowded, with China planting her own tree and both the Colonel and Russ' trees overhanging the others gardens[9]. Colonel Sanders-States has built a tree house in which he can observe the stars but also can *easily* see all of the other gardens. He has plans to expand his tree house to become a 'hotel in the sky' for guests[10]. Russ resents the Colonel's achievements and desires parity like there was in the past. Moreover, Colonel Sanders has said in order to block out the noise and stop the missiles thrown by the 'rogues' who have terrorised the neighbourhood he is going to build an over-arching glass greenhouse. This invisible wall will protect his garden, the community alleys and any garden that wants to be shielded[11]. For Russ and China this is a step too far. They believe that the 'missile shield' is in fact being built to block them out and as such have protested at the United Neighbours. They have also warned that instead of throwing vegetables, they will throw rocks to break the shield and have begun to plan on how to stop or even destroy Colonel Sanders invisible wall and 'Eye in the Sky'[12]. In order to build the greenhouse, Colonel Sanders has withdrawn from an agreement that aimed to prevent community aggression and prohibits the building of New Un-Certified Schemes[13]. With the development of star tourism and the invisible shield in the community there have been calls for the boundaries above the fences to be established. The Garden World is again becoming dangerously sensitive and competitive with the status quo being broken. Without delimitation of the member's skyward boundaries and commencement of their responsibilities to the community the blur and intertwining of their lofty branches will undoubtedly lead to further tension and even conflict.

[9] The increasing number of space faring nations, particularly with the spread of globalisation and the development of nations such as China

[10] In relation to Space Tourism, the plans for an outer space 'hotel' and the recent private space flights

[11] The protection is the 'Son of Star Wars' ballistic missile defence systems

[12] Development of anti-satellite weaponry and advanced systems to counter missile defence

[13] The US withdrawal from missile treaty

The Sky's the Limit?

Establishing a Legal Delimitation of Airspace and Outer Space

And now 'tis man who dares assault the sky . . .
And as we come to claim our promised place,
Aim only to repay the good you gave,
And warm with human love the chill of space.

Prof. Thomas G. Bergin,
Yale University, 'Space Prober.'[1]

a) Introduction

Fifty years ago, at the dawn of space travel in 1957, the definition and delimitation of airspace and outer space became for many commentators "the central, even crucial, issue of public order of outer space."[2] In a post-war nuclear and highly tense global arena, this new frontier had to be organised to forgo confusion and possible conflict. Historically, international law had developed on land and at sea to best reflect the social, political and military climate of the era; traditionally extending the dominance of the State. Even the emergence of air law had developed thorough numerous bilateral and multilateral conventions, particularly the Chicago Convention on International Civil Aviation (1944)[3], to further the individual State's reach. Space technology offered hope to a new age of humanity but also could help lead to its destruction. Could outer space be new property for States and the battleground of the near future or be a platform for human development?

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[1] This was the first poem to be launched into orbit about the Earth. It was inscribed on the instrument panel of a satellite called Traac launched from Cape Kennedy on November 15, 1961
[2] M.S. McDougal, H. Lasswell, I. Vlasik, *Law and Public Order in Space,* Yale University Press, New Haven (1963), at 323, in N. Grief, *Public International Law in the Airspace of the High Seas* (1994) Utrecht Studies in Air and Space Law, Martinus Nijoff Publishers, The Netherlands, at 37
[3] 78.U.K.T.S. 8 1953 Cmd 8742; UNTS 295. Article 1 reads, 'The contracting States recognize that every State has complete and exclusive sovereignty over the airspace above its territory'.

In reality the simmering space pan has not yet boiled over but has in fact generally had long periods of cool stagnation. In 1967 technical experts arrived at the conclusion that at that time 'no scientific and technical criteria could be found which would permit a precise and lasting definition of outer space'[4] and which would be acceptable to all states. Since that point there has been consistent debate but little consensus on defining Outer Space and thus the separation between it and Earth.

However, the space frontier has made great leaps forward technologically and has occasionally heated up legally through agreements such as the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Borders (1967)[5] and the Agreement Governing the Activities of States on the Moon and other Celestial Bodies (1979).[6] Instead of adopting the view expressed in the ancient Roman maxim Cujus est solum ejus usque ad coelum et ad inferos, the international community, at the dawn of this 'new age', attempted to set the foundations for a more egalitarian and international legal platform[7]. Crucially, for example, in contrast to the fact that 'airspace is that part of space subject to the sovereignty of a state'[8], the governing of space law has developed the concepts of 'province of mankind' and 'Common heritage of Mankind', thereby establishing outer space as an international public utility.[9] Nevertheless, as Oduntan notes, similar to the responsibility of nations to their ships on the sea[10], the concept of jurisdiction (ratione instrumenti and ratione personnae) applies to outer

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[4] In the early work at the UN Committee on the Peaceful Uses of Outer Space the delegate from the USSR UN Doc. A/AC.105/39 of September, 6 1967, at 7

[5] Also known as the Space Treaty. 18 UST 2410, 610, U.N.T.S. 205. See Appendix Outer Space Treaty 1967

[6] Also known as the Moon Treaty or Moon Agreement. G.A. Res. 34/68, U.N. GAOR, 34th Sess. Supp. No. 46 at 77, U.N. Doc. A/34/664 (1979)

[7] Whether space is indeed an egalitarian platform for all is not the main topic of this chapter but it is a reason for the need for delimitation. See the No Change Approach arguments below.

[8] Seara Vazquez, *Cosmic International Law*, Wayne State University Press, Detroit (1985) at 27

[9] Article 1 of the Space Treaty (1967) states that the exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind. Article 11 (1) of the Moon Agreement (1979) also provides that 'The moon and its natural resources are the common heritage of mankind'. G. Oduntan, 'The Never Ending Dispute: Legal Theories on the Spatial Demarcation Boundary Plane between Airspace and Outer Space', *Hertfordshire Law Journal* 1 (2003) (2), at 64–84, originally from *Sovereignty & Jurisdiction in the Airspace & Outer Space: Legal Criteria for Spatial Delimitation*, University of Kent (2002)

[10] In fact the responsibility of States goes further in space. The fundamental difference in space law compared to the law of the sea and the law of the air, where the countries are 'responsible' and 'liable' for the space activities of their nationals (persons, companies etc.) While for private ships and planes states exercise a supervisory role (responsibility) and do not generally accept the financial risk (liability), for commercial spacecraft and launch vehicle governments have both supervisory and financial responsibility. This obviously has an effect on the development of private enterprise with states exercising caution and control over projects that could cause serious financial burdens. It also emphasises the state centric history of space travel.

space and is recognised 'in the entire legal framework for regulation of man's activity wherever it occurs in the entire universe'[11]. Even though States face such responsibility for their activities, they do not know where their sovereign territory ends and their international obligations begin. This fundamental difference of national versus community has been at the crux of the space debate and the reason why delimitation is ultimately necessary.

Unfortunately 'there is no universally agreed precise legal, technical or political definition of either the boundaries separating airspace from outer space or of the term outer space itself.'[12] The range of proposals has been extensive as the time the problem has been discussed yet there have been two prevailing schools of thought on how the question of delimitation should be answered. Firstly, the *functional* approach is based primarily on the character and category of individual space activities. Their starting point is the denial of a physical division between airspace and outer space, and the assertion that air and space belong to the same medium.[13] Activities *for* air and space are distinct and as such should be regulated by their own laws, irrespective of the altitude at which they are performed. Therefore space law should govern space activities and operations; even, for example, from the moment they leave the Earth's surface. This approach should clearly obviate the need for a definition or delimitation of airspace and outer space.

The *spatial* approach attempts to establish a lower boundary of outer space. As to the altitude of such a demarcation no less than eight possible criteria have been identified in the two background papers prepared by the Secretariat of the UNCOPOUS[14] Legal Subcommittee in 1970 and 1977[15]. They were listed as follows:

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[11] Examples of such provisions include, Article 8 of the Space Treaty (1967), which states that a state party on whose registry an object launched into outer space is carried shall retain jurisdiction and control over it. Article 12 (1) of the Moon Agreement confers jurisdiction and control over astronauts who are nationals of the sending state and Article VIII of the Space Treaty (1967) also confers jurisdiction on the state of registry irrespective of the nationality of all persons aboard the space vehicle. Further pertinent provisions on this issue are found in the Agreement on the Return of Objects launched in to Outer Space (1968) (Also known as the Astronaut Agreement or Rescue Agreement. U.K.T.S. 56 (1969), Cmnd. 3997; (1969) 63 A.J.I.L. 382. In force 1968. 86 parties, including the five permanent members of the Security Council); Convention on International Liability for Damage caused by space Objects (1972) (Also known as the Liability Convention. U.K.T.S. 16 (1974), Cmnd. 5551; 961 U.N.T.S. 187; 10 I.L.M. 965. In force 1973 76 parties, including the five permanent members of the Security Council); (g) Convention on Registration of Objects Launched into Outer Space (1975) (Also known as the Registration Convention. UNTS 187; 14 ILM 43; UKTS 70 (1978); In force 1976 39 parties including the five permanent members of the Security Council). G. Oduntan, Supra note 9

[12] The Minister of State, FCO, Hansard, H.C., Vol. 546 W.A. 66, July 23, 1993.

[13] N.M. Matte, *Aerospace Law*, Sweet & Maxwell, Carswell (1969) at 62 in Grief, Supra note 2 at 39

[14] United Nations Committee On the Peaceful Uses of Outer Space, the main international forum for the development of international law and principles governing outer space. Established in 1959 by the UN General Assembly under Res. 1472 (XIV) with the main purpose to review the scope of

1. Demarcation based upon the equation of the upper limit of sovereignty with the concept of 'atmosphere'
2. Demarcation based on the division of atmosphere into layers
3. Demarcation based on the maximum altitude of aircraft flight (theory of navigable space
4. Demarcation based on the aerodynamic characteristics of flight instrumentalities (von Karman line)
5. Demarcation according to the lowest perigree of an orbiting satellite
6. Demarcation based upon the Earth's gravitational effects
7. Demarcation based on effective control
8. Demarcation based on the division of space into zones[16].

Generally, the spatial approach has attracted the most attention in addressing the problem of regulating space (and defining the limits of airspace). As establishing a boundary is the traditional method of solving and delimiting differing regimes it equally invites the most debate over where a frontier should be set and what factors should be taken into account. Currently the prevailing, but not definitive, criterion is the demarcation according to the lowest perigree of an orbiting satellite. Estimates vary as to precisely where the lowest perigree is, but the lowest orbit achieved to date appears to be about 90 kilometres (56.25 miles) above the Earth.[17] This boundary is not yet legally binding however and is simply used as a general reference point. If the problem of delimitation is to be finally resolved in the face of a new space age then *all* of the criteria need serious consideration and justification for the benefit of the international community against the self-interest of individual states.

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international cooperation in peaceful uses of outer space. For more information visit www.unoosa.org

[15] The *Question of the Definition/Delimitation of Outer Space*, Background paper prepared by the Secretariat, UN Doc. A/AC.105/C.2/7 of May 7, 1970 and Addendum A/AC./C.2/7/Add.1 of January 21, 1977

[16] Information from Marietta Benko (Ed.) and William de Graaff (in cooperation with) *Forum for Air and Space Law, Vol 1, International Space Law in the Making: Current Issues in the UN Committee on the Peaceful Uses of Outer Space*, Marietta Benko and Kai-Uwe Schrogl, Editions Frontieres, France (1993) at 126

[17] P. Meredith, 'The Legality of High-technology Missile Defence System', *American Journal of International Law*, vol.78 (1984) at 423 and J.E.S. Fawcett, *International Law and Uses of Outer Space*, Manchester University Press, Dobbs Ferry, Oceana Publications Inc. (1968), at 23 to 24. Although advances in technology have reduced the perigree of satellites, there is a point below that they cannot remain in orbit. See N. Grief, Supra note 2

There has generally been a common, although not universal, assumption that there will be a necessary definition eventually but with little drive to alter the lightly regulated status quo. For example, in 1959 Jessup and Taubenfeld[18] assumed a vertical air space limit to territorial sovereignty would be agreed at some point and theorised that eventual practical necessities would lead to its definition[19]. For the past *fifty* years there has been hesitation as to what these necessities are and whether they have been met. The prevailing criteria have been linked to the advancement of science and technology and the subsequent need for parameters. For example, as Cheng states, if commercial space flights were to develop it would be essential to define the boundary between airspace and outer space.[20] Space tourism has already begun with, for example, the opportunity to visit the International Space Station like the businessman Denis Tito's pioneering trip in 2001[21]. Importantly, if the much feared active militarisation of space threatened the security of nations or its interests, would it be more beneficial to world peace to set the boundaries of airspace and outer space to clarify the responsibilities, and limits, of States? See the development of the Strategic Defence Initiative, the new ballistic missile defence system, 'the Son of Star Wars', and the production of Anti Satellite weaponry. Like half a century ago the central and crucial issue facing the international community in outer space is the delimitation of 'sovereign' airspace and 'common' space. This thesis argues that not only have the necessities now been realised, but also the point at which delimitation needs to be addressed has passed. The research will seek to examine the information and present the arguments on the lines of the *three* main approaches: No Present Need Approach, the necessity for change: The Functional Approach, a conclusive rejection, and: The Spatial Approach, establishing the options for delimitation.

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[18] P.C. Jessup and H.J. Taubenfeld, *Controls for Outer Space and the Antarctic Analogy*, Columbia University, New York (1959)

[19] See Alexandra Harris and Ray Harris *Space Policy*, Volume 22, Issue 1, February 2006, Pages 3-7

[20] Cheng, "The Commercial Development of Space: The Need for New Treaties", *Journal of Space Law*, vol. 19 (1991), at 24

[21] As of 2007, Space tourism opportunities are limited and expensive, with only the Russian Space Agency currently providing transport. The price for a flight brokered by Space Adventures to the International Space Station aboard a Soyuz spacecraft is now $30 million. Flights are booked until 2009. However, with the development of sub-orbital flights such as Virgin Galactic's SpaceShipOne and the possibilty of commercial flights before the end of the decade at hundreds of thousands instead of millions, the availability of space flight is widening.

I) The No Change Approach

There is a school of thought that believes that an attempt to delimit air and space is unnecessary and even futile. The deficiency of a boundary has not led to any major international disputes so why is there such an urgency to regulate gratuitously? If a boundary *was* disputed and agreement attempted now many factors would lead to its failure: Delimitation now would be premature and probably counterproductive, as the advance of space technology has drawn as many questions as it has answered. Not only do we not have enough information to set a truly informed boundary, but also any attempt to do so could hinder any future developments; you would be caging the bird before it could fly. Furthermore, if a boundary is set now, it may easily be too high or too low for our ignorance and incompetence and would undoubtedly lead to boundary disputes and counter claims over jurisdiction in the future[1]. Even if a boundary were required it would be better left to when the international community is better prepared and technology more advanced[2].

Against the No Change Approach is the movement for an uprising in Space Law. If there once was a conservative attitude towards delimitation it cannot be justified in the face of developments in technology and thought. There is still a difference in legal regimes operating in airspace and outer space and the increasing use of outer space requires clarity of the law through demarcation. Moreover, the threat of increasing militarisation of space and the distinct possibility of its weaponisation dictates that States should be securely capped, with limits set for security of nations and the safety of the international community. The advance of space tourism indicates the rise of commercial enterprise in space. Space has become a village green which is for the benefit of all but is being exploited by those who have space power; the rich 'governors' and 'councillors' who have access to the garden gates. Establishing a boundary would limit the jurisdictional reach of the State and secure space for all mankind. There is a growing revolution in space technology, military doctrines and attitudes towards space. Delimitation would not simply answer the never-ending dispute but allow the law to keep pace with the revolution. This section is divided into the main arguments pro and contra delimitation examining the caution towards change and the requirement for it. The debate is divided thus:

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[1] As has happened in relation to the definition and delimitation of territorial waters and the high seas in the law of the sea.

[2] Implicit in this viewpoint, there is an expectation that a calculated delay would lead to an agreement with a boundary at a lower altitude, with States not grasping now and thinking later.

a) Reasons not to change

1. *If it isn't broken, don't fix it* – The lack of definite agreement has not led to practical problems and is unlikely to do so. As there is no real problem then any interference is unnecessary.

2. *Wait and See* – The technological and scientific understanding is not yet ready to provide a lasting demarcation.

3. *Race for Space* – If the debate was opened now it would become a quagmire of various conflicting claims.

4. *The Thin Blue Line* – The upper limit of the atmosphere does not have a marked boundary and any legal delimitation would either be an indistinguishable altitude to most or simply an arbitrarily chosen line.

b) Reasons to change

1. *Certainty* – There is a demand to highlight the divide between the sovereign and the common.

2. *Safety* – The recent developments in military technology and the shift in attitudes over 'defence' have led to fears over a new arms race.

3. *For the benefit of all mankind* - Space is meant to be the final frontier for humanity, great pioneers and the 'common heritage' of all.

4. *Revolutions* – Space has experienced a commercial and technological revolution, particularly with the dawn of space tourism.

Space is no longer simply in the fantasy world with the very exceptional few being affected by its activities: Space technology is part of everyday life. The regulation of space is becoming ever more urgent and instead of apathy and against the resolute stance of some space powers there is increasing acceptance of the need for delimitation[3]. Instead of waiting another fifty years to take action the beginning of this space enfranchisement offers the best opportunity to debate the never-ending debate.

A) Reasons not to change

1. If it isn't broken, don't fix it

One of the main arguments of the No Change Approach is the fact that there have been no serious problems without such a demarcation between airspace and outer space. The outlook has been that aircraft and spacecraft have operated in two separate spheres with no real conflict. For example, the view of the United Kingdom has been that delimitation would make no difference to the exercise of sovereign rights by most States, since the lowest height at which satellites can orbit the earth is at least twice the maximum altitude at which the most sophisticated aircraft can fly; and at present effective control can only be exercised up to a relatively low altitudes.[4] The law governing outer space is satisfactory and can deal with the advances in that have been made[5]. Furthermore, if there was a legal boundary it 'might fetter Space activities or needlessly interfere with the existing regime of international aviation'.[6]

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[3] e.g. incorporation of 'outer space' in national laws

[4] *British Yearbook of International Law*, vol.55 (1984), at 564, UKMIL 1984, Part Ten:III. Also see M. Akehurst, A *Modern Introduction to International Law*, 6th ed George Allen & Unwin, London (1987), at 200. See N. Grief, *Public International Law in the Airspace of the High Seas*, Utrecht Studies in Air and Space Law, Martinus Nijoff Publishers, The Netherlands (1994) from 37

[5] Meishan has noted that space commercialisation has brought many 'crucial changes in the relations between the international community, national governments and private entities'. The product of commercialisation could compel changes in public and private relationships. From one angle these relationships can help in the 'formulation of practically applicable legal principles'. However, when reviewing any law there is always the possibility of losing the ethos and purpose of the legislation. Meishan argues that the best way around this risk is to leave the existing treaties as they are and instead enact a series of protocols to complement the law and allow progression when it is necessary. Galloway, E., Guidelines for the Review and Formulation of Outer Space Treaties (1998) 41st Coll. Proc. Law of Outer Space at 245-249. See G. Meishan 'Keeping the Peace in Outer Space: A Legal Framework for the Prohibition of the Use of Force' *Space Policy* Vol. 20 Issue 4, Nov. 2004 at 259-278

[6] Jerome Morenoff, *World Peace Through Space Law* Michie Co. Charlottesville (1967) at 1.

The argument is potent in its assessment of past history but simply because something has not yet happened does not mean that it never will. Traditionally spacecraft exclusively operated in outer space and had modest impact on States so delimitation of outer space was not necessarily urgent. It was assumed that a customary law was developing whereby any object in orbit was in space and that was enough for the time being[7]. However, with the development of what can best be described as 'hybrid' spacecraft[8] for space tourism, the fallacy that the two spheres are completely distinct has been dismissed. The current system has not led to problems in the past but the new age of technology will cause problems in the near future.

2. *Wait and See*

Linked to the fact that the current status quo has had no real problems is the cautious attitude that waiting until a future date would be more prudent and advantageous to all. A later agreement would be more beneficial as it would probably set delimitation at a lower altitude when more scientific and technological data is known and would allow proven considerations on problems such as passage rights. If there is no boundary States and organisations could be forced to work together and resolve such problems as and when they are needed. There is also the view that delimitation is a political and not a legal issue, as the main problem with the lack of definition is that national territories are not defined. Although there will be a need for delimitation, for now, '...it is not of crucial importance'.[9]

Firstly, it can be acknowledged that our knowledge of the atmosphere, airspace and outer space will undoubtedly increase in years to come. Our understanding of the world above is miraculous in comparison to fifty years ago. In fifty years time again discoveries and research will have transformed our perspective. The main question then is, can humanity afford to wait that long? The caution of the international community is the fear of failure and the unknown. The international community needs to face its fears: Delimitation cannot be delayed any longer.

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[7] G.H. Reynolds and R.P. Merges, *Outer space: Problems of Law and Policy*, Westview Press, Boulder (1989) at 349. See Alexandra Harris and Ray Harris *Space Policy*, Volume 22, Issue 1, February 2006, at 3-7

[8] Sub-orbital 'Spacecraft' such as SpaceShipOne and its commercial tourism descendants will have aerospace and space qualities in its flights. See Appendix SpaceShipOne. Also note that craft with a longer history such as the US Space Shuttle 'glide' home.

[9] Bruce Hurwitz, *The Legality of International Air Transport*, Holland (1986) at 31

The point that States would be forced to work together is compelling as necessity would dictate cooperation, or dominance. The optimist would believe that this could lead to greater international harmony whilst the critic would be more sceptical. This 'necessity' to cooperate could be like putting arguing children in a room to resolve their issues. Traditionally, the bully would persevere. An inclusive internationally accepted agreement on delimitation sooner rather than later would settle the law rather than leave it open.

As Goedhart notes, several authors have taken the position that the answer to the demarcation problem is primarily a political issue and that probably the answer lies in the political field with the law only rendering the possibility of assisting in the formulation of a solution.[10] Of course legal codification or delimitation will reflect the political will of its directors and any such debate will be entwined with political, social, scientific, environmental, technological *and* legal concerns. The problem is not whether lawyers should discuss and dissect politics but instead whether politicians and all concerned parties actually can debate and determine the law. There is a need for delimitation, and it is of crucial importance.

3. *Race for Space*

The school advocating a no present need for change in delimitation reflect on the history of humankind to act now and think later. Like the in the Race for Africa the colonisation would become mired in competing interests and ill thought out policies. They believe that any attempt to demark a delimitation boundary would lead to overreaching claims, such as on the high seas, from the fear of the unknown. When the boundary is stipulated it would be extremely difficult for States to relinquish even in light of future technical, scientific or political developments. This would mean that activities that could have taken place at lower altitudes would in the future be prohibited without prior agreements. Even more worryingly is, if when there is an acceptance for the need a boundary, there could be a proliferation of differing claims that would result in an extremely confusing and potentially aggravating situation. This would become a quagmire of various conflicting claims. However, it is highly unlikely that the international community would accept anything other than a comprehensive and definite demarcation.

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[10] See Robert F.A. Goedhart, *Forum For Air and Space Law: The Never Ending Dispute: Delimitation of Air Space And Outer Space* (1996) Vol. 4, Editions Frontieres, France, Marietta Benko, Willem de Graaff (eds.) in the preface.

4. The Thin Blue Line

From the Earth to the Moon
And nothing but sky in between
God's favourite creation must be sky
Why else would there be so much?

Anon

In 1967 technical experts arrived at the conclusion that at that time 'no scientific and technical criteria could be found which would permit a precise and lasting definition of outer space'[11] Not only could you not define space but the USA argued in 1987 that there was no usefulness to a demarcation; 'outer space has no physically observable landmarks and most states are incapable of accurately determining the altitude of space objects and therefore are not in a position to monitor any agreed altitude boundary.'[12] Additionally, an arbitrarily chosen upper limit could easily become a bone of contention. This is in that disputes may arise from boundary violations, which are all the more likely because space objects are in fact difficult to track or identify[13]. The opportunity for unintended boundary violations would be considerable. If there were an infringement the uncertainty and room for misinterpretation would mean that any such boundary would be lead to even more friction. The no change approach states that even if there were a 'Thin Blue Line' there would be no way of recognising, regulating or enforcing the lofty frontier.

This argument no longer carries the weight it once did with advances in the way we understand our world, particularly in technology such as the widely available GPS system that is able to track objects globally[14]. Although it may not be comforting to peaceful uses of space, boundaries undoubtedly could be enforced in the most primitive methods, through force if necessary. The establishment of a boundary would actually promote certainty as to which craft need precise positioning to avoid such incursions. An additional point would be

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[11] See Supra note 4. The representatives of Canada, Great Britain, the United States and some other Western states also expressed such opinions in the early stages of legislative work at the United Nations Committee on the Peaceful Uses of Outer Space.
[12] This was the reaction of the US to a working paper submitted by the USSR in 1987 to COPUOS suggesting the 110 km above sea level limit as the demarcation point See A/AC.105/C2/SR.316, paras. 1-7; see also A/AC.105/C.2/7/Add.1, para.42, at 15.
[13] See Robert F.A. Goedhart, *Forum For Air and Space Law,* Supra note 10 at 7
[14] Or by specific equipment such as the Doris instrument flown on ESA's Envisat for precise positioning of the spacecraft. See Alexandra Harris and Ray Harris, Supra note 7

that it would be beneficial for states to develop or exploit technology to measure altitude of craft if the purpose is to protect territorial integrity. Delimitation would in fact spur many legal debates into action as a consequence of its establishment that would resolve such problems. The States would be forced through necessity to debate the issues, but instead of simply throwing the arguing children into a room, the 'debate' would have a basis from which to work. Moreover, the US claim in 1987 is ridiculous as, if one uses the law of the sea as an analogy, do the oceans and seas of the world have a 'sea wall' that determines where the 12-mile territorial sea limit begins? In the past the reasons against delimitation have partly been due to the lack of capabilities to determine and regulate a boundary. The subject, tools and skill exist for The Thin Blue Line to be drawn; all that is needed is the inspiration to paint the sky.

B) Reasons to change

1. Certainty

As man steps into the void of outer space, he will depend for his survival not only on his amazing technology, but also on this other gift which is not less precious: the rule of law among nations.

–Arthur Goldberg[15]

The overwhelming factor for delimitation for lawyers is the need for legal certainty. The two spaces are at opposite ends of the spectrum of title to territory. Whilst the airspace above a territory and its territorial sea is considered a sovereign part of a State, outer space is considered a platform for the common heritage of mankind[16]. It would normally be inconceivable in law that a boundary between two such contrasting regimes should not be established. One of the main reasons why such a limit has not been established is the lack of real conflict. The advent of the commercialisation, civil use, militarisation and possible

[15] From Richard J. Butler, Major, Sovereignty and Protective Zones in Space and the Appropriate Command and Control Assets, Air Command and Staff College Air University AU/ACSC/034/2001-04 At 3

[16] See The Space Treaty and The Moon Treaty (Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Borders (1967) and the Agreement Governing the Activities of States on the Moon and other Celestial Bodies (1979) respectively).

weaponisation of space is a stimulant to ensure the limit and certainty of these distinct spheres.

Some major reasons for the differences between airspace and outer space are to be found in the principles of free access, free use[17], and non-appropriation[18] of space by States. These principles guarantee the enjoyment of States rights to space in that no State can exercise exclusive control or exclusive use of outer space or celestial bodies on a permanent basis with the intent to do. Space is in effect non-sovereign. Alternatively, Kayser believes that the State's sovereignty of airspace has left them 'much more in control of the rules applicable to the circulation of aircraft over their territories'. This has ultimately forced them, in order not to hamper air traffic, to coordinate their regulatory actions and framework[19]. For example, this has been the case in the area of mutual recognition of certificates of airworthiness, certificates of operating crew, and conditions to be fulfilled by aircraft, especially when flying over another State.[20] Even though the United Nations established a legal framework for space flight, this framework is looser than the one established in the field of air law. By depriving States of the quality of sovereignty in relation to outer space, these principles have also worked against the enthusiasm of States for establishing a detailed regulatory structure. Kayser is correct in his assumption that there is little incentive to govern that which one would not be in control of and yet relinquish such freedoms of action. As States do not have control over space, and the fact that the space powers have little restriction on their activities, there has been apathy towards organisation and delimitation. However, not all States yet have such access to space and the international community should not by swayed by the influence of the unrestricted space powers to decide on what is permissible and where. The increasing use of space will mean that the previously free use of space will become cluttered and confused, causing tension and forcing ad hoc solutions to problems that could have been avoided. The fact still remains that there is a separation of legal regimes and the lack of sovereign control in space should not preclude the international community's obligation to itself to protect its interests and clarify where outer space begins. As a stable platform it

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[17] The Declaration of Principles provided in its principle 2: " Outer space and celestial bodies are free for exploration and use by all States on a basis of equality and in accordance with international law". *Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space*, UNGA Res 1962 (XVIII), in: N.M. Matte ed. *Space Activities and Emerging International Law*, Montreal, McGill Institute of Air and Space Law, McGill University Press, Montreal (1984) at 537

[18] Principle 3 in the Declaration of Principles, *ibid*

[19] Kayser, V. Launching Space Objects: Issues of Liability and Future Prospects, Kluwer Academic Publishers, The Netherlands (2001) at 27

[20] On the Parallel with Air Law, and the Concept of Sovereignty in Air Law, see B. Cheng, *Studies in International Space Law*, Clarendon Press, Oxford (1997). Thereby, a rather regulated control over aircraft flight has been put into place over the years through the International Civil Aviation Organisation (ICAO), implementing the Chicago Convention, and the mechanism of standards and recommended practices.

would further help the development of international legal organisation in areas such as liability and registration is an increasingly busy sector.

2. *Safety*

State sovereignty and national territory are highly protected in international law with rights such as State Immunity and the Use of Force[21]. There are increasing concerns about such rights in relation to space law. Generally, space technology is not been a direct threat to state sovereignty. However the wars of the *near* future *will* be fought in space. Space is being transformed into a battleground and the Space powers are vying for dominance. The advancement of technology, the apparent increased threat from 'rogue' States and real threat of terrorism, the subsequent change in national defence policies and its repercussions has led to a bleak future for space security. This change in global security has re-ignited the concern over the legality of military activities in space. The Outer Space Treaty dictates that space should be used for peaceful purposes, and therefore many have interpreted this to mean non-military. Others, including the United States, have argued that it means non-aggressive[22]. At the moment the only specific limit on the military use of outer space is under Article IV, paragraph 1 of the Outer Space Treaty[23], which states that:

State parties to the Treaty undertake not to place in orbit around the Earth any object carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner.

It is clear that currently outer space *should* be free from weapons of mass destruction. However, there is nothing preventing the stationing of such dangerous weapons in a state's own territory, for example at high altitude. For this reason it would be beneficial to set a limit for a State's vertical boundary. Surprisingly, the issue of weapons of mass destruction in this respect is not the substance of urgency. The question of the use of force in outer space is the current and pressing issue; where is the limit of a state's territory for attack and where does an international peaceful area start?

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[21] I. Brownlie *Principles of Public International Law*, 6th ed. Oxford University Press, Oxford (2003) at 784

[22] M. N. Schmitt, *Bellum Americanum: The US View of Twenty-First Century War and Its Possible Implications for the Law of Armed Conflict* (1998) 19 Mich. J. International Law 1051 1087

[23] Although Article VI paragraph 2 restricts the use of the Moon and other celestial bodies to non-aggressive purposes. There is therefore a limited demilitarisation of space and a complete demilitarisation of celestial bodies.

'The United States relies on space operations for its security, and this reliance may make us vulnerable in some areas. Identifying vulnerabilities will allow us to apply our full range of capabilities to ensure space superiority...[24]*' (Emphasis added).*

One of the reasons why there is heightened tension is the perception that "space supremacy is now the official policy of the United States government"[25]. Whether or not the accusation is accurate is uncertain but recent policy statements have not removed the fear of a new arms race in space[26]. Claims such as the 'Freedom of action in space is as important to the United States as air power and sea power...' indicate the magnitude of regard space now holds. Moreover, the US 'will view purposeful interference with its space systems as an infringement on its rights' and 'oppose the development of new legal regimes or other restrictions that seek to prohibit or limit U.S. access to or use of space.'[27] Many commentators have reflected that the new US space policy reflects a more aggressive and unilateral stance[28]. Some observers have hit back at the accusations, arguing that the policy merely states, more forcefully than is probably warranted, that the United States will not accept a situation whereby other countries can deny America access to space. 'There's a big difference between acting as a space cop and stating that you will not allow another country to push you around'[29]. Also, as White House spokesman Tony Snow said, "The notion that you would do defence from space is different from that of weaponisation of space. We're comfortable with the policy"[30]. Nonetheless, the unambiguous decision to reject even the consideration of arms control is categorically a diplomatic and political error. It is unnecessarily provocative to other states that already view US policy with alarm.

In contrast to the United States apparent aggression, possibly through fears of a new space race, or simply for good public relations, for the last several years Russia and China have been actively trying to build on the Outer Space Treaty. On June 27, 2002 they presented a

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[24] Chief of Staff—General John P. Jumper, *Counterspace Operations*, Air Force Doctrine Document 2-2.1 Secretary of the Air Force, 2 August 2004

[25] See Michael Goldfarb 'Not Really Lost in Space: The New National Space Policy' *The Space Review*, November 13, 2006

[26] As Nader Elhefnawy notes '... (it) may seem like just a matter of emphasis, but not when the language is examined within the document's larger context. Where the 1996 document states that the United States "rejects any limitations on the fundamental right of sovereign nations to acquire data from space," it now states that it "rejects any limitations on the fundamental right of the *United States* to operate in and acquire data from space" (emphasis added).' See N Elhefnawy 'The National Space Policy and Space Arms Control' Nov 27 2006 www.thespacereview.com/article/755/1

[27] http://news.bbc.co.uk/1/shared/bsp/hi/pdfs/18_10_06usspacepdf

[28] New Scientist magazine, Issue 2573 14 October 2006, page 7

[29] D. A. Day *Not Really Lost in Space: the New National Space Policy* Speech on November 13, 2006

[30] http://news.bbc.co.uk/2/hi/americas/6063926.stm

working paper titled 'Possible Elements for a Future International Legal Agreement on the Prevention of the Development of Weapons in Outer Space, The Threat or Use of Force Against Outer Space Objects' at the United Nations Conference on Disarmament in Geneva[31]. The paper proposed a treaty obliging signatories not to place "any kinds of weapons" in space or resort to force or the threat of force against space objects. This would rule out attacks on spacecraft by land-, sea-, and air-based systems. However, Russia and China have also been active in pursuit of space and anti-space weaponry with, for example, China firing high-powered lasers at U.S. spy satellites flying over its territory, with what experts see as a test of Chinese ability to blind spacecraft.[32] Strangely unconfirmed by the United States government[33], this highly provocative act is a clear indication of the beginnings of a new arms race in space.

If the boundaries of national sovereign rights in space are brightly drawn, war will result only from acts of deliberate belligerence; if not, the strain of rival policies may precipitate war against the will of the participants and the interests of humanity. With the certainty of jurisdiction comes a set limit on a States actions and responsibilities. Delimitation would put a lid on the State pan and allow the international community to help begin to cool the steaming space powers.

3. *For the benefit of all mankind*

Article I of The Space Treaty (1967) states that as 'province of all mankind' the exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the 'common interest' and benefit for all countries, irrespective of their degree of economic or scientific development. Article 11 (1) of the Moon Agreement (1979) also provides that 'The moon and its natural resources are the common heritage of mankind'[34]. This principle has been the subject of legal scrutiny. On one hand it could be said that this means whatever

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[31] CD/1679 see http://www.geneva.mid.ru/disarm/doc/CD1679-ENGLISH.pdf. Also note the Russian initiative, 'Measures to promote transparency and confidence-building in outer space activities,' A/RES/61/75

[32] http://wwwdefencenews.com/story.php?F=2121111. Also on 11 January 2007, China allegedly tested an anti-satellite (ASAT) weapon, using a ballistic missile to hit an aging Chinese weather satellite.

[33] This could be for one of several reasons from not wanting to increase tension militarily to the fact that China and the US are major economic partners

[34] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Borders (1967) and the Agreement Governing the Activities of States on the Moon and other Celestial Bodies (1979).

benefits arise from the exploration and use of space should be shared equitably, regardless of a state's technological position or involvement. This would ensure that less developed countries do not lose out from their lack of opportunity to exploit their rights. In reality, however, the common interest doctrine has been interpreted as equitable access to outer space, benefiting those with the technology to take advantage.[35] Space is meant to be the final frontier for *humanity*. Instead of unity and leadership the debate on the future of space is void of any real consensus and cooperation on a fully inclusive international scale. Delimitation would be fairer to the welfare of all rather than the prevailing unrestricted access and use by the current space nations. Even with the United States sharing technology such as the Global Positioning Satellite, national and secular self-interest have been the prevailing concerns in space. The reasons for a lack of demarcation appear to be political and may rest on the fact that absence of a precise boundary is advantageous to the dominant power's interests in international space exploration. To secure space for the benefit of all mankind, and for the good of those not yet able to use space, a boundary would establish limits for 'The Old Astronauts Club'.

As stated above,[36] at present most states appear to agree on the need to establish a demarcation at some date in the future. Generally however, the main calls for resolution to the demarcation issue have come from the less-developed countries that lack a capability to engage in large-scale space activities. They have had concerns over their national jurisdiction and sovereignty against the developed nations that have a virtually free reign on economic interests in space. For example, in the Bogota Declaration of 1976[37] participating equatorial states declared that with no current boundary between airspace and outer space they should have control over the geostationary orbits above their countries. The international community rejected the proposal. Nigeria, backed by many non-space faring nations, in 1990 made a call for 'a clear definition and delimitation of the air space of various countries as distinct from outer space'[38]. Again there was little action by the international community.

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[35] For debate see B.C.M. Reijnen, *The United Nations Space Treaties Analysed*, Editions Frontieres, France (1992) at 13 89

[36] See the Introduction

[37] Declaration of the First Meeting of Equatorial Countries 1976, the Bogota Declaration on the Geostationary Orbit. The issue of the geostationary orbit is in fact still on the agenda of the UNCOPUOS 'taking into account the concerns of all countries, in particular those of developing countries, should consider matters relating to the definition and delimitation of outer space and to the character and utilization of the geostationary orbit.' See Report of the Legal Subcommittee on its forty-sixth session, held in Vienna from 26 March to 5 April 2007 A/AC.105/891 Also see 'delimitation considerations' below.

[38] Address to the 33rd session of the UN Committee on the Peaceful Uses of Outer Space, June 1990. See A/AC. 105. 105/C.2/SR.417-435 Summary record of the Legal Sub-Committee forty fifth session April 4- May 1990. See also Nigerian Institute of International Affairs, 5 Nigeria Bulletin On Foreign Affairs (1990) 6. See also New Nigerian (June 14, 1990) 8. Note that in 1987 the Nigerian reaction to

An example of the rules of international law being developed with the consequence of benefiting the powerful nations is the fact that it has arguably become customary practice to allow the ingress and egress of space vehicles through national airspace[39]. Even though there are obvious reciprocal benefits for space faring nations, in an international community with such disparity on every level, developing nations have to accept the status quo without any real benefit in return. Indeed, one of the fears over an upper boundary was the apprehension that states may begin to unreasonably veto space flights that might have to pass through national territory. It is unlikely that this would happen in reflection of the incident free past history. It is noteworthy that if there was initially a truly even playing field, the law could have developed differently and instead of a small collection of States moulding the direction of international norms, there could have been international cooperation and regulation.

A consistent theme underlying the reasons for change is the inequality in the benefits from space. Those states who could not take advantage of their rights have traditionally supported delimitation and regulation whereas those states who gain the most from the freedom they enjoy have opposed delimitation. There is also the danger that when non space-faring States that previously favoured delimitation became increasingly involved in space technology, their support for delimitation could become less vocal. The space enfranchisement is a great leap forward for all humans and the international community should ensure that *all* States have a real opportunity to take advantage of its benefits, now or in the future. Delimitation is a stepping-stone to limiting the jurisdiction of States and re-establishing outer space for the benefit of *all* mankind.

4. Revolutions

Space is big
Space is Dark
It's hard to find
A place to park.

Sidney Harris

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the Soviet proposal of 110 km suggestion by the US was to support the adoption of a linear delimitation. See A/AC.105/PV.234, at 58.

[39] See G. Oduntan, 'The Never Ending Dispute: Legal Theories on the Spatial Demarcation Boundary Plane between Airspace and Outer Space', *Hertfordshire Law Journal* 1 (2003) (2), at 64–84

(*American Scientist* magazine, 1975)

In 1998, for the first time in history, commercial space activities surpassed in their volume those financed by public institutions.[40] Continued overall growth in commercial space industry has meant that world commercial spending rose from $2.1 billion in 1980 to $100 billion in 2004[41]. Declining commercial launch costs support increased commercial access to space[42]. In the United States the government has sought to revive the national interest in space by calling for Americans to return to the moon in 15 years, and even use bases there to serve as a launch pad for Mars[43]. At the end of 2006 NASA announced they were planning to build a permanent moon base with continual presence by 2024[44]. China, Russia, India, Japan and Europe have all expressed intentions for new missions to the Moon or even Mars[45] by the first quarter of the century. There are now more space faring nations and multinational organisations working together than ever before[46]. Publicly, commercially, privately, technologically and politically space is on the edge of a revolution from being the preserve of the superpowers to becoming an everyday utensil of the masses. This upheaval has had a number of effects in the legal sphere with some success and some uncertainty.

Harris and Harris[47] noted an interesting case of confusion over the perception of the scope or extent of air and space law. Observation satellites such as Ikonos and Quickbird are able to provide images that are comparable to those from aircraft[48]. The satellites are subject to space

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[40] Volker Liebig and Kai-Uwe Schrogl, *Space Applications and Policies for a New Century*, (2000) Peter Lang, Frankfurt, at 2

[41] Space Security Index http://www.gwu.edu/~spi/SSI2005.ppt#287,10,Slide 10

[42] GEO launch costs have declines form about $40,000/Kg in 1990 to $26,000/Kg in 2000 Space Security Index at http://www.gwu.edu/~spi/SSI2005.ppt#287,10,Slide 10

[43] Suzanne Goldenberg 'Bush issues doctrine for US control of space' Thursday October 19, 2006 The Guardian

[44] 'Global Exploration Strategy and Lunar Architecture', Johnson Space Center December 4, 2006

[45] David Hall, director of science at the British National Space Centre explained that 'it is feasible to think that perhaps by 2025 Europe would have the expertise to send a human to Mars and bring them back.' http://news.bbc.co.uk/2/hi/science/nature/2580817.stm

[46] Along with high profile partnerships such as the European Space Agency others have helped combine knowledge, technology, and experience and also spread costs. For example in 1992 China, Thailand and Pakistan proposed an initiative called the Asia-Pacific Multilateral Cooperation in Space Technology and Applications (AP-MCSTA) to promote cooperation to develop space programs in the region, and organized a Workshop in November of the same year in Beijing. At this Workshop a consensus was reached to promote multilateral cooperation in space technology and applications in the region, as well as to establish a regional space cooperation organization. Similarly the Space Conferences of the Americas (CEA) were initiated as an effort to facilitate the dialogue and collaboration in space activities in that continent.

[47] Alexandra Harris and Ray Harris Supra note 7

[48] R. Harris, Earth Observation and Principles on Data. In: C. Harrison and J. Holder, Editors, *Law and Geography Current Legal Issues* Vol. 5, Oxford University Press, Oxford (2003), at 539–555.

law and also to the UN Principles on Remote Sensing[49], and not to air law[50]. There have been comments from some countries that national sovereignty is infringed because of the quality of the images obtained by the satellites. In particular, the access to information on the resources of developing nations by advanced States from satellites has been a bone of contention. One can easily say that in time all States could develop the capabilities possessed by developed nations. For now though there is still the problem of who should have access to the benefits obtained from the position of space. In the interests of the poorer countries the question remains why data should be permitted from space when the same information would be prohibited in airspace. The satellite operator would counter by arguing that the costs and effort justify the rewards. In fact all countries can get the information from being 'sensed' by satellites, but 'on a non-discriminatory basis and on reasonable cost terms'[51]. In many respects this is a great example of the commercialisation of space. This commercial agenda however is endangering the ethos of the common heritage of mankind. The space revolution must guarantee the rights of all nations as increasing the divide between the rich and poor can only lead to exploitation and frustration. Not only should the equality of states be in the policy of the United Nations, it must be in the practice of the international community.

A good suggestion of the increasing awareness and recognition of space and space activities is the inclusion of references to 'space' in national legislation. One such advance is the United States of America's Federal Aviation Administration regulations on private space flights[52] in reaction to the imminent commencement of space tourism. For the purposes of delimitation and the definition of outer space a notable example is the Australian Space Activities Act 1998.[53] Within the original Act the text implied that 'outer space' was at a distance of 100km, a clear indication of developing attitudes one might think. The mere fact that national legislation is attempting to limit space is an indication of the inadequacy of international consensus. In truth the Australian Act was amended in light of international

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[49] The provisions include that 'remote sensing activities shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic, social, or scientific and technological development, and taking into particular consideration the needs of the developing countries.' The UN declaration of Principles Relating to Remote Sensing of the Earth from Outer Space (1986), Principle II, U.N. GAOR, 41st Session, Supp. No. 53 at 115, U.N. Doc A/41/53 (1986)

[50] For a discussion on the debate see R. Harris, 'Earth Observation and Principles on Data', supra note 48. Gabrynowicz JI. 'International and US Remote Sensing Law and Policy: An Overview.' In: Remote Sensing Arabia, Riyadh, Saudi Arabia. International Society of Photogrammetry and Remote Sensing, Conference proceedings, 2005. Also see F. Von der Dunk, Earth Observation Data Policy in Europe—An Inventory of legal Aspects and Legal Issues. In: R. Harris, Editor, *Earth Observation Data Policy and Europe* (2002) A. A. Balkema, The Netherlands, Lissie at 19–28.

[51] See C.M. Petras 'Military Use of the International Space Station and the Concept of 'Peaceful Purposes'. Air Force Law Review 22 March 2002.

[52] http://www.faa.gov/about/office_org/headquarters_offices/ast/human_space_flight_reqs/

[53] National legislation and practice relating to definition and delimitation of outer space A/AC.105/865/Add.1 Distr.: General 20 March 2006

disapproval and concerns over certainty about what constituted 'outer space'. Australia amended certain sections of the Act by replacing the term "outer space" with the phrase "an area beyond the distance of 100 kilometres above mean sea level".[54] Consequently, the Act currently applies to space activities occurring or intended to occur above 100-km in altitude. This still implies that 100 kilometres is the key distance in relation to determining 'outer space' activities but in no way conclusively determines the extent of national sovereignty to respect current international legal doctrines. Alternatively one could provoke a reaction from Australia's legislators and argue that the Act was actually a miscalculation, without real consideration of the facts, and a 'bad' law. This situation is an example of the confusion that will continue in regard to space. As the use of outer space is increasing the lack of certainty over the delimitation question will become progressively more contentious. There is a space revolution and the law needs to evolve to meet the demands of this new regime.

C) Conclusions: The Necessity for Change

'Ah, but a man's reach should exceed his grasp, or what's a heaven for?'

Robert Browning (1812-1889)

There is a persuasive position that there is no present need to change the current status of international law in regard to the delimitation of airspace and outer space. The lack of definite agreement has not led to practical problems and the current legal framework means that it is unlikely that there will be any insurmountable problems in the near future. As there is no real problem then any interference would be unnecessary and only lead to confusion and conflict over its establishment. Additionally, any such demarcation may be dominated by the trend of powerful nations dictating the law for their own benefit and could also possibly result in a quagmire of contrasting claims. Therefore it would be more prudent to retain a conservative and cautious attitude allowing reflection and understanding of all of the issues. Not only is there not enough technological and scientific awareness of the edge of the Earth but also any attempt at delineation would be an unenforceable or arbitrary 'Thin Blue Line'. It would be better left to when there is a more mature appreciation of space and all of its problems. However:

[54] See supra note 53

'If you do not do a thing because it has not been done before then the world will stand still.'

Lord Denning[55]

The No Change Approach is not simply guarded; it is on the verge of promoting incompetence in the face of the space revolution. This could be calculated conservatism by the dominant space powers as the present coolness to delimitation equates to unfettered access to space. If the matter were opened up for multilateral treaty consideration then their control would be diminished. Demarcation is essential not only for national sovereignty and jurisdiction, but also for issues of legal and scientific certainty, international safety, and to secure space for all of humanity, as it was intended. Commercialisation of space has led to private initiatives leading the way to space tourism. Importantly, this thesis points out that space has become militarised and is threatened with becoming weaponised. The dangers of 'Star Wars' have been long recognised and pose a risk to even the survival of humanity. Leaving the issue of delimitation to some indeterminate point in the future is far more likely to lead to increased tension and conflict. Instead of waiting another fifty years to take action the beginning of this space enfranchisement offers the best opportunity to debate the never-ending debate.

[55]Lord Denning *Parker v. Parker* (1954) A.C. 15 at 22.

II) The Functional Approach

(Space law) ...cannot be associated with a limited space, but only with the character of the activity under regulation.[1]

The difficulty in setting a boundary based on vertical criteria has led to a theory that proposes to dismiss the need for delimitation at any particular altitude. The supporters of the functional approach believe that instead of trying to enforce an arbitrary, controversial or unjustifiable delineation we should be concerned with the *activities* of space[2]. Their starting point is the denial of a physical division between airspace and outer space, and the assertion that air and space belong to the same medium.[3] The approach is based primarily on the *character* and *category* of individual space activities. Activities for air and space are distinct and as such should be regulated by their own laws, irrespective of the altitude at which they are performed. Therefore space law should govern space activities and flights; even, for example, from the moment they leave the Earth's surface.

Both Diederiks-Verschoor[4] and Oduntan[5] have concluded that the functional approach is submitted on several concepts:

a) Space law deals with transport through outer space: therefore space law should be applicable to all transport form earth to a point in space;
b) In view of the definition of aircraft in Annex 7 of the Chicago Convention[6], all other vehicles that pass through and beyond the atmosphere would be classified as spacecraft;

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[1] Gál G. *Thirty Years of Functionalism* (1997) 40 PCLOS 125 at 126 See V. Pop 'A Celestial Body is a Celestial Body is a Celestial Body...' *American Institute of Aeronautics and Astronautics* (2001) at 8
[2] The approach was referred to even as early as 1959. See Ad hoc Committee On The Peaceful Uses of Outer Space, U.N. Dec. A/AC, 198/2 General Assembly (June 1959), at 8
[3] N.M. Matte, *Aerospace Law* Sweet & Maxwell, Carswell (1969) at 62 and goes on to explain that Craft would be subject to air or space law according to their function rather than their location, air law applying to those engaged in navigation between different points on the Earth and space law to those engaged in navigation between the Earth and a point elsewhere in the universe (at 66). In N. Grief, *Public International Law in the Airspace of the High Seas* (1994) Utrecht Studies in Air and Space Law, Martinus Nijoff Publishers, The Netherlands, at 39-40
[4] I.H. Diederiks-Verschoor "Similarities with and Differences between Air and Space Law Primarily in the field of Private International Law" Vol III 172 *Recueil* The Hague (1981) at 338
[5] G. Oduntan, 'The Never Ending Dispute: Legal Theories on the Spatial Demarcation Boundary Plane between Airspace and Outer Space', *Hertfordshire Law Journal* 1 (2003)
[6] In Chapter 1 of Annex 7 of the Chicago Convention on International Civil Aviation (1944) – *Aircraft Nationality and Registration Marks*, to the Convention, the term "aircraft" was redefined in 1967 as follows: "Aircraft. Any machine that can derive support in the atmosphere from the reactions of the air

c) Airspace extends to the maximum altitude for aircraft; space starts at the lowest point where spacecraft can orbit the earth. In between should be a 'mesospace';

d) All space activities should be permitted at any level of altitude as long as the security of the underlying State has been guaranteed. All spacecraft should have a cosmic or astronautical objective in outer space. In other words, any activity involving the launching of a space object into space should be for the purpose of exploring or for the use of outer space; and

e) Given the absence of a demarcation line in the Space Treaty (1967) and the lack of a definition of spacecraft in other space treaties, then the Space Treaty (1967) is by nature a functional treaty. Putting all these together, Space law is seen as a functional body of laws and the definition of outer space must be a functional one.

Critical to the functional approach is the distinction between the character and category of air and space activities: For what purpose is the activity taking place and how is it being performed? Indications of the activities performed would be based on their mission, objectives, tasks and tools used. Therefore, inherent in differentiating the two are the definitions of what aircraft and spacecraft and objects are actually are:

'Aircraft - 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.'[7]

An aircraft, unlike a spacecraft, obtains its motion capacities from the properties of the air. The aircraft is directed as when it is accelerated backwards the resulting force propels the aircraft forwards. Aerodynamic lift occurs when the pressure of the air above the wings decreases while it increases below it, due to the shape of the wings. Factors affecting this lift include the density of the air and the speed of the aircraft. If either rises, so does the aircraft. Alternatively, a decrease in air density reduces the aircraft's lift. The highest altitude of an aircraft is reached when the difference in air pressure below and above the wings is too little to produce enough lift to equalize the gravitational force that is proportional to its mass. This is the case when the air density is so low that the remaining accelerated mass of air does not

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other than the reactions of the air against the earth's surface." This revised definition, adopted through Amendment 2 to Annex 7, was aimed at excluding all air cushion type vehicles (ACVs). Moreover, the definition of "aeroplane" reads: "Aeroplane. A power-driven heavier-than-air aircraft, deriving its lift in flight chiefly from aerodynamic reactions on surfaces which remain fixed under given conditions of flight." See http://www.icao.int/eshop/pub/anx_info/an07_info_en.pdf

[7] Chicago Convention on International Civil Aviation (1944) Annex 7 *ibid*

provide sufficient speed in order to guarantee for a sufficient lift. It is unlikely that a *conventional* aircraft will ever fly above 60km[8].

There is no definition of what a space object is but an explanation can be given of what its characteristics[9] are. Spacecraft do not rely on air like aircraft. To get to space a rocket uses force against the Earth's surface to reach escape velocity and ascend in to orbit. In the 'void' of space, only the craft's velocity and the Earth's gravity determine its trajectory. As it is practically in a state of free falling it is very difficult to alter the trajectory in any significant way. When the altitude of a spacecraft becomes too low and it reaches the atmosphere of Earth the drag force reduces its velocity. Consequently, when the spacecraft becomes slower the relation between the gravitational force of the Earth and the force resulting from the velocity of the spacecraft, the centrifugal force, becomes unbalanced and the spacecraft is pulled towards the Earth. As the expansion of the atmosphere alters to some extent and the drag force on the spacecraft depends on its geometry no fixed altitude for this process can be determined. Normally though, a craft will not be able to complete a full circle around the Earth below 100km[10]. Obviously this leaves a void between the maximum height of aircraft and the lowest orbit of a spacecraft, with rockets being the exception to penetration. This would be known as the 'mesospace' where authors such as Wassenbergh have advanced a 'right of innocent passage' of space objects through foreign airspace. [11]

The functionalists believe that there can be a clear distinction between the purposes and activities of air and space. The functional approach can be critically evaluated by examining its benefits and drawbacks.

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[8] Marietta Benko (Ed.) and (in cooperation with) William de Graaff *Forum for Air and Space Law, Vol 1, International Space Law in the Making: Current Issues in the UN Committee on the Peaceful Uses of Outer Space*, Marietta Benko and Kai-Uwe Schrogl, Editions Frontieres, France (1993) at 113-115

[9] Neither the *Convention on International Liability for Damage Caused by Space Objects* March 1972, nor the *Convention on Registration of Objects Launched into Outer Space* January 1975, offer a definition of 'space object' but they stipulate that a space object includes its component parts as well as the launch vehicle and parts thereof (Art. I (d) and Art. I (b), respectively). See http://untreaty.un.org/unts/1_60000/26/35/00051736.pdf and http://www.islandone.org/Treaties/BH653.html

[10] Benko Supra note 8 at 114-115

[11] H.A. Wassenbergh, *Principles of Outer Space in Hindsight*, Martinus Nijhoff Publishers, London (1991) at 18

A) Advantages of the Functional Approach

'Splitting of the area above the earth would lead to a host of legal rules applicable to one and the same spacecraft in quick succession...wherefore it would be impossible to say clearly and exactly at any point of time which legal regime is relevant to the spacecraft concerned.'

Chaumont[12]

One of the main arguments behind the basis of law on activities is that it would relieve the confusing and speculative delimitation based on some disputed vertical altitude. In view of the fact that there are so many complications in finding dependable physical or technological criteria for solving the problem of an upper limit of state sovereignty, a distinction should be made between aeronautical and astronautical activities. This suggestion has received some support, especially from Latin American States:

"The aerospace object should have a single legal designation, subject to special provisions determining the applicable regime, especially in view of the impossibility of specifying precisely where air space and outer space begin and end respectively, a problem which has made it difficult to reach a consensus on criteria to be adopted in defining aerospace objects. Consequently, applying either air law or space law depending on the type of space crossed by the trajectory of the aerospace object would cause problems. Our preference is therefore for the second option of applying either one regime or the other throughout the entire flight, according to its destination"[13]

The separation of law based on aeronautical and astronautical activities would in fact follow legal custom[14]. The normal pattern of legislation is to permit certain activities and prohibit others. Accordingly, it would be better to seek this objective, not by trying to set boundaries but by defining objectives and missions for space vehicles. Significantly, the interests of all countries would be protected more effectively, not by putting territorial limits to national sovereignty but by legally prohibiting those actions in the course of space activities that would endanger these interests. As there is no demarcation line in the Outer Space Treaty and the lack of a definition of spacecraft in other space treaties, then the Treaty is by nature a functional treaty and the definition of outer space must be a functional one. Furthermore, as

[12] See a great debate on the opinions in Chaumont, *Le Droit de l'espace* (1960) at 37-61.
[13] Colombian position from document prepared by OOSA reference A/AC.105/635/Add.5 at 5
[14] See Barrett R.J. 'Outer Space and Air Space; The Difficulties in Definition' *University Review* May-June (1973)

the regulation of spacecraft would apply from launch to landing and as there is no delimitation of vertical airspace, as the scope of international space law gradually extends, international regulation will have to approach the launching pads. The only way to preserve the logical unity of legal regulation, it is contended, is by dispensing with a demarcation in space and adopting a functional criterion.

Finally, since the largest portion of the earth is covered by the seas[15], which are not subject to State sovereignty, those who favour the functional approach argue that there is no need to establish a boundary between air and space, because the one can be regarded as an extension of the other, with a gradual transition[16]. Regarding legal custom, current legal space practice and a smoother continuation of international law, functionalism would therefore be the more appropriate approach.

B) Disadvantages of the Functional Approach

The functional approach negates the need for a delimitation 'boundary', or a line in the sky if you will, and as such all of the complications concerning its location. Although Gardiner [17] describes the functional approach to air and space demarcation as the most promising, there are major flaws in this argument. Instead of issues concerning spatial definition, the criteria of space activities raises the problem of defining what a space 'activity' may consist of. Using the purpose of each activity as the criterion could be ambiguous: what would be the activity of an aircraft equipped with scientific instruments to observe an eclipse, or balloons bearing instruments for space observations? Another criticism of distinguishing activities is the question over how comprehensive the approach is: Whether it covers activities still in the planning stage or partially performed on earth, but directed toward space or applies to all space activities anywhere? Moreover, the prospects of scientific and technical progress in the development of aircraft and space vehicles make the practical problem of distinguishing between them ever more complicated. One such issue has been the development of craft such as the US Space Transportation System, better known as the 'Space Shuttle', and the equivalent Soviet 'Buran'. This form of system operates a rocket launch on the way to being placed in orbit above the Earth, indicating a spacecraft, but it glides home on the way back to

[15] The continental territories, to which this sovereignty applies, account for only about 29 per cent of the earth's surface, while the remainder is covered by the oceans.
[16] I.H. Diederiks-Verschoor, Supra note 5 at 338
[17] R. Gardiner, *International Law*, Longman, New York (2003) at 560

the Earth's surface using aerodynamic lift, as an aircraft would. The problem here is obvious: when is the Space Shuttle governed by space law and when is it governed by air law?[18] Another intricate problem of potentially great scope is how nations could differentiate between space activities at low altitudes and air activities, so as to police each productively and coherently.

The functional approach of demarcation classifies space as a centre of activities. This does not take into account the fact that outer space is a physical place, not just a place where activities that are ultimately based on earth are carried out[19]. The functional approach would in fact not be a continuation of current practice but completely revise the historical trend of international law as to State's obligations to territory and the current status of international air law. Functionalism would contradict the normal proclivity of states to preserve their sovereignty. States do not take issues of sovereignty, security, and in particular, passage rights, lightly. For example, a spacecraft, under the functional approach, would be subject to the law of space even when it would traverse another State's national airspace. As spacecraft launches, manoeuvres and re-entry are dangerous, and even though functionalists accept this needs to be taken into consideration, it would become another moot point between the underlying State and the launch State as to how safe an activity would be. Moreover, it would still leave open the question of what precise altitude particular responsibility would end and obligations begin. Certain activities which are permissible within the area of territorial sovereignty or over the high seas, like for instance the stationing of nuclear weapons aboard aircraft flying over a State's own territory, would not be allowed in outer space[20]. As Goedhuis argues, it is impossible to pretend that the height and location of activities are irrelevant to the legal regime to be applied.[21] International law *dictates* that air and outer space law have distinct legal philosophies: the sovereign versus the common.

Furthermore, on the issue of international 'spaces', the intriguing and notable functionalist's belief that as outer space and the high seas are regarded as alike international spaces, they could be categorised as one space has received criticism. As the majority of space activities

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[18] 'The technological capability of the Shuttle to land on a runway reminiscent of the landing of a conventional aircraft has posed a problem for decision makers to determine the legal regime applicable to is decent and landing.' See an early debate in S. Gorove 'International Space Law in Perspective - Some Major Issues, Trends and Alternatives' Vol. 181, *Recueil* (1983) 349-410, especially 383 onwards.

[19] See Alexandra Harris and Ray Harris *Space Policy*, Volume 22, Issue 1, February 2006, at 3-7

[20] See also on this subject Nicolas M. Matte *Aerospace Law*, Sweet & Maxwell, Carswell (1969) at 23 and 44. Also Bin Cheng 'The Legal Regime of Airspace and Outer Space: The Boundary Problem. Functionalism versus Spatialism: the Major Premises' *Annals of Air and Space Law* (1980) Vol. V at 323 to 361

[21] D. Goedhuis, "The Changing Legal Regime of Air and Outer Space", *The International and Comparative Law Quarterly*, vol.27 (1978) at 576 and 591

unsurprisingly originate from *sovereign* territory and involve the *sovereign* interests of other states, it is ridiculous to disregard the need to address territorial problems. As such the functional approach has not received extensive endorsement from States. However, this author believes that the notion cannot be totally dismissed as uniformity and clarity of any legal issue is desirable. The prospect of two zones of space, sovereign and non-sovereign, could form part of future international law. This obviously would be a spatial delimitation.

One of the key points of functionalism is the rejection of scientific and legal criteria for a spatial demarcation as it too uncertain and controversial. However, the functional approach within its design also incorporates such discrepancies. For instance it is submitted that every movement with less than circular velocity (i.e. the launching velocity of a spacecraft amounting to 9.4 km/s) has to be considered a flight through airspace, and therefore subject to the overflown State's jurisdiction, regardless of its height. On the other hand every movement with escape velocity or one exceeding that velocity (i.e. 11.2 km/s or faster) should be considered a space flight, which of course by definition (presumably as a result of acceptance under customary law of the right of ingress and egress of spacecraft) is free from all state interference, irrespective of the height at which it is carried out. In other words the speed of objects in itself is the distinguishing feature.[22] Given that movements at less than circular velocity speed are still possible at an altitude of 1000 km[23] or even higher and movements with escape velocity can be below that altitude, the distinguishing feature of the speed of the objects would be incredibly confusing.

Overall the collection of ideas, fudged together with the best of intentions, do not solve the problem of delimitation. In attempting to relieve the exertion surrounding the spatial criteria, the functional approach has in fact created the same uncertainty and confusion. It is true that the law seeks to permit some activities and forbid others and as such the current regulation of space activities does conform somewhat to the functional ideal. However, the entire philosophy behind the creation of an international public utility in space was to distinguish it from the sovereign and exclusive control over territory States enjoy. There is no justifiable reason to re-establish the foundations of international law and go in the face of protective States simply to impose equally negligible criteria over space operations. The uncertainty over the definition of outer space would be replaced by a potentially more mystifying debate over what constituted space and air activities that both intermingle and traverse established

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[22] R.F.A. Goedhart, *Forum For Air and Space Law: The Never Ending Dispute: Delimitation of Air Space And Outer Space* Vol. 4 Marietta Benko, Willem de Graaff (eds.) Editions Frontieres, France (1996) at 82.
[23] See Goedhart *ibid.* at 89

international norms. The framework of international relations has its foundations in the separation of the sovereign and sovereign, and the national and international. On this score functionalism will never receive support from States who want to secure their boundaries and retain responsibility for all space activities carried out on their behalf, public and private[24]. If the basis of space flight rested exclusively in the hands of commercial groups or individuals, and the sovereign state were phased out of the equation, then the functionalist approach would certainly gain more favour. Ironically, the spark of such individual existence on one hand has also provided reasons for the arguable rejection of the functional approach on another. The decisive failure of the functional approach has been prophesised before and was realised by an individual called Brian in a remote US desert with a Nazi bomb!![25]

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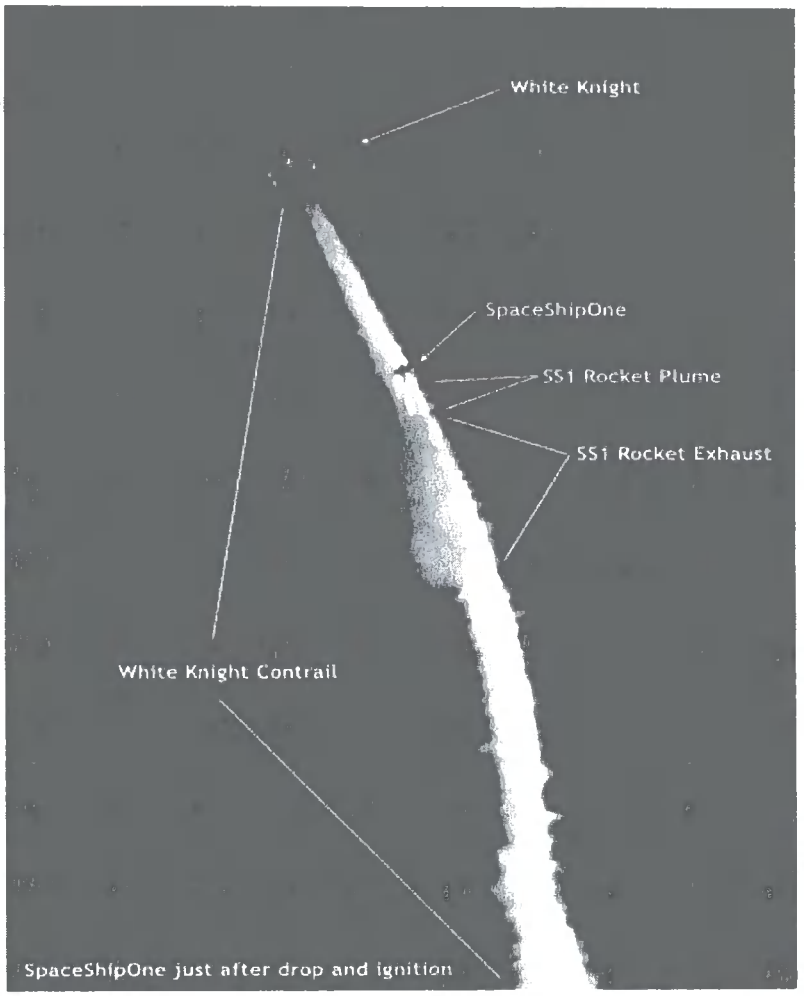
[24] The Treaty on Principles Governing Activities of States in the Exploration and Use of Outer Space Including the Moon and Other Celestial Bodies (27 January 1967 'the Outer Space Treaty') stipulates, inter alia, in Article VI that '[t]he activities of non-governmental entities in outer space (...) shall require authorization and continuing supervision by the appropriate State Party to the Treaty.'

[25] The design of SpaceShipOne was based on World War Two rockets such as the German V I 'doodlebugs'.

C) SpaceShipOne: A Conclusive Rejection of Functionalism?



On 4th Octoer 2004, SpaceShipOne was the first private vehicle to complete two sub-orbital flights within two weeks carrying weight equivalent to three human adults up to about 62.5 miles (100 km) to win the Ansari X Prize[27]. It was carried during one hour by an aeroplane up to nearly 50 000 feet (9.5 miles) from where it was released into a glide and then propelled vertically for 80 seconds by a rocket motor to an altitude of more than 62 miles at apogee, reaching a speed over Mach 3. Then falling back to return to earth, it re-

[26] Image from http://scaled.com/projects/tierone/gallery/X-Prize_2/04_10_04_SpaceShipOne_X_Prize_2_0197_annotated

[27] The Ansari X-Prize was founded in 1996, modelled after the Orteig Prize that Charles Lindbergh won in 1927 by flying solo across the Atlantic Ocean.

entered the atmosphere and glided during 15 to 20 minutes before landing back on the runway of departure[28].

In the functional approach the activities of air and space are defined by their character and category. This section shows how the developments of craft that cross the divide have in essence conclusively rejected elements of the naïve assumptions of functionalists. The SpaceShipOne programme has characteristics of both aircraft and spacecraft, similarly to the 'Space Shuttle'. However, it does not reach orbit and is presented as the first real step towards true space tourism: what therefore is the real nature of SpaceShipOne,[29] and how does this leap forward affect the functionalist approach and the problem of delimitation in general?

As explained above, the SS1 system involves flight in a 3-place spaceship, initially attached to a turbojet launch White Knight aircraft to climb to fifty-thousand feet, above eighty-five per cent of the atmosphere. As shown in the picture above, the spaceship then drops into gliding flight and fires its rocket motor while climbing steeply, reaching a speed of two thousand, five hundred miles per hour. The ship coasts up to a hundred kilometres (Sixty two miles) altitude, then falls back into the atmosphere. The coast and fall are under weightless conditions for more than three minutes. During weightless flight, the spaceship converts to a high-drag configuration to allow a safe, stable atmospheric entry. After the entry deceleration the ship converts back to a conventional glider, allowing a leisurely glide from eighty thousand feet altitude down to a runway where a landing is made at light plane speeds[30]. From this one can examine its aircraft and spacecraft qualities in regard to the law.

As an aircraft is '...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'[31] SS1 does therefore not operate as an aircraft during the ballistic portion of the flight as it is not supported by the reactions of the air[32]. However, the first phase of the mission is carried out in partnership with the White Knight aircraft, without which SS1 could not reach its destination. Also, after reaching the pinnacle at over 100 kilometres, during re-entry into the atmosphere, the craft transforms to *glide* back to base. Therefore, during different sections of the flight the craft is

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[28] International Civil Air Organisation, Council 175th Session, Working Paper, *The Concept of Sub-Orbital Flights* C-WP/12436 30/05/05 at 1.3 PLEASE note that this was the first time there were TWO flights within two weeks but the first flights of SpaceShipOne were in June of 2004.

[29] From now referred to as SS1

[30] http://www.scaled.com/projects/tierone/message.htm see Annex SpaceShipOne and SSO flight below

[31] **Chicago Convention on International Civil Aviation (1944) Annex 7**

[32] Even though some degree of aerodynamic control exists throughout the trajectory from launch altitude until the craft enters the upper reaches of the atmosphere where the air density is no longer sufficient for aerodynamic flight.

both a rocket[33] and also an 'aircraft'. Importantly, SS1 has been granted a launch license by the U.S. Federal *Aviation* Administration as a 'Reusable Launch Vehicle', classifying it in the United States as a rocket[34]. Conversely, it has not been registered as a space object internationally[35] but this could be due to the fact that the Registration Convention applies only to space objects 'launched into Earth orbit or beyond'[36]. Therefore should sub-orbital vehicles *eventually* be considered as aircraft, consequences might follow under the Chicago Convention[37]. Noticeably the confusing status of SS1's characteristics emphasise the deficiencies in the functionalist approach. Even though the current law does not offer an answer to the delimitation problem, SS1 is a clear example of how technological advances can undermine the criteria of activities approach.

As international law obviously cannot define delimitation between airspace and outer space it cannot conclude on the applicability of either air law or space law to sub-orbital flights: would the functionalist approach fair any better? At the beginning of this chapter several concepts of functionalism were presented[38] and which fail through the example of SS1. Firstly, Space law deals with transport through outer space: therefore space law should be applicable to all transport form earth to a point in space, rather than a surface-to-surface flight. The functionalist viewpoint could argue that air law would prevail in the case of SS1 since airspace would be the main centre of activities of sub-orbital vehicles in the course of an earth-to-earth transportation, any crossing of outer space being brief and only incidental to the flight. How can this be when the entire purpose of the flight is to offer an experience of 'outer space'? Even if the craft passes through space for a minute, it is still transported through space.

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[33] Note there is no definition of a spacecraft, as explained above. See Supra note 9.

[34] Furthermore, The U.S. Commercial Space Launch Amendment Act of 2004 (CSLAA) was enacted on 23 December 2004. This legislation entrusts to the Department of Transportation (DOT) and the FAA the responsibility for regulating the safety of the crew and "space flight participants" for commercial human space flights. Concerning safety, the CSLAA is based on principles of informed consent and voluntary assumption of risk by space flight participants. Consequently, the FAA issued in February 2005 *Draft Guidelines for Commercial Suborbital Reusable Launch Vehicle Operations with Flight Crew* and *Draft Guidelines for Commercial Suborbital Reusable Launch Vehicle Operations with Space Flight Participants* (see http://ast.faa.gov/). While it is recommended that the pilot hold an FAA pilot certificate and the flight crew an FAA second class medical certificate, sub-orbital RLVs are to be considered as "suborbital rockets", namely, "[a] vehicle, rocket-propelled in whole or in part, intended for flight on a sub-orbital trajectory, and the thrust of which is greater than its lift for the majority of the rocket-powered portion of its ascent" (49 U.S.C. § 70102 (19) (2004)).

[35] UN Register of Space Objects See the website of the United Nations Office for Outer Space Affairs (OOSA) at www.oosa.unvienna.org/SORegister/regist.html

[36] **Article II of the *Convention on Registration of Objects Launched into Outer Space* January 1975**

[37] Internationally in terms of registration, airworthiness certification, pilot licensing and operational requirements.

[38] See Supra note 4 and 5

Secondly, in view of the definition of aircraft in Annex 7 of the Chicago Convention, all other vehicles that pass through and beyond the atmosphere would be classified as spacecraft. Does the SS1 not classify as a rocket, and as such 'use force against the Earth' *and* have the characteristics inherent to aerodynamic flight? Also, being a 'rocket' does not necessarily denote SS1 as a spacecraft, as there is no formal definition, one has to simply use the evidence: and what the evidence 'concludes' is debatable! If one looks at similar past concepts, the difference between SS1 and the Space shuttle is that the former never reaches orbit. Does this mean that SS1 has not passed 'through and beyond the atmosphere'? Thirdly, functionalists state that as airspace extends to the maximum altitude of approximately 60 kilometres for aircraft, and space starts at the lowest point where spacecraft can orbit the earth, around 100 kilometres (62.5 miles), a 'mesospace' should exist between the two. Brian Binnie's SS1 flight carried him all the way to 367,442 feet or *69.6 miles* above the Earth's surface[39]. Even with the clear contradiction in functional doctrine that there is a scientific delimitation to their approach, the insertion of SS1 between the spaces destroys this criterion. The functionalist approach fails on this count for attempting to establish regulation based on activities and then it inserts boundary assumptions on those activities. Fourthly, the functional approach states that all spacecraft should have a cosmic or astronautical objective in outer space. In other words, any activity involving the launching of a space object into space should be for the purpose of exploring or for the use of outer space. The purpose and use of outer space by SS1 is for the experience itself, whether this in itself satisfies 'a cosmic or astrological objective' is unclear.

Finally, the lack of delimitation so far does not denote that space law is exclusively functional. Admittedly, the current law dictates what is permitted and what is not but the development of space law is nonetheless in its adolescence at best. The foundations of free use, non-appropriation and establishment of the common heritage of mankind are worthy building blocks. The rise of the Space Revolution will force the law and the international community into action. The issue of delimitation is still on the agenda of UNCOPUOS, and in light of technological developments such as SS1[40] and the threat of further militarisation of space, the

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[39] In the sixties, the United States National Aeronautics and Space Administration (NASA) undertook the flight of the US Craft X-15 which performed flight at the altitude of 108 kilometers. In that part of the flight it was really a free falling rocket, with no aerodynamic control possible. In fact, it was considered an astronautical flight, and the pilot got, as a consequence, his "astronautical wings", i.e. the recognition of being an astronaut. Interestingly here, NASA decided to qualify pilots as astronauts when they reached 80 kilometers of altitude. In addition to meeting the altitude requirement to win the X-Prize, pilot Brian Binnie also broke the August 22, 1963 record by Joseph A. Walker, who flew the X-15 to an unofficial world altitude record of 354,200 feet.

[40] Plans have been announced by Virgin Galactic (commercial operator of the SpaceShip craft) for the development of a fleet of five sub-orbital vehicles to carry paying passengers, six per vehicle; it plans that the first of these will be ready for commercial operations before the end of the decade. There are indications that at least one other company is planning to offer rival sub-orbital flights.

pressure to resolve demarcation is heavier than ever. This chapter does not conclude that the functional approach could not find methods to 'fit in' the technological advances. In fact, the example of SpaceShipOne, as you may have noted, does show many characteristics to establish it within the functional approach. Unfortunately, the main reasons why functionalism could not be adopted in a comprehensive manner are both physical and political. The truth that air and outer space are different spheres is unavoidable. At some point a boundary would have to be set. Crucially, this follows on to the jealous nature of sovereign States. Even if passage rights could be resolved, an upper limit for territorial integrity would be needed as airspace is within the realm of nations. The functional approach is appealing in a crude manner like calling a spade a spade. The attitude seems simple and attractive. However, the actual confusion that would ensue with functionalism would provide too many uncertainties and it would leave just as many questions as it would answer. The functionalist ideal is to regulate activity, as any future laws should be. Nevertheless, outer space is a place *and* a platform for activities, so any answer to the delimitation question should attempt to resolve both conditions, not just offer a half-hearted remedy.

III) The Spatial Approach

"Substantial orbital space flight is possible only out of the dense atmospheric lays. Speeds of an atmospheric aircraft are dozens and hundreds of times less than of a spacecraft. These objective performance attributes lead us to the logical conclusion that definitely there is the border between air space and outer space, and this border has not only formal physical meaning[1]*."*

The Spatialist approach attempts to satisfy the need for delimitation through establishing a particular boundary along the lines of a determinate criterion, normally scientific and technical criteria, but including security and arbitrary theories. In essence, 'air law and space law would cover the space above the Earth's surface split into two slices by different legal regimes as the legal status of territorial sea differs from that of free open space.[2]' The space frontier has made great leaps forward technologically and has through agreements such as the Outer Space Treaty (1967) and The Moon Treaty (1979)[3] which sought to establish basic principles for states to abide by. Instead of adopting the view expressed in the ancient Roman maxim *Cujus est solum ejus usque ad coelum et ad inferos*, the international community, at the dawn of this 'new age', attempted to set the foundations for a more egalitarian and international legal platform. Crucially, in contrast to the fact that 'airspace is that part of space subject to the sovereignty of a state'[4], the governing of space law has developed the concepts of 'province of mankind' and 'Common heritage of Mankind', thereby establishing outer space as an international public benefit.[5] Not only was space physically different to airspace, it had become legally dissimilar as well. The spatial approach attempts to establish a lower

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[1] Ukrainian Delegate Sergei A. Nekoda *"Proposals on Definition of the Border Between Air Space and Outer Space"* given during the 42nd Session of the COPUOS Legal Subcommittee, On March 28, 2003

[2] Gál G. *Thirty Years of Functionalism* (1997) 40 PCLOS at 125 See V. Pop 'A Celestial Body is a Celestial Body is a Celestial Body...' American Institute of Aeronautics and Astronautics (2001) at 5

[3] See the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Borders (1967) 18 UST 2410, 610, U.N.T.S. 205. The Agreement Governing the Activities of States on the Moon and other Celestial Bodies (1979). G.A. Res. 34/68, U.N. GAOR, 34th Sess. Supp. No. 46 at 77, U.N. Doc. A/34/664 (1979). For discussions on the effects on the treaties see Christol C.Q. *The Modern International Law of Outer Space*, NYUP, New York, (1982), Oduntan G, 'The Never Ending Dispute: Legal Theories on the Spatial Demarcation Boundary Plane between Airspace and Outer Space', *Hertfordshire Law Journal* 1 (2003) (2) and Nandasiri Jasentuliyna, *International Space Law and the United Nations,* Kluwer Law International, The Netherlands (1999)

[4] Seara Vazquez, *Cosmic International Law,* Wayne State University Press, Detroit (1985) at 27

[5] Article 1 of the Space Treaty (1967) states that the exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind. Article 11 (1) of the Moon Agreement (1979) also provides that 'The moon and its natural resources are the common heritage of mankind'.

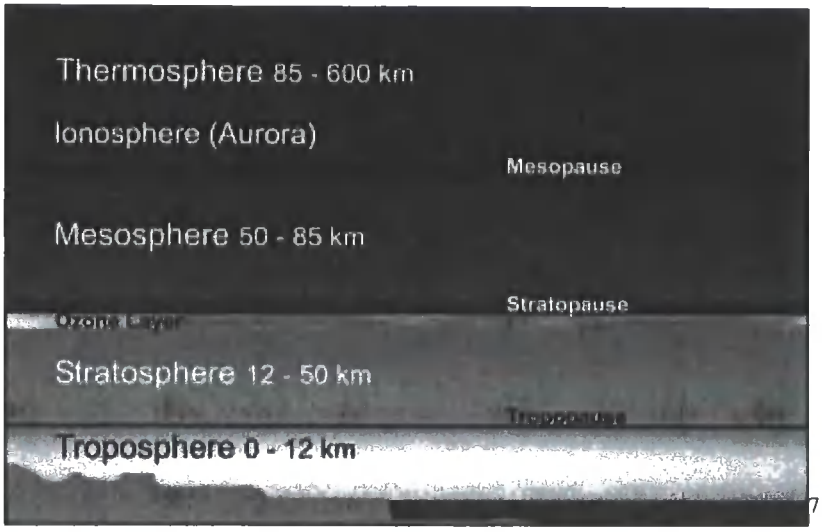
boundary of outer space to differentiate these spheres. As to the altitude of such a demarcation no less than eight possible criteria have been identified in the two background papers prepared by the Secretariat of the UNCOPOUS Legal Subcommittee in 1970 and 1977[6]. They were listed as follows:

a) Demarcation based upon the equation of the upper limit of sovereignty with the concept of 'atmosphere'
b) Demarcation based on the division of atmosphere into layers
c) Demarcation based on the maximum altitude of aircraft flight (theory of navigable space)
d) Demarcation based on the aerodynamic characteristics of flight instrumentalities (von Karman line)
e) Demarcation according to the lowest perigree of an orbiting satellite
f) Demarcation based upon the Earth's gravitational effects
g) Demarcation based on effective control
h) Demarcation based on the division of space into zones.

Generally, the spatial approach has attracted the most attention in addressing the problem of regulating space (and defining the limits of airspace). As establishing a boundary is the traditional method of solving and delimiting differing regimes it equally invites the most debate over where a frontier should be set and what factors should be taken into account. This chapter examines the criteria individually and assesses the benefits and drawbacks in each:

a. Demarcation based upon the equation of the upper limit of sovereignty with the concept of 'atmosphere'

[6] The *Question of the Definition/Delimitation of Outer Space*, Background paper prepared by the Secretariat, UN Doc. A/AC.105/C.2/7 of May 7, 1970 and Addendum A/AC./C.2/7/Add.1 of January 21, 1977



[7]

Unfortunately, the atmosphere is not as easily distinguishable as the diagram above. It does however provide a useful guide to the various layers of the 'air' and space above the Earth. The troposphere, the layer closest to the earth, reaches up to nearly fifteen kilometres at the equator and approximately nine to ten kilometres at the pole. It is the layer in which weather phenomena occur, and it is the field of operation for most conventional aviation. The troposphere contains seventy five per cent of all the air surrounding the Earth[8]. Most of the rest of the air in the atmosphere is contained in the next layer, called the stratosphere. It is above the weather and is reached only by the most advanced aircraft and research balloons. Its upper limit is between forty and fifty kilometres. The troposphere and stratosphere contain about 99.7 percent of the Earth's air[9].

A third layer, called the mesosphere, extends to about eighty five miles, and literally means the 'middle sphere', which is particularly cold. The highest layer of the atmosphere is the exosphere, which consists of the ionosphere and the thermosphere. In the 'sphere of ions', low pressure and solar radiation help reflect radio waves, enabling them to travel over long distances. The heat sphere is the outer layer of the atmosphere. Here, molecules become very hot from the Sun's energy but the thermosphere would actually feel very cold because of the scarcity of the molecules. The exosphere extends to the upper limit of our atmosphere, even with traces up to ten thousand kilometres above the Earth's surface. The atmosphere here merges into space in the extremely thin air. Air atoms and molecules are constantly escaping to space from the exosphere. In this region of the atmosphere, hydrogen and helium are the prime components and are only present at extremely low densities. This is the area where

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[7] www.airapparent.ca/.../full_text/atmosphere.htm
[8] Barrett R.J. 'Outer Space and Air Space; The Difficulties in Definition' *University Review* May- June (1973)
[9] *Ibid*

many satellites orbit the Earth[10]. For example, the space shuttle regularly flies at three to four hundred kilometres, but even there enough air remains to seriously limit orbital lifetime. Satellites usually, but not exclusively, orbit from several hundred kilometres and up[11].

Hopefully, the information presented has shown that any attempt to delimit based on the levels of the atmosphere would be extremely difficult. Firstly, the physical qualities of the atmosphere can be evaluated on alternative standards, ranging from the constitution of the gases, their densities and their temperatures. These properties are not uniform at any particular height[12]. The boundaries of the atmospheric levels are therefore not precise, regular in altitude, or constant. They can vary with solar activity, the time, the month and dozens of other criteria. Unlike the sea, where water ends and air begins, the atmosphere gets more and more rarefied, and where space begins is open to interpretation. Any attempt to regulate a boundary on such an approach would be faced with an irregular, uncertain, even an *extremely* arbitrary 'Thin Blue Line', which would not be a stable basis for the enforcement of international law and protection of national sovereignty. Furthermore, there is the question of at what particular atmospheric level would one define legal space as; would it be at several thousand kilometres, well above spacecraft, or a dozen kilometres, close to aircraft flights, and below advanced craft?

b. Demarcation based on the division of atmosphere into layers

As can be seen from the layers of the atmosphere above, delimitation can be based at many heights. One of the options for a solution to the delimitation problem is to enforce a number of boundaries to reflect different spheres of influence, control and recognition. This would open the floor to try to take elements from each of the proposed theories to best suit the international legal framework. The division of atmosphere into layers could provide a compromise to both those who favour the need for complete delimitation and those who oppose it.

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[10] www.airapparent.ca/.../full_text/atmosphere.htm

[11] See 'Where Does Space Begin?' at http://www.phy6.org/stargaze/StarFAQ2.htm#q28

[12] For example, near the ground the atmospheric density drops to half every five kilometres, so at ten kilometres where jets fly, density is down to a quarter. This is only an approximate process, but continues more or less up to 100 km, with temperature varying. See 'The height of the Atmosphere' *Ibid*

The most notable limits to choose from would be those that are examined within this chapter, ranging from the maximum altitude of aircraft to the lowest perigree of satellites, effects of the Earth's gravity to the limits of the atmosphere. For example, Cheng believes it could be between three hundred to six hundred miles[13] and later three hundred to five hundred miles based on hypothesis as to where the atmosphere ends.[14] Diederiks-Verschoor explains the 'mesospace' theory of demarcation based on the division of space into layers, with a region in between: reflected in the functional approach. Here however, outer space would start at 240 kilometres above sea level, whereas airspace would extend up to 150 kilometres. In this intermediary zone all internationally accepted rules would be applicable. As the author notes though, the theory could lead to conflicting interpretations, specifically regarding reciprocal rights[15]. A common example would be to limit territorial airspace, set the lowest point of outer space, and allow a freedom of transit in the layer in between[16]. One of the problems of the layered approach is its freedom to choose several distances; it multiplies the opportunities for debate. In fact between 1957 and 1960 alone the proposals made ranged from 20 km to 1,500,000.[17] Similarly to elements of the functional approach, the layered criterion would provide an excellent platform for combining the interests of the parties concerned within a larger agreement. However, like the delimitation problem in general, the layered approach would need a true consensus rather than satisfying the interests of the dominant States. Although with multiple layers it would be doubly difficult to negotiate, the opportunity to compromise interests could offer double the reward.

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[13] Bin Cheng, 'From Air law to Space Law', Vol. 13 *Current Legal Problems* (1960) at 23; and Cheng, 'Recent Developments in Air Law', Vol. 9 *Current Legal Problems* (1956) at 208

[14] Cheng 'From Air Law to Space Law' *ibid* at 43

[15] Diederiks-Verschoor I.H. "Similarities with and Differences between Air and Space Law Primarily in the field of Private International Law" Vol III 172 *Recueil* The Hague (1981) at 337

[16] See for example, D. Goedhuis who states '*There have been suggestions to divide the space above the Earth in three regions, all having their own legal status. The advocates of this system assume an upper limit of air space of 50 km because no balloon or aircraft can operate at a greater height. Accepting the lower boundary of outer space to be a height of 100 km, they propose that for the region between 50 and 100 kms that can only be traversed or penetrated by rockets or rocket-propulsed aircraft – the name mesospace should be given and that it be a zone with its own legal status. But what should this legal status be? It is suggested that the rules as set out in the corpus juris spatialis should be applied to this area. As there would be no difference between the legal regimes of outer space and mesospace, one may ask for what purpose three zones would be instituted. Acceptance of this proposal would in fact mean that the free zone would in fact be lowered to 50km. It is not surprising that several States have already rejected it.*' See the objections raised by Italy (UN Doc.A/AC.105/C.2/7/Add.1, at 13); The Federal Republic of Germany (UN Doc.A/AC.105/C.2/SR.270, at 3); The Soviet Union (UN Doc.A/AC.105/C.2/7/Add.1, at 15) in 'The Changing Legal Regime of Air and Outer Space' *The International and Comparative Law Quarterly*, Vol. 27, No. 3 (July 1978) at 576 to 595

[17] For a tabulation of proposals see Robert F.A. Goedhart, *Forum For Air and Space Law: The Never Ending Dispute: Delimitation of Air Space And Outer Space* Vol. 4 Editions Frontieres, France, Marietta Benko, Willem de Graaff (eds.) (1996) at 3-4

c) Demarcation based on the maximum altitude of aircraft flight (theory of navigable space)

When considering how to create a boundary between airspace and outer space, probably one of the first responses one might give is to ask, as airspace is the domain of aircraft, what would be the highest point an aircraft could fly? To fly (heavier than air craft), there is a difference in pressure above and below the wings. As the pressure above the wing is lower than the pressure beneath it, the aircraft rises, or uses 'lift'. With altitude the air becomes less dense and it becomes increasingly difficult to create lift[18]. Furthermore, the faster the aircraft travels the more lift, and height, a craft can obtain. It has been held in scientific and legal circles that twenty-five miles above sea level is perhaps the maximum height for the practical use of aircraft requiring aerodynamic support to sustain flight and using breathing motive power. Approximately, around fifty miles above sea level is perhaps the maximum height at which the atmosphere is sufficiently dense to provide any appreciable aerodynamic lift[19]. With the initial assumption of setting a boundary at the height of an aircraft come the established law of the air and the sovereignty of States. As the history of airspace has developed in the organisation, control and capabilities of aircraft, surely the limit of sovereignty is the same limit as the aircraft.

One of the main criticisms of the theory of navigable space is the fact that if one sets a limit based on science and technology; either could develop and change the boundaries of law. This incapability to settle the limit would lead to confusion and conflict. Also as the U-2 spy plane shot down in *1960* was about 20 miles over the USSR[20], for security it is very unlikely that states will ever remain content to restrict their claim to sovereignty with anything other than a region extending far above the possible use of aircraft.. One suggestion could be to use the maximum height of aircraft and the lowest perigree of satellites and give the *average*

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[18] Goedhart explains the theory as '*the displacement of an aircraft through air space at a constant height meets a simple condition which can be expressed equation-wise: weight = aerodynamic lift + centrifugal force. With increasing altitude the density of air, as well as the upward pressure of air, decreases. Beyond ...air buoyancy ...only the centrifugal force or Kepler force would remain, which could keep an aircraft in flight, if it can travel at a certain speed. To continue flight after the air lift has been reduced to zero, circular velocity (i.e. +/– 7,900 m/s) is required; in this way the aircraft would describe the demarcation line between two areas with legal regimes (i.e. air space and outer space).*' *Ibid* at 61. This would be the von Karman line, but that is not the practical maximum level of current conventional aircraft. As such the maximum height of aircraft, if all aircraft could exploit *all* possible aerodynamic lift, would be integral to the von Karman approach as well.

[19] G. Oduntan, 'The Never Ending Dispute: Legal Theories on the Spatial Demarcation Boundary Plane between Airspace and Outer Space', *Hertfordshire Law Journal* 1 (2003) (2), at 72

[20] See NASA, "High Altitude Perspective", *NASA SP-427* Washington D.C. (1978) at 4.

height as delimitation. Although this may give States a little extra control, they could still want and claim more, and the limit would still be subject to technological advances, and be another arbitrary line. A challenge to this criterion would also be the development of hybrid craft such as the X-15 and the SpaceShipOne programme, which exhibit characteristics of both aircraft and spacecraft and have been shown to fly well above the traditional limits of navigable airspace[21].

d) Demarcation based on the aerodynamic characteristics of flight instrumentalities (von Karman line)

Intricately linked to the maximum height of aircraft[22], the characteristics of flight instrumentalities attempt to establish the boundary where aerodynamic lift becomes irrelevant and centrifugal force takes over. The von Karman line can be explained thus:

"In Aeronautics, level flying higher and higher meant to deal with less and less dense atmosphere, thus to the need for greater and greater speeds to have the flying machine controllable by aerodynamic forces. A speed so big in fact, that, above a certain altitude, it could be close to or even bigger than the circular orbital speed at that altitude (i.e. lift was no longer needed, since centrifugal force took over; and consequently aerodynamic flight was meaningless). Conversely, in Astronautics, lower and lower orbital flying led to encountering more and more dense atmosphere, so much that it would be impossible to maintain the orbit for a number of turns around Earth without significant forward thrust (thus making the free fall, or orbiting, concept meaningless). A lot of calculations were made, and finally it was concluded and accepted by all scientists involved, that the boundary could be set at an altitude of around 100 km. The 100-Km altitude, ever since named the "Karman Line", thus came into existence as the boundary separating Aeronautics and Astronautics.[23]"

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[21] See the Functionalist Approach and SpaceShipOne above.

[22] For example, this delimitation would produce similar results to the maximum height of possible lift in the theory of navigable space. In early estimates it would have established the boundary between airspace and outer space at about 85 kilometres (53 miles) above the Earth, at the point at which an object travelling at 25,000 feet per second loses its aerodynamic lift and becomes subject to centrifugal force. See further M.S. McDougal, H. Lasswell, I. Vlasik, *Law and Public Order in Space* Yale University Press, New Haven (1963) at 332 to 334. With technological developments the boundary is now expected to be at about 100 kilometres (62 miles) altitude. I.H. Diederiks-Verschoor Supra note 15, at 336-337

[23] The history and reason behind the discovery of the von Karman is a useful insight in to the attempt to establish delimitation of airspace and outer space: *'in the early 1950's, Aeronautics and Astronautics were considered the same thing. In fact Astronautics, besides the "dreams" of a few scientists and engineers, was only a military endeavour, linked to Aeronautics in the military establishments of the*

The von Karman line has not simply been another arbitrary, useless theory that has had no practical use. This definition is accepted by the Fédération Aéronautique Internationale (FAI) as the separation between aeronautics and astronautics for international standard setting and record keeping. The approved rules became Section 8 of the FAI Sporting Code. Naturally, they started by setting the rule that a flight could only be considered an Astronautical flight, and then qualify for a record under Section 8 of the FAI Sporting Code, when that flight goes beyond the 100 km line, i.e. the Karman Line[24].

Since the pioneering flights in the sixties, where the United States National Aeronautics and Space Administration (NASA) undertook the flight of the US Craft X-15 that performed flight at the altitude of 108 kilometers, an unofficial world altitude record of 354,200 feet[25], there has been forty years of expectation. There was no more talk of suborbital space flight until 1996, when the X-Prize Foundation launched a competition for rocket experts around the world. On 21 June 2004, SpaceShipOne became the first aerospacecraft developed by a privately owned company to successfully reach an altitude of over 100 km (62.5 miles), marking the beginning of a new revolution in space. From the SpaceShipOne designs, new craft will form the backbone of a fledgling space tourism industry with Virgin Galactic. In fact, Brian Binnie's SS1 flight carried him all the way to 367,442 feet or *69.6 miles* above the Earth's surface.

However, the FAI does not in itself define the 'boundary of space' but instead simply refers to the 'Karman Line' or a '100 kilometre altitude boundary for astronautics. This is reflected in the following definitions:

'Aeronautics — For FAI purposes, aerial activity, including all air sports, within 100 kilometres of Earth's surface.

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time. But Theodore Von Karman [(1881-1963), who is considered to be one of the great aeronautical scientists of the twentieth century] had the feeling that there was a difference between the two. If such was the case, a line could be defined to separate them. The basics were there : Astronautics needed the lack of atmosphere to be viable; Aeronautics needed the presence of atmosphere. And atmosphere existed near the Earth's surface, but did not exist far above the ground. In Astronautics, speeds impossible to maintain in atmospheric drag could be maintained for very long periods without power applied to the vehicle. In Aeronautics (heavier than air vehicles) sustained flying without power is unthinkable. And so on. Thus, both disciplines could be separated in certain important aspects just because of their dependence, in opposite ways, on atmosphere.' Adapted from an article written by Dr S. Sanz Fernandez de Cordoba, President of ICARE, the FAI Astronautic Records Commission. See http://www.fai.org/press_releases/2004/documents/12-04_100km_astronautics.doc

[24] *Ibid*

[25] August 22, 1963 record by Joseph A. Walker

Astronautics — For FAI purposes, activity more than 100 kilometres above Earth's surface[26].'

These definitions could therefore be described as partially functional in their outlook. As activities above or below a certain altitude become one or another, they could be described as being a space or air flight. Unlike functionalism, the spatialist approach of the von Karman line does not attempt to regulate space activities irrespective of the altitude. Even though the FAI do not refer to the von Karman line as a boundary, establishing one sphere against another and setting a limit between them, would normally indicate such a demarcation. Undoubtedly, when space tourism is firmly established, it is very possible that the von Karman line would become a recognised 'boundary' between air and space.

Unfortunately, if one examines the von Karman line with its navigable airspace sister criterion above, the school of aerodynamics has drawn some criticism. For example, the boundary at the theoretical limit of aerodynamic flight at an altitude where aerodynamic lift is exceeded by ascentional pressure, which was originally supposed to be at an altitude of about 85 kilometres, is now estimated to occur at about 100 kilometres altitude. The aerodynamic school approach involves several difficulties that seem to preclude a uniform and constant boundary. The theoretical limit of the height of air flight may increase as the result of such developments as improved cooling techniques or more heat-resistant materials. This line is unstable, as it may change according to technical developments[27]. Also, the aerodynamical forces also fluctuate with the nature and pace of the individual object involved. Moreover, the density of the atmosphere itself is not constant but is subject to a variety of fluctuations[28]. One of the most significant advantages of the von Karman line however, is that it has been a used and proven boundary, and many of the other criterion are even more arbitrary and subject to such change.

e) Demarcation according to the lowest perigree of an orbiting satellite

The criterion based on the lowest orbiting altitude of a satellite has gained considerable support, even from the early stages of space activities. In 1960, Cooper suggested that outer space should be defined as,

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[26] http://en.wikipedia.org/wiki/K%C3%A1rm%C3%A1n_line See http://www.fai.org
[27] I.H. Diederiks-Verschoor Supra note 15, at 336-337
[28] See Goedhart, Supra note 17, at 60

"the area whose upper or outer boundary is the outer limits of the solar system, and whose lower or inner boundary is the lowest altitude at which an artificial satellite may be put in orbit around the Earth."[29]

The supporters have ranged from early writers such as Jastrow[30], McNair,[31] and Johnson, who declared,

"A practical solution would seem fix the limit of airspace so that it is just below the height maintained by space vehicles in orbit,"[32]

to proponents such as Goedhart[33], Diederiks-Verschoor[34], and Kopal[35], and more recently Grief[36]. In regard to civil organisations, The International Law Association did adopt in 1968 in Buenos Aires a definition of outer space. This was the space beyond the lowest perigee reached by any satellite placed in orbit before 27 January 1967, the date on which the Outer Space Treaty was opened for signature[37]. Support for the method of using the lowest perigree

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[29] J.C. Cooper, "International Control of Outer Space", *Zeitschrift fur Luftrecht und Weltraumrechtsfragen*, vol. 9 (1960), at 288, cited in McDougal, Lasswell and Vlasik, supra note 22, at 355. Also note Cooper, 'Fundamental Questions of Outer Space Law' (Lecture given at Leiden University, October (1960)) at 3. Cooper, at an earlier time belonged to the Aerodynamic Lift School of thought as reflected in earlier papers written in 1951. See J.C. Cooper, 'High Altitude Flight and National Sovereignty', in *Explorations in Aerospace Law: Selected Essays*, Vlassic (ed.) (1968) at 259, but for his changing opinions and study of the area see, 'Legal Problems of Upper Space', at 209-271.

[30] *'The reference to orbiting vehicles, or satellites immediately introduces the possibility of a physically sound definition for the limits of airspace...I have in mind the fact that at low altitudes a satellite is quickly destroyed by friction. Therefore, I suggest that the boundary to the airspace of a nation should be defined as the altitude at which the density of the atmosphere is sufficiently low to permit the completion of one circuit by an orbiting vehicle, without destruction by atmospheric friction...'* Jastrow, Proceedings, 1st Collquium on the Law of Outer Space, (1958) at 82

[31] McNair, *The Law of the Air* 3rd ed. Stevens, London (1964) at 16. He wrote *'a more sensible approach is reflected in the view that a state should only exercise sovereignty over that area whose boundary is the lowest altitude at which an artificial satellite can be put in orbit at least once around the earth'*. From G. Oduntan supra note 19 at 79

[32] D.H.N. Johnson, *Rights in Airspace* Manchester University Press, Manchester (1965) at 61 in N. Grief *Public International Law in the Airspace of the High Seas* (1994) Utrecht Studies in Air and Space Law, Martinus Nijoff Publishers, The Netherlands, from 44

[33] Goedhart, Supra note 17, at 50-51

[34] Diederiks-Verschoor, *'A limit averaging 100 kilometres above the earth's surface could, in actual practice, be observed by all orbiting satellites, at least during their useful life in outer space...Personally, I hold the view that, bearing in mind its impact on matters of liability, the fixing of an arbitrary limit, e.g., at about 100 kilometres, might be the best solution for the time being. Beyond that limit, the provisions of the Space Treaty would be applicable.'* Supra note 15 at 336-338

[35] V. Kopal, 'The Question of defining Outer Space' *Journal of Space Law*, vol.8 (1980) 170-173; See also Kopal, 'Issues Involved in Defining Outer Space, Space Objects and Space Debris', Proceedings 34th Colloquium (1991) 30-44.

[36] Grief noted that 'though final agreement has not been reached, the lowest orbiting altitude of satellites commends itself as a logical basis for delimitation'. See N. Grief, Supra note 32, at 45.

[37] Barrett R.J. Supra note 8

of satellite orbits for the definition of outer space is to be found in United Nations documents relating to the registration of objects launched into outer space[38].

There are several reasons for supporting the lowest perigree of a satellite as the delimitation boundary. Obviously, as it is the lowest point in which any satellite could operate, it therefore would cover all space activities under current law. Unlike other criterion, such as the atmospheric boundary, no satellites could operate beneath it without re-entry or destruction. Furthermore, as current conventional aircraft do not operate above approximately 60 kilometres, there would be no serious conflict of interest, as long as there was a right of passage. A right of peaceful passage for 'spacecraft' take-off and landing, with a similar boundary of 100-110 kilometres, has been proposed, or even claimed, before by the former USSR[39], and subsequent Russian Federation[40]. Also, apart from the Bogata Declaration[41], with no real long standing objection to satellite over-flights, the presumption that satellites operate outside of national airspace could indicate a boundary of 100 kilometres[42]. The lowest orbit of a satellite would in fact appeal to the encroaching and protective nature of States, as they could claim air 'territory' with a boundary well above the limit of conventionally used airspace.

The lowest perigree is not without is problems nonetheless. It shares many of the faults inherent in other scientific and technical spatial criteria. Primarily, advances in technology could lead to changes in what height satellites could decrease to. For example, developments such as the concept of a so-called 'tethered' satellite TSS[43] that is a joint US/Italian project offer problems. Such a satellite (subsatellite) will be reeled upwards or downwards from a

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[38] I.H. Diederiks-Verschoor, Supra note 15

[39] UN Doc. A/AC.105/C.2/L.139 of April 4, 1983 Although the Soviet Union claimed such a right had been established through international practice, there has not been an acceptance of it into international custom. For a slightly more detailed discussion, see the 'delimitation considerations' below.

[40] Russian Federation delegation replaced the USSR position and issued a new detailed working document A/AC.105/C.2/L.189 0f 30 March 1992. Instead of formulating a proposal especially with respect to passage rights this paper contains the following statement:
"...The practice has been established whereby a space object launched by a State may, when being placed in orbit, pass without hindrance over the territory of other States at virtually any altitude. To be sure, prior notification has been given in a number of cases when the altitude of the flight over the territory of a foreign State was approximately 100km or less. However, such notifications were voluntary and prompted by considerations of international courtesy."

[41] In the Bogota Declaration of 1976, participating equatorial states declared that with no current boundary between airspace and outer space they should have control over the geostationary orbits above their countries. Declaration of the First Meeting of Equatorial Countries 1976, the Bogota Declaration on the Geostationary Orbit. The international community however have rejected the proposal to date but do believe the matter needs attention.

[42] See *Question of the Definition/Delimitation of Outer Space*, Background paper prepared by the Secretariat, UN Doc. A/AC.105/C.2/7 of May 7, 1970, para 31

[43] See Wilson, Andrew, Interarvia Space Directory 1992/1993. 8th ed. (1992), Surrey: Jane's Data Division at 170-180

Space Shuttle cargo bay on a tether that is 100km long. Thereby it can fly approximately 20 km above but especially 100km *lower* than the shuttle, even possibly at the lowest perigree line[44]. How would this affect any such boundary? Regardless of technology, the precise scientific limit of the lowest orbit of a satellite has not yet been truly discovered, nor will it ever be, as there will always be variations in the Earth's atmosphere. Again the school of thought would need to resort to an arbitrary line based on some scientific data, but without real precision to its justification. There could be a *particular* altitude denoting the lowest orbit of a satellite, but in reality it would not necessarily be the lowest perigree of every satellite on every trajectory in 'space'. Such a determination would depend on the characteristics of the object and the atmosphere; and these vary.[45] As such this theory could not have longevity as a certain boundary. For example, the lowest perigree theories have ranged from 70 km to 160km. According to professor de Jager of COSPAR[46] in 1975, demarcation according to the lowest perigree of an orbiting satellite is considered to be about 160 kilometres. Meredith states that the lowest orbit achieved (by 1984) appears to be about 90 kilometres (56.25 miles) above the Earth.[47] Generally however, the supporters of this criterion have quoted 100 kilometres as the limit. This could be due to its relation to other theories that have a similar altitude, such as the theories based on navigational airspace and the von Karman line. Whether this is deliberate, or simply due to confusion, is unclear. Currently, the lowest perigree criterion has the least objection in the international community, and could form the basis of a widely accepted agreement and therefore cannot be disregarded.

f) Demarcation based upon the Earth's gravitational effects

Another scientific spatial criterion is delimitation with respect to Earth's gravity. Gravity refers to the attractive force the Earth, or any body, exerts on objects. On Earth for example, it has an approximate $9.8 m/s^2$ value of which means that, without air resistance, the speed of an object falling freely increases about 9.8 metres per second every second. The delimitation of air and space would stop at the point at the height from which an object can be dropped on a territory. Gravity decreases with altitude as greater altitude means greater distance from the

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[44] Marietta Benko (Ed.) and William de Graaff (in cooperation with) *Forum for Air and Space Law, Vol 1, International Space Law in the Making: Current Issues in the UN Committee on the Peaceful Uses of Outer Space*, Marietta Benko and Kai-Uwe Schrogl, Editions Frontieres, France (1993) at 140

[45] R.J. Barrett Supra note 8

[46] Professor C. de Jager, in an address to the UNCOPUOS, presented at the 145th Meeting of this Committee on 10th June 1975

[47] P. Meredith, 'The Legality of High-technology Missile Defence System', *American Journal of International Law*, vol.78 (1984) at 423. In N. Grief Supra note 32 at 43

Earth's centre. However, it is a common misconception that astronauts in orbit are weightless because they have flown high enough to 'escape' the Earth's gravity. In fact, at an altitude of 250 miles, roughly the height that the Space Shuttle flies, gravity is still nearly 90% as strong as at the Earth's surface, and weightlessness actually occurs because orbiting objects are in free-fall[48]. The gravitational criterion has some major drawbacks. Two criticisms are the fact that gravity is inconsistent around different parts of the globe, and, the sheer distance that gravity has an effect on.

First, gravity is weaker at lower latitudes. To the best of the authors understanding, this is because in an accelerating referance frame a 'ficticious' centrifugal force acts in a direction perpendicular to the axis of rotation. The gravitational force on a body is partially offset by this centrifugal force, reducing its weight[49]. Also the equatorial bulge, itself caused by centrifugal force, causes objects at the equator to be farther from the planet's centre than objects at the poles. Therefore, objects at the equator experience a weaker gravitational pull than objects at the poles.

Secondly, it is not possible to indicate an exact altitude where a boundary could be drawn based on the earth's attraction[50]. And, even if one were feasible, this demarcation is unstable because the gravitational pull would be 327,000 kilometres in the direction of the moon, while it would be 187,000 kilometres in the direction of the sun[51]. Additionally, the effect of gravity would also depend on the velocity of the space-object. With these criticisms it is hard to see how the gravitational criterion could be a major contender in the delimitation debate.

g) Demarcation based on effective control

"There is an incontestable right in every nation to control its superjacent air space to take any action therein that is necessary to its preservation and at whatever altitude it may be necessary or useful"[52]

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[48] http://en.wikipedia.org/wiki/Earth's_gravity

[49] Boynton, Richard 'Precise Measurements of Mass' (2001). *SAWE PAPER No. 3147*, Arlington, Texas: S.A.W.E., Inc

[50] In fact if one takes gravity to its limits, Earth, like every other celestial body, also has a gravitational field that extends out indefinitely, losing more and more strength the further out it goes. We are theoretically, at least always under the simultaneous gravitational effect of all heavenly bodies. The Practical Gravitational Boundary of the Earth http://www.hq.nasa.gov/office/pao/History/SP-4026/noord2.html

[51] I.H. Diederiks-Verschoor, supra note 15 at 336

[52] Y.A. Korovin presented a paper addressing issues arising from human penetration of the stratosphere and attending legal problems in Leningrad in 1933, at a conference dealing with air law. From Kopal, V. *"Vladimir Mandl: Founding Writer on Space Law"* and quoted by Dr. Stephen E. Doyle, Director of

As there have been many problems with the uncertainty of the scientific approaches, there is an option of demarcation based on the limit of effective control[53]. As one of the more base and draconian criterion, the limit of national territory would be at the point to which a State can control and exercise its authority. Conventionally, there has been a requirement for a State to exercise effective control over the areas in which it asserts sovereignty[54]. States can exercise many forms of activity as evidence of control ranging from settlement and cultivation of land, to the governing of the area. On a basic but critical issue, what would you define effective control of 'space' as? With the control approach, the traditional and most basic method is the cannon-shot rule; the place where the power of the arm ends is the same as the place where the national territory ends, *terræ potestas finitur armorum vis;or ubi vis ibi jus*, or loosely, where there is force, there is law[55]. With the law of the air and the law of space, this, along with traffic management, would be one of the few options of a State to enforce their claim. Unfortunately, with the development of anti-satellite technology, the new missile defence program in the United States and the threat of the weaponisation of space, the effective control criterion could be realised to the detriment of the entire international community.

Similarly to the gravitational criterion, the two main areas of problems with the effective control approach are power and inconsistency. It is undesirable in the 21st Century for the practice of sovereign control to be based on the strength and power a nation can demonstrate. If each country were allowed to project its sovereignty upward and sideward in accord with its effective power, conflicting claims would seem highly likely to occur; and there would be no way to resolve them except naked power[56]. States would become frustrated at possible

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the International Institute of Space Law (IISL) in the *Origins of International Space Law* (2002) Univelt Incorporated, at 8-13

[53] Grief notes that a former Judge of the International Court of Justice espoused the control criterion. See A. Alvarez, *Le droit international nouveau* Paris, Librairie Pèdone(1959) at 559 from N. Grief supra note 32 at 42. Oduntan has pointed out the support for this approach is not insignificant, with the view among African scholars that state sovereignty persists to any point in outer space if activities conducted therein affect state security or human welfare. It is in fact posited that '...a state can deny the freedom of outer space flight above its territory if the activity endangers state security or human life'. U.O. Umozurike, *Introduction to International Law* Spectrum Books Ltd, Ibadan (1993) at 264. Cooper also suggested that 'at any particular time the territory of each state extends upward into space as far as the scientific progress of any state in the international community permits such state to control Space above it'. Cooper, 'Selected Essays' supra note 29. See Oduntan, supra note 19 at 78

[54] D. Goedhuis, supra note 16 at 592

[55] V. Pop 'A Celestial Body is a Celestial Body is a Celestial Body...' speech at the American Institute of Aeronautics and Astronautics (2001) at 4

[56] See Barrett, supra note 8. Barrett also notes that many believe this view 'as fraught with serious dangers'. See Manfred Lachs, *The Law of Outer Space: An Experience in Contemporary Law Making* (1972) 571. See also O. Schacter, 'Legal Aspects of Space Travel,' *Journal of British Interplanetary Society* (1952).

restrictions on movement in previously usable space causing further international friction and even 'acquisition' of space territory not necessarily 'allocated' for them. If any one criterion were to spark a 'Race for Space', the effective control would certainly provide the impetus. Space would in fact become colonised. Space *should* not become simply another platform of frontiers of confrontation and as such national sovereignty should be capped at a level not based on military prowess. Whether the increasing militarisation of space can be prevented however is doubted[57].

The second flaw in the control criterion is the fact that the effective rule of each State would be different, with obvious problems for space traffic, certainty and security. Since nations are at extensively diverse points of development, their sovereign spaces would be equally as diverse. Even the suggestion that delimitation should be effected at the height at which the most advanced State could exercise effective control would not be satisfactory[58]. Like many of the scientific criterion that the school of security criticise, the developments of technology in the future would mean that effective control could alter the boundary, possibly indefinitely with the lust for 'control'. Furthermore, criticism directed against this criterion is that this procedure would favour the rich and powerful States, and would be contrary to the principle contained in Article 1, paragraph 2, of the Charter of the United Nations, stipulating equal rights for States[59]. States that do not possess sufficient technological or military potential would be deprived of their rights as equal subjects of international law. On so many levels the effective control approach would be unfair, unequal, uncertain and contrary to the concept of the 'common heritage of mankind' and equality of States, especially in regard to space. The current and newly developing space powers would command a monopoly that would only lead to exploitation, colonisation, confrontation and eventual conflict. It is the duty of the international community to ensure that the militaristic policies being slowly developed by the space powers never become a *legalised* military practice.

h) Demarcation based on the division of space into zones.

The basis of this theory could be said to have originated and be an extension of the maxim *Cujus est solum, ejus est usque ad coelum et ad infernos, does, primae facie* (to whomsoever

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[57] See 'No Change Approach' above and 'delimitation considerations' below.
[58] J.C. Cooper, "High Altitude Flight and National Sovereignty", *International Law Quarterly*, vol.4 (1951) at 411 and 418
[59] I.H. Diederiks-Verschoor, supra note 15 at 337

the soil belongs, he owns also to the sky and to the depths); for the owner of a piece of land owns everything above and below it to an indefinite extent. The zoned criterion of demarcation, without a cap, would establish limits on a horizontal rather than a vertical basis. Imagine Earth as a disco light ball enshrined in a metal grill. This could denote the boundaries of States and the high seas. When switched on the shadows cast by the grill would be thrown into space to establish the division of 'territory'. Now envisage the disco light spinning and circling in a room as Earth rotates and orbits the Sun. Each beam of light from the disco ball would never remain at any constant 'piece' of the room. The revolution of the Earth requires that its position in relation to space and celestial bodies is never constant for the slightest conceivable fraction of time. Such a projection into Space would give us a series of adjacent irregularly shaped cones of jurisdiction, continuously moving into themselves, with celestial bodies moving into and out of these cones ceaselessly.[60] Regardless of the scientific and technical problems with such an approach, the extension *ad infinitum* of sovereignty has arguably been rejected by Article II of the 1967 Space Treaty, which does not permit national appropriation of outer space by claims of sovereignty, by use or occupation, or by any other means[61]. However, with the lack of delimitation and any real definition of either airspace or outer space, the zoned approach has attracted some attention. In 1976, eight equatorial States made an assertion claiming sovereignty above their countries up to the geostationary orbit, 36,000 kilometres from Earth[62]. The geostationary orbit is unique; within it the orbit of satellites around the Earth is synchronised with the rotation of the Earth upon its axis. To date the international community has rejected the Bogata Declaration and maintained that the geostationary orbit is a limited natural resource and equitable access must be guaranteed[63]. It is probably one of the least favoured approaches,

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[60] Wifred Jenks, 'International Law and Activities in Space', 5 *International Comparative Law Quarterly* (1956) at 99, 102. See Oduntan, supra note 19 at 78

[61] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Borders (1967)

[62] Declaration of the First Meeting of Equatorial Countries 1976, the Bogota Declaration on the Geostationary Orbit. The international community however have rejected the proposal to date but do believe the matter needs attention, especially as the Declaration has not been rescinded.

[63] 'The Legal Subcommittee recalled that the General Assembly, in its resolution 61/111, had endorsed the recommendation of the Committee on the Peaceful Uses of Outer Space that the Subcommittee, at its forty-sixth session, taking into account the concerns of all countries, in particular those of developing countries, should consider matters relating to the definition and delimitation of outer space and to the character and utilization of the geostationary orbit, including consideration of ways and means to ensure the rational and equitable use of the geostationary orbit.' Committee on the Peaceful Uses of Outer Space Fiftieth session Vienna, 6-15 June 2007 See A/AC.105/891 at 13. Between 1963 and 1982, 126 satellites were placed in the geostationary orbit on a 'first come, first served' basis. See *UN Chronicle*, vol. XIX (No7) (1982) at 58. Article 44(2) of the 1992 Constitution of the International Union enshrines the principle of equitable access. See further J.M. Smits, *Legal Aspects of Implementing International Telecommunication Links,* Martinus Nijhoff Publishers, London (1991) at 72 to 78

and yet, the option actually remains open for any theory to be applied, however popular they are.

As can be shown from every example of criteria above, there are many possibilities and concerns to be taken into account when debating the question of the delimitation of airspace and outer space. Within the spatial approach itself the criteria are loosely divided into theories based on scientific and technical data, and those with a state-centric or security basis. Each has its own advantages and supporters, and all have their drawbacks and critics. This chapter has given an introduction of the ideas that could form the basis of any policy of a State and the backbone of any international agreement. There is an increasing requirement for clarity and definition of the law as the real Space Revolution takes off. The State, civil and international actors all have an obligation to secure space on behalf of humanity, whilst individual nations obviously have a duty to secure their boundaries. The present situation is becoming desperately close to either jealous secularism of the space powers and ignorance in the face of egalitarianism, or incompetence from the international community altogether. Space does provide a platform for new opportunities but every person, not just every State, should have a fair chance to take advantage of the rights they hold. Before drawing a line under delimitation and explaining this author's position, the next chapter and its sections will examine what considerations now need to be taken into account in any proposal in demarcation.

IV) Considerations for Delimitation

Before drawing any thorough conclusion, after suggesting the possibilities available, one must examine the issues that would affect any decision. In the case of delimitation of airspace and outer space there are several outstanding problems that would be included in any debate on demarcation or would be affected by the imposition of a legal boundary to space. Although there are potentially thousands of such issues, many are beyond the scope of this thesis, and as such, the problems below are considered to be the most pressing in the debate on delimitation. As the previous chapter concluded on the zoned criterion and the Bogata Declaration, the Geostationary Orbit will be discussed first, followed by the concern over Remote Sensing, the increasing potential Space Tourism, Space Traffic Management, the status of Passage Rights, and Security considerations.

a) The Geostationary Orbit and the Bogata Declaration

Within the geostationary orbit a satellite around the earth is harmonized with the rotation of the earth on its axis, making the satellite appear stationary[1]. As such, the geostationary orbit offers a unique vantage for coverage of Earth, being especially useful for navigation and communication. As the only orbit capable of providing continuous communication between ground stations via a single satellite, the geostationary orbit is a 'limited natural resource' and 'equitable access' *should* be guaranteed.[2] From a very real threat of the space powers taking exclusive advantage of such a position, in 1976 eight equatorial States[3] made an assertion

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[1] Bogata Declaration, section 1 reads 'The geostationary orbit is a circular orbit on the Equatorial plane in which the period of sideral revolution of the satellite is equal to the period of sideral rotation of the Earth and the satellite moves in the same direction of the Earth's rotation. When a satellite describes this particular orbit, it is said to be geostationary; such a satellite appears to be stationary in the sky, when viewed from the earth, and is fixed on the zenith of a given point of the Equator, whose longitude is by definition that of the satellite.'

[2] Between 1963 and 1982, 126 satellites were placed in the geostationary orbit on a 'first come, first served' basis. See *UN Chronicle*, vol. XIX (No7) (1982) at 58. Article 44(2) of the 1992 Constitution of the International Union enshrines the principle of equitable access. See further J.M. Smits, *Legal Aspects of Implementing International Telecommunication Links*, Martinus Nijhoff Publishers, London (1991) at 72 to 78; G.C.M. Reijnen and W. de Graff, *The pollution of Outer Space, in particular of the Geostationary Orbit* Martinus Nijhoff Publishers, London (1989), at 3; Sir R. Jennings and Sir A. Watts (eds), *Oppenheim's International Law*, vol.I (Peace), 9th Ed. British Yearbook of International Law (1992), Parts 2-4, Ch. 7, para.371. See N. Grief, *Public International Law in the Airspace of the High Seas* (1994) Utrecht Studies in Air and Space Law, Martinus Nijoff Publishers, The Netherlands at 40-42

[3] Brazil, Columbia, Congo, Equador, Indonesia, Kenya, Uganda and Zaire

claiming sovereignty above their countries up to the geostationary orbit, 36,000 kilometres from Earth: the Bogata Declaration[4]. At the time of the declaration Gorove gave an insight into the feelings of the equatorial countries and their positions[5]. A sampling of some of the arguments advanced in the Bogota Declaration reveals that they were based on such considerations as:

1. The geostationary orbit is a physical fact arising from nature of our planet because it depends exclusively on its relation to gravitational phenomena caused by the Earth;
2. Under rules of the International Telecommunications Union, the geostationary orbit is a limited natural resource over which the equatorial countries exercise permanent sovereignty in line with UN resolutions;[6]
3. There is no satisfactory definition of outer space to support the argument that the geostationary orbit is included in outer space;
4. The ban on national appropriation is not applicable in view of the lack of definition of outer space;
5. Technological partition of the orbit is inappropriate;
6. The geostationary orbit is not covered by the Outer Space Treaty; and
7. The Outer Space Treaty cannot be the 'final answer'.[7]

Certain additional arguments were added in the course of subsequent UN discussions in 1977 and 1978. The Columbian delegate expressed some of them thus:

1. The prevailing uncertainty on the matter of outer space is illustrated by the variety of criteria suggested for its definition;[8]
2. Until the definition of outer space is arrived at the provisions of domestic law will apply to demarcate space;[9]
3. There is no right of succession in regard to satellites;[10]
4. Exercise of sovereign rights is in keeping with positive international law;[11]
5. Countries that have not ratified the treaty are not bound by it;[12]

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[4] Declaration of the First Meeting of Equatorial Countries 1976, the Bogota Declaration on the Geostationary Orbit. For the text of the Bogota Declaration see *Journal of Space Law*, Vol. 6 No.2 (1978) at 194 and Appendix Bogata Declaration

[5] Stephen Gorove The Geostationary Orbit: Issues of Law and Policy *The American Journal of International Law*, Vol. 73, No. 3. (Jul., 1979), at 444-461.

[6] Bogata Declaration, section 1

[7] Bogata Declaration, section 4

[8] UN Doc A/AC.105/C.2/7/Add.1 (1978)

[9] UN Doc A/AC.105/C.2/SR.296, 4 April, 1978, at 3

[10] UN Press Release OS/222, April 3, 1978, at 2

[11] UN Doc A/AC.105/C.2/SR.296, 4 April, 1978, at 4

6. The orbit is unique because it is the only point at which it is economically feasible to maintain a satellite in a stationary position and because it is the only feasible position for solar energy platforms;[13] and
7. The geostationary orbit is a limited resource because of its possible saturation with solar energy platforms and telecommunication frequencies.[14]

The position of the States was that they had exclusive jurisdiction over the geostationary orbit since it lies above their territory and outer space had not been, and still has not been, conclusively defined. Furthermore, the principles of the freedom of use and the non-appropriation of outer space[15] are not binding upon them because they have not ratified the Outer Space Treaty.[16] Without such restrictions they needed to protect their interests. The equatorial countries noted that:

'In spite of the principle established by Article 33, sub-paragraph 2 of the International Telecommunications Convention, of 1973, that in the use of frequency bands for space radiocommunications, the members shall take into account that the frequencies and the orbit for geostationary satellites are limited natural resources that must be used efficiently and economically to allow the equitable access to this orbit and to its frequencies, we can see that both the geostationary orbit and the frequencies have been used in a way that does not allow the equitable access of the developing countries that do not have the technical and financial means that the great powers have. Therefore, it is imperative for the equatorial countries to exercise their sovereignty over the corresponding segments of the geostationary orbit.[17]'

The states reaffirmed 'the right of the peoples and of nations to permanent sovereignty over their wealth and natural resources'[18] and declared that,

Devices to be placed permanently on the segment of a geostationary orbit of an equatorial state shall require previous and expressed authorization on the part of the concerned state,

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[12] *Ibid*
[13] *Ibid*
[14] *Ibid*
[15] Articles 1 and 2 of the Outer Space Treaty
[16] See the comments of the Columbian delegate at the meeting of the UN Committee on the Peaceful Uses of Outer Space, 23 June 1977, in D. Goedhuis, "The Changing Legal Regime of Air and Outer Space", *The International and Comparative Law Quarterly*, Vol. 27, No. 3 (July 1978) at 589
[17] The Bogata Declaration, supra note 4, Section 1
[18] Set forth in Resolution 2692 (XXV) of the United Nations General Assembly entitled 'permanent sovereignty over the natural resources of developing countries and expansion of internal accumulation sources for economic developments'. Also the United Nations General Assembly Resolution 3281 (XXIV), Article 2) subpara 1) reads, 'All states have and freely exercise full and permanent sovereignty, including possession, use and disposal of all their wealth, natural resources and economic activities'.

and the operation of the device should conform to the national law of that territorial country over which it is placed[19].

The situation at that time was impractical and unfair to those States without the resources or capabilities at that time to take advantage of space[20]. The Bogata declaration was an attempt to rectify and defend the interests of those less developed countries that happened to be under the geostationary orbit. In fact, although the declaration highlighted the inequities of space doctrines at the time, as well as the shallow concept of the 'common heritage of mankind', the international community has not adopted the principle of sovereignty extending into 'space' (as imagined by the majority of States[21]). The equatorial States could simply not use the excuse that the lack of delimitation invited the (re)-assertion of 'rights', amounting to nothing more than an annexation. Nor could they discount the accepted principles of non-appropriation and free use as those two legal principles were binding as customary international law even before the conclusion of the Outer Space Treaty.[22] One of the main counter arguments was the fact that States had not protested at the passage of satellites over

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[19] The Bogota Declaration, supra note 4, Section 2

[20] *'The enormity of the problems faced by developing states is reflected in the fact that even in such instruments as the ITU Convention (1973), the right of states to these finite resources is calculated to be based not on possible future competence or capabilities but as expressed in this instance, 'according to their needs and technical facilities at their disposal'. From this perspective it can be seen that while such documents purport to ensure 'equitable access' the premise upon which this access is based is far from equitable since it is short-sighted and limited to present realities and to the neglect of future changes and needs which will surely take place. For instance as at the time the ITU Convention was made in the early 1970s the expression space powers would refer mainly to the US and the then USSR, today the term is said to include not only the major industrialized countries but others like China, India and Brazil.* Bergquist, Michael Laffaitur and Kai-Uwe Schrogl, 'A European View on UNISPACE III follow up', 16 *Space Policy* (2000) 193. *By similar reasoning the list will surely continue to expand. The question is by the time it does, will there literally be any space left? It is for this reason among others that the parties to the Bogota Declaration insist that the ITU documents are impractical and unfair.'* See G. Oduntan, 'The Never Ending Dispute: Legal Theories on the Spatial Demarcation Boundary Plane between Airspace and Outer Space', *Hertfordshire Law Journal* 1 (2003) (2) at 75-76

[21] The claims were rejected by other States and are were said to be without foundation in international law. See e.g. the joint statement issued by twenty-three States at the 1979 World Administrative Radio Conference held under the auspices of the ITU, in *Digest of US Practice in International Law* (1979), at 1188; V.Kopal, "The 31st Session of the Legal Sub-Committee of the Untied Nations Committee on the Peaceful Uses of Outer Space", *Journal of Space Law*, vol. 20 (1992) at 44, and 55 to 56

[22] Goedhuis, "The Changing Legal Regime of Air and Outer Space", supra note 16 at 589 to 590. See General Assembly resolution 1962 (XVIII), 'Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space', *ILM*, vol. 3 (1964), at 157 and Guenter Weissberg "United Nations Movements toward World Law" *The International and Comparative Law Quarterly*, Vol. 24, No. 3 (Jul., 1975), pp. 460-524. The resolution was adopted unanimously on December 13 1963. The equatorial States cannot claim to be persistent objectors since their opposition was expressed after the principles were established.

their territory.[23] Whether the over-flight of satellites had become accepted custom by the mid-1970's, and the uncertainty of what measures are required to protest, is beyond the detail of this particular section[24]. However, the continued growth in space activity has vastly increased over-flights, and to date there has been no assertion of an underlying State's 'rights' on such level as the Bogata Declaration. The actual reason why the Bogata Declaration is impractical is comparable to many of the possible criterion for delimitation; it is incomprehensible that national sovereignty should extend to 36,000 kilometres!

Even in the face of such opposition, particularly from the developed States, the Bogata declaration has had a number of effects. Latin American states[25] have been quick to point out the need to place discussions over the use of the geostationary orbit on the agenda of the international community until it is resolved. Furthermore, when forming any future agreement, it has been proposed that the interests of the developing countries should be taken into account[26]. Other advances came at the International Telecommunications Union, which allocated the satellite positions and frequencies in such orbit. Initially performed on a 'first-come, first-served' basis, the concern over the dominant space powers[27], who were launching increasing numbers of satellites, led to the conclusion that the geosynchronous orbit would be 'filled up' before developing States could even enter the race[28]. By the 1980's, the developing nations had forced the ITU to revise the procedures for allocating satellite

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[23] D.J. Harris, *Cases and Materials on International Law*, 4th edition, Sweet and Maxwell, London (1991), at 231 to In any case,"the (geostationary) orbit derives its attributes from the planet as a whole, and not directly from the territory over which it lies" 232 *British Yearbook of International Law*, vol. 55 (1984), at 565, *UKMIL 1984*, Part Ten:III

[24] for a related issue, see Remote Sensing below

[25] See the following: A/AC.105/C.2/SR.297, paras. 35-36.GAOR: 38th Sess. Suppl. No. 20 (A/38/20), p.11, paras. 60-64; A/AC.105/320 7-11, paras. 40-45; A/AC.105/318, p. 15, paras. 80-83. See also UNGA Res. 37/89 of Dec. 10, 1983, paras. 5 (b) (iii) and 7 (b) (ii); UNGA Res. 45/72 of 11 Dec. 1990, paras. 4(b) and 7(b) (ii); GAOR: 45th Sess. Supp. No 20 (A/45/20), paras. 18-19, 112-118. For the views of the Republic of Ecuador see A/AC.105/PV.234 (March 26, 1982) 27-28.

[26] Indeed the 1985 Report of the UNCOPOUS Legal Sub-committee notes '...Some delegations, though agreeing that a special legal regime should take account of the position of the developing countries, were unable to concur in the view that by reason of their geographical position the equatorial countries should be considered as having special rights to segments of the geostationary orbit superjacent to their territories.' Very impressively the report continues by noting that, 'nor can the present system of 'first come, first served' be condoned if equitable access to the geostationary orbit is to be guaranteed to all countries. Moreover, the view was expressed that the geostationary orbit as part of outer space is 'a common heritage of mankind.'

[27] See Franz G. Klotz, 'Space, Commerce and National Security', Council on Foreign Relations, January 1999

[28] Hudson, *Communication Satellites: Their Development and* Impact Free Press, New York (1990) at 251-55

positions, and reserved at least some slots for every member nation to use or lease.[29] Furthermore,

' The Legal Subcommittee agreed to recommend that countries engaging in coordination with a view to the utilization of satellite orbits, including the geostationary orbit, should take into account the fact that access to the geostationary orbit must take place, inter alia, in an equitable manner and according to the radio regulations of the International Telecommunication Union (ITU). In the case of comparable requests for access to the orbit, a country already having such access should take all practicable steps to enable developing countries or other countries to have equitable access to the orbit. In order to guarantee effective use of the orbit, delegates also agreed that countries wishing to use frequencies and satellite orbits, file such requests according to the relevant provisions of the ITU regulations. It was also agreed that these recommendations would be made available to the ITU. '[30]

Not only were the rights of developing nations not being ignored, but also the geostationary orbit has become increasingly regulated. However, as a result of crowding of the geostationary orbit, access to it is no longer entirely 'free'. It is subject to limits and restrictions imposed by a perceived need on the part of most nations, including the United States, to coordinate their activities and to accept the authoritative allocation of an increasingly scarce resource by an international body.[31] Indeed, whether there is a better deal for developing States against the power of old and new space faring nations is unclear. The major space powers still reap the benefits of *their* efforts so why should there be complete equity? In relation to the delimitation of airspace and outer space, the increasing cooperation between States is an outstanding example of how space is becoming another sphere of everyday international political, commercial, technological and legal life. The Bogata Declaration certainly acted as a stimulant to debating the rights of all States. It also provides a precedent for those who believe that the space revolution should not neglect the development of law. Even with such advances since the seventies, the geostationary orbit *still* provides problems for the international community both politically[32] and economically[33]. Delimitation

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[29] Mahindra Naraine, 'Constraints in the Use of the Geostationary Orbit' in Jasani (ed) *Outer Space: A Source of Conflict or Cooperation?* The United Nations University Press and in co-operation with SIPRI, Tokyo (1991) At 108-109

[30] Agreement on Utilization of and Equitable Access to Geostationary Orbit UN Outer Space Legal Subcommittee Concludes Thirty-Ninth Session in Vienna, 27 March to 6 April UNIS/OS/216

[31] S.D. Krasner 'Global Communications and National Power: Life on the Pareto Frontier' *World Politics*, Vol. 43, No.3 April (1991) at 363

[32] The question of the geostationary orbit, with delimitation, is still on the agenda of the UNCOPUOS. See www.oosa.unvienna.org see for example A/AC.105/891

[33] Even when the ITU formally allocates a particular slot or frequency to a nation, differences still arise. For example, in early 1997, officials of Tongasat, Tonga's national satellite company, accused

through international agreement would be a major step forward in regulating all of space and enshrining the equitable rights of all nations.

b) Remote Sensing

Another example of inequitable space activities is the concern over the remote sensing of earth from space. The long running debate could be portrayed as a battle between the contrasting interests of technologically advanced space powers against the vulnerability of underlying developing state[34]. In fact, it is an example of the balance of the freedom of use of space against the sovereignty of a state; whether collecting data is a right or whether the consent of sensed state is required, and what should be done with the collected information[35]. Many issues have surrounded the information collected from space, but the interest of this thesis is to show how sovereignty is effected by the changing technology and politics, and how it is 'resolved' by past and current international practice.

The international governance of remote sensing and access to satellite imagery was developed from the 1986 Resolution containing the Principles Relating to Remote Sensing of the Earth from Outer Space.[36] From the sensed States point of view there were the several problems: that national sovereignty was infringed, which states should have the benefits obtained from the position of space and why data should be permitted from space when the same

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Indonesia of interfering deliberately with the signals of a satellite occupying a geosynchronous slot assigned to Tonga by the ITU. The alleged motive was an Indonesian demand that one of their satellites operate in that same slot. To complicate matters, the affected satellite actually belonged to a Hong Kong firm that had leased the slot form Tonga. Indonesia denied the charge that it was jamming the satellite and claimed it had a right to 'share' the slot based on an earlier agreement with Tongasat. *Satellite News*, Vol. 20 No. 9 March 3 1997

[34] 'Two opposing views collided: one was presented by States, such as the United States and some other developing countries, that advocated unrestricted use of satellites for remote sensing and freedom of distribution of satellite imagery. The other view, advanced by developing, socialist and some developed countries, stressed the acquisition and distribution of the satellite imagery must be governed by the principle of State sovereignty.' See Ram Jakhu *Legal Issues Relating to Global Public Interest in Outer Space* (Oct 2005) Institute of Air and Space Law, McGill University, Montreal, paper prepared as part of the Advanced Methods of Cooperative Security Program at the Center for International and Security Studies, Maryland at 41-45

[35] For a detailed discussion of remote sensing, an excellent piece is from Jakhu, Ram 'International Law Regarding the Acquisition and dissemination of Satellite Imagery' Vol. 29 (No. 1 & 2) *Journal of Space Law* (2003) at 65 onwards.

[36] UN GA Res. 41/65, 3 Dec. 1986. The issue was discussed for about fifteen years in the Legal Subcommittee of the COPUOS. See appendix Remote Sensing

information would be prohibited in airspace[37]. From a space sensing power, the freedom of exploration and use of space was a priority. Also the satellite operator would counter by arguing that the costs and effort justify the rewards. The Principles sought to promote a compromise between the two groups. In fact all countries would now get the information from being 'sensed' by satellites, but 'on a non-discriminatory basis and on reasonable cost terms'[38], in return for relinquishing the claim for prior consent. The resolution attempted to establish a fair balance of interests of all States and which arguably could now have become part of customary international law.[39]

The principles have nonetheless not quelled all of the concerns in remote sensing. When in development, the principles had 'common utility' in mind rather than private commercial purposes. After the adoption of the Principles, a feeling began to grow whereby the sovereignty issues arising from remote sensing were gradually losing ground as a result of the growing activity of private entities in space.[40] With the advance of commercialism in space, the private sector is a major player in sensing. What information should be given to the 'sensed' state, possibly from 'raw' data, which is unhelpful, to analysed data, which is useful and potentially valuable, is unclear in regard to these new players. Some commentators, such as Christol, have argued that the issue of the right of the sensing State to engage in commercial space activities without the prior consent of the sensed State remains unresolved by the Principles[41]. From the perspective of the developing countries, the compromise in the Principles is still far from perfect.[42] Not only this, but with the changing political arena, in light of terrorism and heightened international competition, States have become less prepared to adhere to the originally non-binding Principles. Unfortunately, several States have recently started applying their own national laws and policies in ways that could restrict access to

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[37] For a discussion on the debate see R. Harris, 'Earth Observation and Principles on Data' In: C. Harrison and J. Holder, Editors, *Law and Geography Current Legal Issues* Vol. 5, Oxford University Press, Oxford (2003), at 539–555. Gabrynowicz JI. 'International and US Remote Sensing Law and Policy: An Overview.' In: Remote Sensing Arabia, Riyadh, Saudi Arabia. International Society of Photogrammetry and Remote Sensing, Conference proceedings, 2005. Also see F. Von der Dunk, Earth Observation Data Policy in Europe—An Inventory of legal Aspects and Legal Issues. In: R. Harris, Editor, *Earth Observation Data Policy and Europe* (2002) A. A. Balkema, The Netherlands, Lissie at 19–28.

[38] See C.M. Petras 'Military Use of the International Space Station and the Concept of 'Peaceful Purposes'. *Air Force Law Review* 22 March 2002.

[39] Gaudrat P. and Tuinder H.P. ' The Legal Status of Remote Sensing Data: Issues of Access and Distribution,' in Lafferranderie G. and Crowther D. (eds) *Outlook on Space Law over the Next 30 Years* (1997) at 351 to 353

[40] Professor Williams, 'Remote Sensing Earth Observation Satellites' Berlin Conference (2004) Space Law Committee of the International Law Association, at 4

[41] Professor Christol, Comments form Committee Members, Berlin Conference (2004) Space Law Committee of the International Law Association, at 10

[42] Niklas Hedman, Introductory Report at the Berlin Conference (2004) Space Law Committee of the International Law Association, at 6-8

remote sensing data in an arbitrary or discriminatory manner[43]. For example Principle XII states that,

'As soon as the primary data and the processed data concerning the territory under its jurisdiction are produced, the sensed State shall have access to them on a non-discriminatory basis and on reasonable cost terms. The sensed State shall also have access to the available analysed information concerning the territory under its jurisdiction in the possession of any State participating in remote sensing activities on the same basis and terms, taking particularly into account the needs and interests of the developing countries.'

In opposition, this is contrasted with the position of the United States which in its Remote Sensing policy of 2003 states,

'Because of the potential value of its products to an adversary, the operation of a U.S. commercial remote sensing space system requires appropriate security measures to address U.S. national security and foreign policy concerns. In such cases, the United States Government may restrict operations of the commercial systems in order to limit collection and/or dissemination of certain data and products...'[44]

This attitude is not unilateral and has been reflected elsewhere[45]. Security considerations are a concern for all nations and countries do have a right to protect themselves. However, the entire philosophy of the Principles set down in 1986 was to meet a compromise between the use of space and the security of the *sovereignty* of the sensed States. The advancement of technology and the interests of the space nations have obviously taken a hypocritical precedence, again. Unlike the claims in the Bogata Declaration, which were never accepted, the Principles were unanimously accepted as a way of balancing the interests of all nations. The perceived gradual withdrawal from the relatively few obligations to sensed States, particularly the poorest nations, and the commercialisation of the activity represents a

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[43] Ram Jakhu *Legal Issues Relating to Global Public Interest in Outer Space* (Oct 2005) Institute of Air and Space Law, McGill University, Montreal, paper prepared as part of the Advanced Methods of Cooperative Security Program at the Center for International and Security Studies, Maryland at 41-45

[44] U.S. COMMERCIAL REMOTE SENSING POLICY April 25, 2003. This policy supersedes Presidential Decision Directive 23, U.S. Policy on Foreign Access to Remote Sensing Space Capabilities, dated 9 March 1994.

[45] 'The Government of Canada reserves the right to... make available to the government of any country, including Canada, data acquired by its system concerning the territory under the jurisdiction of such a government (the sensed State) in accordance with the UN A/RES/41/65 Principles Relating to Remote Sensing of Earth from Space. However, such data shall not be provided to the sensed State if its uncontrolled release is *determined to be detrimental to Canada's national security or foreign affairs interests (emphasis added)*' 'Canada to Control Imaging Satellites' News Release No. 134, Dept. of Foreign Affairs and International Trade, Ottawa, June 9, 1999

betrayal. The practice of remote sensing has indeed been accepted in light of the Principles and increasing activity as international custom[46]. Whether there could be any limits to the *commercialisation* is doubtful as it may be too late now to impose Treaty restraints on those practices.[47] The developing nations are, however, attempting to formulate a response to these new obstacles against the dissemination of data and information. In mid 2007 the African Union and UNESCO had organised a high level workshop with the aim of defining a strategy for the applications of satellite remote sensing for sustainable development in Africa[48].

In a conclusion of the Berlin Conference of 2004 by the International Law Association the Chair Dr Williams[49] stated that the regulation of the area should continue, to 'cover certain gaps in the Principles and provide interpretation criteria to shed light on some of the general principles.' This was because, for example, 'the Principles are silent on significant aspects of remote sensing in today's world, *inter alia*, the distribution, dissemination and commercialisation of data collected by earth observation satellites and subsequently processed.' Unfortunately, there is no consensus between States for the need for restrictions, probably due to the security and commercial concerns of some nations. Dr Rajan believes that 'a single unified law may be a utopia'.[50] As such Dr Williams concludes that national domestic legislation should attempt to further the guidelines on the distribution of data and deal with the authorisation and supervision of private activities in space[51].

The example of remote sensing proves the sectional and self-interest attitudes surrounding the benefits from space. If national laws were the preferred method of advancing the regulation of space activities, although it is a positive action, it would only serve to reinforce the conflicting interests of those who have and have not. This section has attempted to emphasise the hypocrisy of space policy and practice of those who instead of leading the way forward for the benefit of mankind, are simply winning in the race for space. This thesis does not intend to act as a campaign leaflet for the disadvantaged space bourgeoisie (the poorer countries), but the lack of a truly fair Treaty to protect the common heritage of mankind is concerning. Delimitation would not immediately solve all of the issues surrounding the use and exploration of space. Instead, as stated before, it would clarify the limits of State sovereignty and allow the progression of *international* law in space. When the boundary

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[46] See supra note 39
[47] Professor Christol, Comments form Committee Members, Berlin Conference (2004) Space Law Committee of the International Law Association, at 10
[48] See UN official records of COPUOS A/62/20 at 17
[49] See Appendix Berlin Conference 2004
[50] Professor Rajan, Comments form Committee Members, Berlin Conference (2004) Space Law Committee of the International Law Association, at 11
[51] In the light of Article VI of the 1967 Space Treaty

between airspace and outer space is secured, it would force the actors, both public and private, to address the pressing concerns involved in remote sensing and the geostationary orbit.

c) Space tourism

'There is also the bastard child of space business - tourism. Long scoffed at by serious space explorers, space tourism could actually become one of the driving financial forces of s-commerce.'[52]

The dawn of space tourism has brought forward feelings of expectation, excitement and the promise of a 'new world' where the masses could reach for the stars. The technological and scientific advances need to be matched with a great leap forward in the regulations and law surrounding the fledgling sphere, without compromising the industry's development. Tourism is one of the greatest developments for space activities but with it comes some of the most serious problems, since the presence of private paying passengers brings with it a number of specific parameters, aspects and consequences as compared to professional astronauts and scientists working in or near outer space[53]. The sub-orbital space tourism experience has in fact been likened to 'little more than a fairground ride'. However, the opportunity of experiencing weightlessness, viewing the Earth from 100km above the surface and becoming a certified 'astronaut' has certainly attracted interest[54].

Even though there has been much media interest surrounding 'pioneers'[55] the prospect of space tourism becoming a reality is within this decade. Virgin Galactic plans to begin offering sub-orbital passenger space-flights in 2009, using technology scaled up from SpaceShipOne[56]. The company has a list of 65,000 would-be fliers from 121 countries, and has '$15 million of deposits sitting in the Virgin Galactic accounts,' paid by scores of customers to reserve their

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[52] Lou Dobbs *Space: The Next Business Frontier* Ibooks (2001) at 9

[53] 2006 Practitioners Forum on "Space Tourism – Legal and Policy Aspects" 17 March 2006 Europen Space Agency Head Quarters, Paris, France. For more information see http://www.esa.int/SPECIALS/ECSL/index_1_a.html

[54] Dr Sam Adlen, Europe and Space Tourism, What is Space Tourism? www.vega-group.com

[55] For now, the space tourism market is largely financed by billionaires and millionaires: Amazon.com's Jeff Bezos, the Virgin Group's Richard Branson, real-estate magnate Robert Bigelow and PayPal co-founder Elon Musk.

[56] For more information on SpaceShipOne and the Functionalism Approach see Chapter II section c) page 31 onwards

seats[57]. The Futron Corporation conducted the current definitive market study for space tourism in 2002[58]. The Futron study predicts that there will be approximately a thousand sub-orbital passengers per year by the end of the decade and paying passengers generating a market for space tourism of nearly $1billion globally by 2021. By 2021 over 15,000 passengers could be flying annually, representing revenues in excess of $700 million. As a result there are many projects that are developing systems and 'packages' for space tourism[59].

A good suggestion of the increasing awareness and recognition of space and space activities is the inclusion of references to 'space' in national legislation. One such advance is the Federal Aviation Administration regulations on private space flights[60] in reaction to the imminent commencement of space tourism. Adventurers looking to soar into space would need to be informed in writing of serious risks, including death, and promise not to sue the government under the first-ever rules for commercial space travel[61]. Other steps include mandatory training and pre-flight tests before being issued a licence. The rules in fact seek to establish a regulation for the new industry whilst not trying to bury the new companies in red tape. As such, for now, the flights aren't required to be safe for passengers. The FAA was

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[57] http://www.msnbc.msn.com/id/15303947/#storyContinued

[58] 450 telephone interviews of "qualified" individuals in the United States were undertaken by Zogby International in January 2002. The survey margin of error was +/- 4.7%. Futron restricted the respondent pool to people with a household income of at least US$250,000 annually, or a minimum net worth of US$1 million. These particular figures were carefully chosen as the parameters necessary to identify the proper market segment and to extrapolate the survey results. The income/net worth qualifier selected to identify the survey population was the highest-level qualifier that would enable a statistically valid sample that could be extrapolated for a global forecast. See Adlen, Supra note 54

[59] See, for example, The Canadian-based Da Vinci Project, or the Project Enterprise - http://www.talisinstitut.de/ and http://www.spl.ch Bristol Spaceplanes - http://www.bristolspaceplanes.com/ Reaction Engines - http://www.reactionengines.co.uk/ Starchaser Industries - http://www.xprize.org/teams/starchaser_industries.php ARCA - http://www.xprize.org/teams/arca.php EADS Space Transportation and Dassault: EADS
There are number of 'operators', 'tourism brokers' springing up throughout Europe. Some of these organisations include Pro Toura Space, Pure Galactic and Space Travellers. Whilst some of these companies are beginning to take reservations for space tourism experiences, each is very much in the fledgling stages of growth. While the majority of spaceports are proposed in the U.S. Virgin Galactic has also set its sights on northern Sweden (Kiruna) and Northern Scotland. Flights from Kiruna could begin as early as 2011 and may feature flights through the aurora borealis. Because Kiruna is home to a sounding rocket range today, it has a number of benefits, including free airspace. Like Kiruna, northern Scotland also has relatively open airspace needed for suborbital flights to regularly take place. There has been much activity recently in the realm of space tourism as players position themselves to try and secureparts of the predicted billion-dollar market. The major players include Virgin Galactic, Space Adventures and Rocketplane with each company suggesting that commercial operations will begin before the end of the decade.

[60] The rules apply to American companies launching from anywhere in the world, and to foreign companies launching in the U.S.
http://www.faa.gov/about/office_org/headquarters_offices/ast/human_space_flight_reqs/ the power was invested to the FAA to provide licences such as 'experimental permits' under the Commercial Space Launch Amendments Act of 2004 (Public Law 108-492)

[61] This reflects the responsibility of all states to any space activity and the consequences therein Article II of the Liability Convention

given the authority to begin regulating passenger safety in eight years, or if an accident causing serious injury or death happened before then[62]. Importantly the regulations have already taken effect; SpaceShipOne has been granted a launch license by the U.S. Federal Aviation Administration as a 'Reusable Launch Vehicle', classifying it in the United States as a rocket with implications for the users[63].

The example the US has shown in its imposition of laws now and a plan for the future is a welcome one in regards to leading the regulation of space. However, the interest the US government has shown in space tourism[64] demonstrates the lack of coordination internationally and also highlights the state centric nature of all present space activities. That is not to say that there has been concern. The increasing awareness of the importance of space tourism is reflected not only in legislation but also in legal conferences and between scholars, scientists and others concerned with the development of the industry.[65] The problem with the current international position on space tourism is recognised as the simple lack of

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[62] Erica Werner, 'FAA issues its first rules for space tourism' Associated Press http://www.chron.com/disp/story.mpl/nation/4406290.html

[63] The U.S. Commercial Space Launch Amendment Act of 2004 (CSLAA) was enacted on 23 December 2004. This legislation entrusts to the Department of Transportation (DOT) and the FAA the responsibility for regulating the safety of the crew and "space flight participants" for commercial human space flights. Concerning safety, the CSLAA is based on principles of informed consent and voluntary assumption of risk by space flight participants. Consequently, the FAA issued in February 2005 *Draft Guidelines for Commercial Suborbital Reusable Launch Vehicle Operations with Flight Crew* and *Draft Guidelines for Commercial Suborbital Reusable Launch Vehicle Operations with Space Flight Participants* (see http://ast.faa.gov/). While it is recommended that the pilot hold an FAA pilot certificate and the flight crew an FAA second class medical certificate, sub-orbital RLVs are to be considered as "suborbital rockets", namely, "[a] vehicle, rocket-propelled in whole or in part, intended for flight on a sub-orbital trajectory, and the thrust of which is greater than its lift for the majority of the rocket-powered portion of its ascent" (49 U.S.C. § 70102 (19) (2004)). Conversely, SpaceShipOne has not been registered as a space object internationally but this could be due to the fact that the Registration Convention applies only to space objects 'launched into Earth orbit or beyond' Article II of the *Convention on Registration of Objects Launched into Outer Space* January 1975. for details of the treaty see www.islandone.org/Treaties/BH653.html

[64] House Science Committee Chairman Sherwood Boehlert stated 'This is about the future of the U.S. aerospace industry. That's important to our nation's future." See Adlen supra note 54. Furthermore, not only does the US see the potential of space tourism, it wants to guard it. One could argue that the protective stance regarding the export of technology is a method of establishing a near monopoly in the early stages of space tourism through the US International Traffic in Arms Regulations. One of the problems of export control laws is that it does not treat nations nominally allied with the U.S. (like the U.K., Canada, etc.) any differently than other countries. A two-tier approach has now been proposed, with streamlined regulations for countries like the U.K. that are allied with the U.S. This sort of discretion is another example of the dominance of the advanced nations and the exclusion of developing States, against the principles of equality supposedly in the Outer Space Treaty.

[65] For example, The European Centre for Space Law (ECSL) dedicated the 2006 Practitioners Forum (17 March 2006) to this issue, and in particular some of the major legal and policy aspects thereof. These included the licensing of companies, vehicles and crews; the status of crews and passengers; liability and insurance issues; and the financing and securities against such financing. Such aspects were approached principally from an international perspective, but for obvious reasons both the role of national legislation in general, and the substance of US developments in this respect in particular, were also discussed. See the 2006 Practitioners Forum on "Space Tourism – Legal and Policy Aspects" 17 March 2006 ESA HQ, Paris, France http://www.esa.int/SPECIALS/ECSL/SEMJ0YVLWFE_0.html

directly applicable legislation. Although space tourism could fall under the 'use' of space, the OST was directed in a space arena exclusively State based, primarily militaristic. Furthermore, States in fact not only have jurisdiction and responsibility under Article VIII OST but also are burdened with the liability for all space activities under Article II of the Liability Convention[66]. This means the risks are with the State and this in itself fosters domestic regulation. Admittedly, the safety and regulation is essential. However, disunited national controls equate to differing standards and an atmosphere of secularism. As States are responsible, liable, regulate and enforce their space activities, they are more inclined to protect their interests, including any benefits from it (and why shouldn't they?) Other responsibilities include registering the launch of space objects under the Registration Convention[67]. This gives nations more control over what space activities are permitted but what if a nation has not a signed up to the Convention?[68] With the possibility of 15,000 space tourists annually by 2021 is the system antiquated? If there was a multilateral Treaty, similar to the aviation industry's Warsaw Convention, several problems from insurance to the loss of life could be debated and a standardised system enforced. The space legislation, even in domestic law, would have to expand explosively if it waits even for ten years.

The problems so far have been political or legislative. One of the most notable issues in regard to delimitation and space tourism however is more technical. With the advent of space tourism comes how to regulate the industry and how to define what constitutes a space flight. In particular, whether air or space law regulates craft? For example, as seen in the Functional Approach above, as SpaceShipOne displays characteristics of both spacecraft and aircraft; it is classified as a 'rocket' (by an aviation authority), takes off and lands as an aircraft, does not reach orbit, travels to 100km and is with Virgin Galactic advertised as the first plausible space flight operator. The domestic regulation would suffice for such flights if they remained within their own borders. The possibility of travel between nations brings concerns of conflicting regulations, classification of craft, issues of liability and the lack of certainty over the status of such travel. If craft such as SpaceShipOne were classified as aircraft then they would be subject to all of the safety requirements therein. They would probably also lose some of their appeal. If they were spacecraft, the lack of certainty over rights of passage, traffic management, state responsibility and the registration of such activities would lead to a space tourism meltdown. There are simply too many irregularities and gaps in what the status

[66] The Convention on International Liability for Damage Caused by Space Objects ('Liability Convention') GA Resolution 2777 (XXVI) 1972

[67] Convention on the Registration of Objects launched into Outer Space GA Resolution 3235 (XXIX) 1976

[68] For example, in 2003 there were only 44 ratifications, 4 signatures and 2 acceptances of rights and obligations to the Registration Convention

of craft like SpaceShipOne are. For space tourism to be a viable major industry the resolution of what is defined as a spacecraft and where space actually begins is essential.

The issues discussed above are both directly and indirectly linked to the delimitation question, but would be affected by it. The need to explain the lack of parameters was essential as the open reign of tourism is a key factor in the requirement for a demarcation boundary. As there is little legislation surrounding the new industry, a boundary would not unsettle any traditions in this regard. The United States, leading the industry, has begun to impose a few regulations in the area. If this lead were to continue, then the divide between space faring nations and the developing nations would be even greater. For the present however, as the US has noted, regulating space tourism on the strict lines of the aviation industry might, *at this point,* hinder rather than help the young enterprise. However, the experimental element of the dangerous industry could lead to it stumbling in the first few years with, for example, three people being killed in an explosion during a test of rocket systems at SpaceShipOne's home base.[69] This danger in itself indicates the need for clarity. Establishing demarcation would not in itself resolve all of the problems in space tourism. Instead, an agreement that set the limit for space would set up a future possible limit for State responsibility and liability, a definition of what constituted an actual 'space flight', and again reiterate the 'public utility' nature of outer space.

d) Space Traffic Management

'The corner stone of the system misses: no State can exercise its sovereignty, there is no territorial State, no State able to exercise its territorial jurisdiction. Only personal jurisdiction applies. When there is only one territorial jurisdiction on a national territory, there are many personal jurisdictions applying on an international space if nationals or many States are using this space. When traffic management is concerned the problem is obvious: Who is going to make the rules, who is going to control their implementation, and who is going to punish violations?[70].

[69] 'Three die in Branson's space tourism tests' *Guardian Unlimited* Friday July 27, 2007
[70] Professor Armel Kerrest "Space Traffic Management: Comparative Legal Aspects" presented in the IISL/ECSL Symposium on Prospects for Space Traffic Management on occasion of the 41st Session of the COPUOS Legal Subcommittee, in Vienna/Austria, on 2 April 2002

The principle of non-appropriation in space dictates that States cannot exercise sovereignty is space. As they have complete control within their boundaries, countries can manage the activities and also coordinate with other countries on the traffic that crosses divides. There is no such control in space. The need for such regulation is necessary and vital. If the increasing use of space is not checked then the freedom of use[71] guaranteed within the Outer Space treaty would contrast with the resulting activities 'interfering'[72] with activities of other States. There are currently around 9000 man-made objects larger than about 10 cm are currently catalogued; out of which only 650 are operational spacecraft. Furthermore, there are currently about 100,000 objects larger than 1 cm, most of them not catalogued[73]. As of 2007 about 50 countries have accessed space[74]. With the advent of commercialisation, the problem of space debris, increasing numbers of space states and the dawn of space tourism, it is important for countries to see the urgency of the situation[75] and the collective benefits that would stem from increased cooperation and consensus. In the aviation sector countries quickly realised that a commercial civil aviation industry could not maintain a sustainable growth without an international safety regulatory framework and as such the International Civil Aviation Authority was created[76]. An excellent start to the management of space would be to define where space begins.

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[71] Article I of the Outer Space Treaty

[72] Article IX of the Outer Space Treaty

[73] Corinne Contant-Jorgenson, Petr Lála and Kai-Uwe Schrogl 'The IAA Cosmic Study on space traffic management' *Space Policy* Vol. 22 Issue 4, November 2006, At 283-288

[74] *An ICAO for Space?* International Association for the Advancement of Space Safety May 2007 at 11

[75] For example, the significant perforation of the thermal radiator in the Columbia space shuttle disaster of 2003 showed how important orbital space debris management is for human space flight. Furthermore, in January 2007 when a satellite was destroyed in an anti-satellite test, it created fragments with apogees of 3,500 km and perigrees below 200km altitude, which will stay in orbit for hundreds of years. The risk for the International Space Station from fragments bigger than 1cm increased by 59%. Another example problem is when ground controllers of a satellite were surprised to find they were sharing the same Geosynchronous Earth Orbiting slot with another operator and that the two satellites at times passed unacceptably close. Leonard David *Space Traffic Control: Steering Clear of Collisions* Tech Wednesday, May 5 2004

[76] At the Chicago Convention on International Civil Aviation, Dec. 7, 1944, Art. 44, 61 Stat. 1180, 15 U.N.T.S. 295, 296

Although a comprehensive debate on Space Traffic Management[77] is beyond the scope of the delimitation discussion, there are some relevant issues for this thesis. For example, as stated before, a fundamental difference in space law with reference to air law, while for planes owned by the private sector States exercise a supervisory role and responsibility but do not accept the financial risk and liability[78]. For commercial spacecraft and launch vehicle governments have both supervisory and financial responsibility. Therefore there is obviously a difference in the management of air law and space law. On a base level, one would require a limit to where one jurisdiction ends and the other starts. With the possibility of space tourism, particularly with sub-orbital craft such as SpaceShipOne, there either needs to be a separation of air and space traffic, a new regime for outer space, or an integrated air and space traffic control. Whatever action needs to be taken needs to be resolved urgently as space has become as sea and air, another realm where it is in the interest of the global community to operate in accordance with clear international rules instead of vague principles.

e) Passage Rights

Traditionally one will imagine passage rights in relation to the law of the sea. Under customary law a State would not prevent foreign ships from navigating continuously and expeditiously through territorial waters. In relation to the law of air, primarily justified on

[77] The most in-depth work on STM so far has been undertaken by the International Academy of Astronautics (www.iaaweb.org), which published a 'Cosmic Study' in 2006. A common perception though is that as orbits are becoming overcrowded the need for a space traffic management system to track space objects, prevent collisions and interference and deal with debris is pressing. Serious political and economic barriers to its creation include the tendency for countries to seek unilateral solutions to safeguard individual nations and moves towards the weaponization of outer space. However, only a cooperative global body will be able to manage space efficiently and fairly. Nonetheless, some unique rules exist in international space law as well as in international telecommunication law, which can be considered as basic elements of a space traffic management system (especially for use of the geostationary orbit (GEO) by means of the ITU radio regulations). These rules, however, are neither complete nor harmonized. ITU rules, aimed at the avoidance of radio-frequency interference, are far more advanced than rules aimed at the avoidance of physical interference. Corinne Contant-Jorgenson, Petr Lála and Kai-Uwe Schrogl 'The IAA Cosmic Study on space traffic management' *Space Policy* Vol. 22 Issue 4, November 2006, At 283-288 Brazilian Professor José Monserrat Filho states that some measures are necessary to deal with space traffic management, such as: "*a) a new kind of international co-operation as deep and confident as we do not have yet; b) a complex and competent international system (network) with highly qualified international teams and state of the art hardware to fulfill all involved tasks; c) global space traffic management institutionally established*". He emphasizes "*Without a permanent, efficient and self-sufficient institutional framework, true global space traffic management seems to be impracticable*" Professor José Monserrat Filho "Space Traffic Management: Comparative Institutional Aspects" presented in the IISL/ECSL Symposium on Prospects for Space Traffic Management on occasion of the 41st Session of the COPUOS Legal Subcommittee, in Vienna/Austria, on 2 April 2002.

[78] This reflects the responsibility of all states to any space activity and the consequences therein Article II of the Liability Convention

security and safety grounds, there has never been such a transit right of 'innocent passage' for foreign aircraft to fly over sovereign territory.[79] However, there has been a debate on whether such a right exists, or should exist, for the launch and re-entry of spacecraft to outer space. The importance of this right to the delimitation debate cannot be underestimated. Depending on where demarcation is decided to be affects the possibility of whether spacecraft will have to pass over several territories, and even request permission with the possibility of refusal. This section examines the basics of passage rights along with the debate that comes with it.

Currently, State sovereignty horizontally extends out to its boundaries, which equates for coastal nations to 12 miles of territorial sea and consequent airspace. Vertically there is no certainty to its jurisdiction (the point of this thesis). However, as explained above in the spatial approach, the maximum height a conventional aircraft can fly is about 60 kilometres. The lowest perigree of a satellite is approximately 100 kilometres. Consequently there is a region between the two that is neither used by aircraft nor by spacecraft: except for landing or take off operations of spacecraft. Traditionally spacecraft have high elevations to pass through the atmosphere with minimal drag, in the shortest time and at the lowest speed[80]. This results in spacecraft reaching the lowest perigree altitude only a few hundred kilometres from its launching site. As most States capable of launching spacecraft have sites well within their own borders or are generally located close to the ocean coastline (for the obvious safety reason of fast clearing inhabited areas), there is a small chance of passing over foreign airspace. International airspace is the majority of interest for launch and re-entry operations. This does not mean that there is not a potential problem. For example, if a State were small, 'land-locked' or simply built close to another's border, if they wanted to access space, they would need to enter foreign airspace. A real issue for the near future would be sub-orbital flights. Although the current SpaceShipOne operations are well within the United States, the plans for inter-continental flights are not far behind. As such, either suborbital flight will need to develop regulations like those for civil aviation, or the issue of passage rights needs to be resolved. At present there is very little *requirement* to coordinate on space launches with only the Arms Control and Disarmament Negotiations having led to notification practices, prior to launch. They were developed in the Hague Code of Conduct against Ballistic Missile Proliferation of 2002, thus superseding the status of civilian space law and negotiations in COPUOS. The existence of a right of transit in general may be said to be dependent on two basic conditions: first, the State claiming such right must be able to justify it by reference to

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[79] Prasert Ponpongsuk, 'Transit Rights over Territorial Airspace; Reflections on the Practice of Thailand' *Thai Law Forum Law Journal*, June 2002

[80] Marietta Benko (Ed.) and William de Graaff (in cooperation with) Forum for Air and Space Law, Vol 1, International Space Law in the Making: Current Issues in the UN Committee on the Peaceful Uses of Outer Space, Marietta Benko and Kai-Uwe Schrogl, Editions Frontieres, France (1993) at 116

considerations of necessity; secondly, the exercise of the right must be such as to cause no harm or prejudice to the transit State.[81] The justification and opposition to passage rights provide a useful insight to the positions of countries, which in fact take a familiar tone.

To date there has been no major protest at spacecraft orbiting over national territory.[82] If there is no objection to over-flight at altitudes above 100 kilometres, where does the States responsibility end and at what point should notification be given, if any? The advocates of the rights of passage draw reference to Art. I of the Outer Space Treaty that States space shall be *free for exploration and use by all States.* How could this clearly established right mean anything other than access to space as well? As Goedhuis argues, for all States to be able, *on an equal basis*, to draw the benefits flowing from the exploration and use of outer space, the recognition of a principle of free access is indispensable.[83]

Such a position has been adopted by non-western nations, historically the USSR and developing States. In 1983 the USSR submitted a proposal on the delimitation to the UN including a boundary and a right of 'innocent' passage[84]. First, the binding boundary between outer space and airspace would have been established at an altitude not exceeding 110 kilometres. Secondly, there would be the right of innocent passage over the territory of other States at altitudes lower than the agreed boundary for the purpose of reaching orbit or returning to Earth. Innocent or 'peaceful' passage was explained as not causing adverse effects in the territory of the State whose airspace is crossed.[85] Although the USSR's proposal was not approved at the time, the succession of the Russian Federation led to a new document in 1992[86] including the statement that,

"...The practice has been established whereby a space object launched by a State may, when being placed in orbit, pass without hindrance over the territory of other States at virtually any altitude. To be sure, prior notification has been given in a number of cases when the altitude of the flight over the territory of a foreign State was approximately 100km or less. However, such notifications were voluntary and prompted by considerations of international courtesy."

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[81] E. Lauterpacht 'Freedom of Transit in International Law' 1958 *Transactions of the Grotius Society* at 313 see Goedhuis Supra note at 593
[82] Except if one includes the Bogata Declaration of Sovereignty
[83] D. Goedhuis 'The Changing Legal Regime of Air and Outer Space' *The International and Comparative Law Quarterly*, Vol. 27, No.3 (July 1978) at 592
[84] UN Doc. A/AC.105/C.2/L.139 of April 4, 1983
[85] USSR Delegate B. Maiorski recorded in UN Doc. A/AC.105/C.2/SR.392
[86] A/AC.105/C.2/L.189 0f 30 March 1992.

As Benko recognises, this was not a claim but an assertion of established practice.[87] Such a practice is not within international custom, yet, as there have been few flights that have indeed needed to cross multiple airspace jurisdictions. This does not remove the concern of emerging space powers and developing States who would like a guarantee that their freedom to use outer space will be not be blocked by claims of breaching sovereignty. With the advent of point-to-point flights within the next decade[88], both the definition of what constitutes space, space activities, and the question of passage rights must be answered.

Passage 'rights' are in fact nothing more than claims. As States have complete sovereignty over their airspace, flights have been permitted through bilateral and multinational agreements. In regard to means of access to space, there have been no problems to date with such flights, as they have been within sovereign territory, or in international airspace. Problems with such claims of transit are matched with equally compelling concerns for safety and security. As spacecraft do not have comparable standards internationally in airworthiness[89] and licensing, it is the State's obligation to ensure the safety of its inhabitants. Furthermore, even if one had a right of passage, how could it be determined as 'innocent' and 'peaceful'? The establishment of its mission is nigh impossible without better technology; and from whose perspective would it depend on? For example, would a communication satellite that provided both the military and civilians with access be 'innocent'? What if it could also intercept foreign military frequencies? Not only this but future developments could change the height 'conventional' aircraft could fly at, or blur the definition of aircraft and space craft, and therefore complicate passage rights.

Such a blur does exist. Early examples include the US space Shuttle and the Russian Buran, remarkably similar to the US version, which displayed characteristics of both space and aircraft. Also, as they glide over a greater distance back to Earth[90], they had a greater danger of transgressing foreign air space. The United States has argued in the past against

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[87] Marietta Benko Supra note 80 at 135-139

[88] While the majority of spaceports are proposed in the U.S. Virgin Galactic has also set its sights on northern Sweden (Kiruna) and Northern Scotland. Flights from Kiruna could begin as early as 2011. other possibilities are in the middle east, Singapore and Japan. With the option of multiple spaceports, intercontinental flights are a certainty.

[89] Aircraft engaged in international navigation must always carry a certificate of airworthiness according to international air traffic law Art. 29 (b) and Annex 8 of the Convention on International Civil Aviation

[90] The space shuttle has to pass the distance of about 8000km after re-entry into Earth's atmosphere at altitudes below 100-110km before landing see Benko supra note 80 at 119. The US space shuttle has however been secured passage through agreements with those states for emergency conditions. see Wilson, Andrew, Interarvia Space Directory 1992/1993. 8th ed.1992, Surrey: Jane's Data Division, p 120 (in Morocco, Gambia and a possible landing in Germany)

delimitation[91] (and passage rights) on the basis that the space shuttle did not fly over other States, but only over oceans and the North American territory during its re-entries into the Earth's atmosphere. However, the USSR's Buran once flew in 1988, and de-orbited over part of South Africa and flew over North Africa and re-entered Baikonur possibly over Turkey.[92] Although there was no formal complaint about this trajectory, there could have been serious legal and diplomatic issues if it had crashed[93].

Recent developments have also provided interesting reading in regard to passage through airspace. With the progression of space tourism and craft like SpaceShipOne, the separation between what is characterised as a spacecraft and an aircraft is more blurred than ever. Again the prospect of realisation of point-to-point flights has forced the issue. In fact the United States has begun to meet the challenge of space tourism and flights by beginning to police and consider options for legislation on the issue. As explained above in Space Tourism, there are new FAA regulations on sub-orbital flights on their safety and licensing. Furthermore, concepts on how to manage point-to-point operations have been put forward.[94] For example,

'Like today's carriers, commercial 'aerospaceline' companies (would) coordinate flight plans and ensure that the vehicle's operation conforms to these plans... The mission profile includes the use of trajectory modelling to analyse the vehicle's trajectory, identify transition points at airspace boundaries, specify Air Defence Identification Zones (ADIZ's) that will be penetrated, and define the Air Traffic Control strategies that will be used to ensure safety of flight.[95]'

The US is obviously well prepared to establish a system for accommodating space tourism. This however will be within the current lose framework in relation to space law and ignore delimitation and passage rights. Actually, this approach could in fact help the new tourism

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[91] In the 42nd Session of COPUOS Legal Subcommittee, held in April 2003, the Delegate of the United States stated that this subject was nonsense because it had no practical application.

[92] Dudar, E.N., "Flight Dynamics Analysis of Aerospace System with Subsonic Carrier Plane", *Russian/Ukrainian/ German Symposium on Space Transportation and Propulsion*, DGLR Bericht, 26-28 May 1993

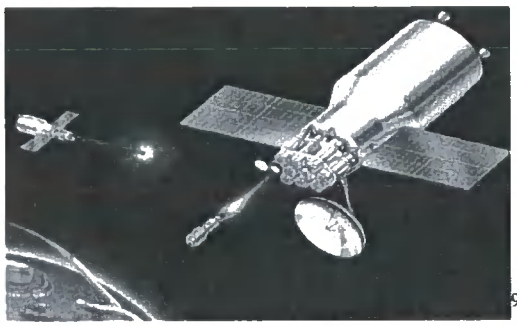
[93] Álvaro Fabricio dos Santos *Sovereignty and Space Traffic Management* Revista da SBDA , Direito Aeronáutico e Direito Espacial Revista Brasileira de, Direito Aeronáutico e Espacial, Março de 2007 - Número 90

[94] For example see Commercial Space Transportation, Concept of Operations in the National Airspace System, Office of the Associate Administrator for Commercial Space Transportation, Federal Aviation Administration May 2001

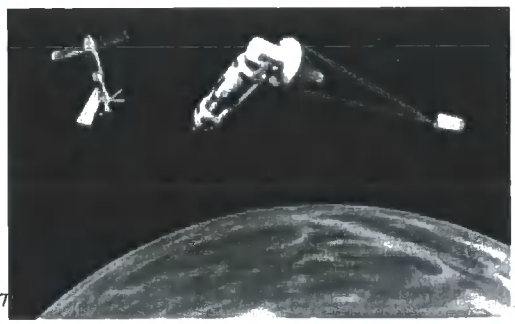
[95] *Ibid* at 19-20 Hypersonic point to point refers to missions involving ultra-high altitude international transit of passengers and/or cargo. For flights operating above the National Airspace System the mission profile also includes 1) the vehicle's target point for insertion into space, and the corresponding Space Transition Corridor coordinates and Schedule, and 2) the re-entry and corresponding Space Transition Corridor coordinates and Schedule

industry. Also, along with the increasing use of outer space, its commercialisation and inclusion as a fourth dimension in warfare, the regulation of space, an 'international space flight organisation' would do better and be more efficiently built by simply extending the International Civil Aviation Organisation mandate to the 'near-space': the region up to and including geostationary orbits[96]. This does not help those developing countries that may in the future be able to get to space and who may find a system to which they had not contributed towards already established. It is another instance of how leaving the regulation of space to a later date would only reiterate and enshrine the dominance of those who started the race. There is no customary right of passage of spacecraft, and although there are provisions for containing sub-orbital space tourism, the delimitation of where space begins would limit the control of the State and promote an inclusive regulation of 'near-space', possibly with the ICAO, or a version of it. It is likely that any immediate rights of passage regarding 'pure' spacecraft will arise from bilateral agreements. If the possibility of a general right of free passage is secured it will only be after further space enfranchisement and progress of space law currently led by developed countries.

f) Security



[97]



[98]

There is something more important than any ultimate weapon. That is the ultimate position the position of total control over Earth that lies somewhere out in space. That is...the distant future, though not so distant as we may have thought. Whoever gains that ultimate position

[96] IMPORTANT; this is not the position of the United States. It is however, a logical progression of current practices to bring 'near-space' within the conscience of everyday activities. *ICAO for 'Near-Space' Safety?* International Association for the Advancement of Space Safety May 2007 at 88

[97] http://www.thespacereview.com/article/755/1

[98] An artist's concept of a Space Laser Satellite Defense System, 1984.

gains control, total control, over the Earth, for the purposes of tyranny or for the service of freedom.

Lyndon B. Johnson, United States Senator, 1958[99]

Currently, the race for the 'ultimate position' in space is being won by the United States. Whether this is for the 'protection' of Earth, or for the maintenance of the resulting global status quo, is an issue that is contested. There may not even be a space race and the enfranchisement of space may simply be a projection of mankind's nature beyond the atmosphere. On Earth State sovereignty and national territory are highly protected in international law with rights such as State Immunity and the Use of Force[100]. There are increasing concerns about such rights in relation to space law. Generally, space technology has not been a direct threat to state sovereignty. However the wars of the *near* future *will* be fought in space. Space is being transformed into a battleground and the Space powers are vying for dominance. The Outer Space Treaty dictates that space should be used for peaceful purposes, and therefore many have interpreted this to mean non-military. Others, including the United States, have argued that it means non-aggressive[101]. At the moment the only specific limit on the military use of outer space is under Article IV, paragraph 1 of the Outer Space Treaty[102], which states that:

State parties to the Treaty undertake not to place in orbit around the Earth any object carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner.

It is clear that currently outer space *should* be free from weapons of mass destruction. However, there is nothing preventing the stationing of such dangerous weapons in a State's own territory, for example at high altitude. For this reason it would be beneficial to set a limit for a State's vertical boundary. Surprisingly, the issue of weapons of mass destruction in this respect is not the substance of urgency. The question of the use of force in outer space is the

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[99] Space Operations, AIR FORCE DOCTRINE DOCUMENT 2-2, SECRETARY OF THE AIR FORCE 27 NOVEMBER 2006

[100] I. Brownlie *Principles of Public International Law,* 6th ed. Oxford University Press, Oxford (2003) at 784

[101] M. N. Schmitt, 'Bellum Americanum: The US View of Twenty-First Century War and Its Possible Implications for the Law of Armed Conflict' (1998) 19 *Michigan Journal of International Law* 1051 1087

[102] Although Article VI paragraph 2 restricts the use of the Moon and other celestial bodies to non-aggressive purposes. There is therefore a limited demilitarisation of space and a complete demilitarisation of celestial bodies.

current and pressing issue; where is the limit of a state's territory for attack and where does an international 'peaceful' area start? This section will examine the attitudes surrounding the militarisation of space, evidence of the possible defence proliferation and the subsequent need for delimitation.

As the introductory statement by Johnson recognises, the inherent position of weapons in space would give any State an advantage in combat, or even the threat of it. For fifty years there has been posturing and claims of development to a new era of 'Star Wars'. The technological potential has steadily been increasing, but it has been the political will and pressure that has prevailed in preventing, or at least postponing, the weaponisation of space. The costly Strategic Defence Initiative of Reagan's 1980's battle against the evil empire helped succeed in marginalizing the USSR, but through attrition of funding rather than warfare. Since then there has been one superpower. However, when one examines recent changes such as the advancement of technology, the apparent increased threat from 'rogue' States and real threat of terrorism, the emergence of China and resurgence of Russia, the subsequent change in national defence policies and its repercussions has led to a bleak future for space security. This change in global security has re-ignited the concern over attitudes towards military activities in space. For example, even in *1998* General Ronald R. Fogleman stated,

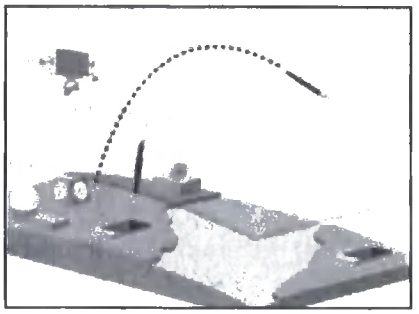
When you think about protecting this nation's global interests, you have to remember it starts with space. It's a presence with a real impact... Because of what we do in the space medium, I would suggest that space is the fourth dimension of warfare.[103]

The most publicised US military response to the new century's threats has been the missile defence programme. Missile Defence as a generic term is a military strategy and associated systems to shield an entire country, or theatre, against incoming Intercontinental Ballistic Missiles (that travel through space). Defensive missiles or lasers would intercept the ICBM's, either near the launch point (boost phase), during flight through space (mid-course phase), or during atmospheric descent (terminal phase).[104] As the identification and tracking of the missiles would be conducted from space, then those satellites may be targeted themselves, resulting in the need for self-defence measures, then countermeasures and proliferation even

[103]General Ronald R. Fogleman, USAF AFDD 2-2 (Draft, March 1998), 'Space Operations'. Air Force Doctrine Center United States Air Force. Chapter 3 also more recently; 'Space is a domain, like the air, land, sea, and cyberspace, within which military operations take place'. *Space Operations*, AIR FORCE DOCTRINE DOCUMENT 2-2, SECRETARY OF THE AIR FORCE 27 NOVEMBER 2006

[104] www.wikipedia.com

further. The introduction of the missile defence for the US, its interests and it's allies is the first step on a onto a slippery slope.



[105]

It is the policy of the United States to deploy as soon as is technologically possible an effective National Missile Defense system capable of defending the territory of the United States against limited ballistic missile attack (whether accidental, unauthorized, or deliberate)...

- National Missile Defense Act of 1999[106]

Unlike the original Strategic Defence Initiative, which put weapons directly into space and was designed to counter the USSR, the National Missile Defence programme would be have ground based weapons and protect against 'rogue States'. To realise these measures, the US unilaterally withdrew from the Anti Ballistic Missile Treaty of 1972, which prohibited a national missile defence system, with alarm from countries such as China and Russia. In response, Russia withdrew from the 1993 START II Treaty, which reduced nuclear arms. Although there have been some moves forward, such as new agreements to reduce arms[107], the tension is still there. The recent policy position of the United States has certainly not quelled concerns:

'The United States relies on space operations for its security, and this reliance may make us vulnerable in some areas. Identifying vulnerabilities will allow us to apply our full range of capabilities to ensure space superiority...[108]' (Emphasis added).

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[105] BBC News Friday 23 feb http://news.bbc.co.uk/1/hi/world/americas/696028.stm
[106] Public Law 106-38
[107] Russia and the US signed a major new arms reduction deal in May 2002, agreeing to cut their nuclear arsenals by two-thirds - to about 2,000 warheads each http://news.bbc.co.uk/1/hi/world/americas/696028.stm
[108] Chief of Staff—General John P. Jumper, *Counterspace Operations*, Air Force Doctrine Document 2-2.1 Secretary of the Air Force, 2 August 2004

One of the reasons why there is heightened anxiety is the perception that "space supremacy is now the official policy of the United States government"[109]. Whether or not the accusation is accurate is uncertain but recent policy statements have not removed the fear of a new arms race in space[110]. Claims such as the 'Freedom of action in space is as important to the United States as air power and sea power...' indicate the magnitude of regard space now holds. Moreover, the US 'will view purposeful interference with its space systems as an infringement on its rights' and 'oppose the development of new legal regimes or other restrictions that seek to prohibit or limit U.S. access to or use of space.'[111] Many commentators have reflected that the new US space policy reflects a more aggressive and unilateral stance[112]. In fact, national and Department of Defense space policy state that "[p]urposeful interference with US space systems will be viewed as an infringement on sovereign rights."[113] One could also argue that the position could be said to be contradictory, with statements such as:

'No nation, no non-state actor, should be under the illusion that the United States will tolerate a denial of our right to the use of space for peaceful purposes,' but then goes on to say, *'We reserve the right to defend ourselves against hostile attacks and interference with our space assets. We will, therefore, oppose others who wish to use their military capabilities to impede or deny our access to and use of space. We will seek the best capabilities to protect our space assets by active or passive means.'*[114]

The *peaceful* rights of free use, freedom of passage and non-interference are met with the promise to deny and *interfere* with hostile threats, and even prevent nations and actors obtaining that capability. Adopting such a position, particularly with the language used, does not lead to a cooperative and peaceful atmosphere (politically and literally!). Some observers have hit back at the accusations, arguing that the policy merely states, more forcefully than is

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[109] See Michael Goldfarb 'Not Really Lost in Space: The New National Space Policy' *The Space Review*, November 13, 2006

[110] As Nader Elhefnawy notes '... (it) may seem like just a matter of emphasis, but not when the language is examined within the document's larger context. Where the 1996 document states that the United States "rejects any limitations on the fundamental right of sovereign nations to acquire data from space," it now states that it "rejects any limitations on the fundamental right of the *United States* to operate in and acquire data from space" (emphasis added).' See N Elhefnawy 'The National Space Policy and Space Arms Control' Nov 27 2006 www.thespacereview.com/article/755/1

[111] http://news.bbc.co.uk/1/shared/bsp/hi/pdfs/18_10_06usspacepdf

[112] New Scientist magazine, Issue 2573 14 October 2006, at 7

[113] Space Operations, AIR FORCE DOCTRINE DOCUMENT 2-2, SECRETARY OF THE AIR FORCE 27 NOVEMBER 2006

[114] Elaborating publicly for the first time since the October release of a new national space policy, Robert G. Joseph Undersecretary of State for arms control and international security. "Talk of Satellite Defense Raises Fears of Space War U.S. Says Attacks on Crucial Systems Are Possible, Warns It Would Respond Forcefully", an article by Marc Kaufman *Washington Post*, Sunday, December 17, 2006

probably warranted, that the United States will not accept a situation whereby other countries can deny America access to space. 'There's a big difference between acting as a space cop and stating that you will not allow another country to push you around'[115]. Also, as White House spokesman Tony Snow said, 'the notion that you would do defence from space is different from that of weaponisation of space; we're comfortable with the policy'[116]. Nonetheless, the unambiguous decisions that even the consideration of arms control are categorically diplomatic and political errors. The administration insists that there is not an arms race in space, but the United States is the only nation that opposed a recent United Nations call for talks on keeping weapons out of space. It is unnecessarily provocative to other states that already view US policy with alarm.

In contrast to the United States apparent aggression, possibly through fears of a new space race, or simply for good public relations, for the last several years Russia and China have been actively trying to build on the Outer Space Treaty. On June 27, 2002 they presented a working paper titled 'Possible Elements for a Future International Legal Agreement on the Prevention of the Development of Weapons in Outer Space, The Threat or Use of Force Against Outer Space Objects' at the United Nations Conference on Disarmament in Geneva[117]. The paper proposed a treaty obliging signatories not to place "any kinds of weapons" in space or resort to force or the threat of force against space objects. This would rule out attacks on spacecraft by land-, sea-, and air-based systems. Remarkably, the response from Russia reflects the response the former USSR made to the threat of a war in space over twenty years before. On Aug. 10, 1981, the USSR submitted to the UN General Assembly a Draft Treaty on the Prohibition of the Stationing of Weapons of Any Kind in Outer Space[118]. Both responses tried to show why a legal instrument on the Prevention of an Arms Race in Outer Space (PAROS) was needed, and what could be done.

In the most recent working paper China and Russia stressed that the weaponisation of outer space was no longer an academic question nor science fiction, but an imminent danger. Reasons to be concerned include the truth that weapons were not fully prohibited in space by the Outer Space Treaty, the technology exists or was feasible for the weaponisation of space, the *Long Range Plan*[119] of the US Space Command has been to dominate and control space,

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[115] D. A. Day *Not Really Lost in Space: the New National Space Policy* November 13, 2006
[116] http://news.bbc.co.uk/2/hi/americas/6063926.stm
[117] CD/1679 see http://www.geneva.mid.ru/disarm/doc/CD1679-ENGLISH.pdf Also note the Russian initiative, 'Measures to promote transparency and confidence-building in outer space activities,' A/RES/61/75
[118] UN Doc. A/36/192
[119] United States Space Command, Long Range Plan, April 1998 see http://www.fas.org/spp/military/docops/usspac/lrp/cover.htm

the actual preparation for a war in space[120] and the perceived threat of a space 'Pearl Harbor'. This is due to the fact that the US feels vulnerable in space and feels that they could be shocked by a surprise attack. As such they need to defend themselves. The proposals in the working paper include provisions 'Not to place in orbit around the Earth any objects carrying any kinds of weapons, not to install such weapons on celestial bodies, or not to station such weapons in outer space in any other manner'. Furthermore, there would be a ban on the use of force *against* outer space objects, including from Earth. Also the proliferation of such activities to other actors would be prohibited. Problems with such proposals are not minute. For example, on the definition of what constitutes a 'weapon', Canada has proposed a description of sorts in a paper to the UN conference on Disarmament, in which the authors say 'any device or component of a system designed to inflict physical harm through deposition of mass and/or energy on any other object.[121]' Whether all States, particularly the United States, could accept any agreement is doubtful.

Although in excellent anti-weaponisation cause, the reasoning behind the Russian and Chinese fears could be from the dominance and lead that the US has, rather than the complete exclusion of such activities. Russia and China have also been active in pursuit of space and anti-space weaponry with, for example, China firing high-powered lasers at U.S. spy satellites flying over its territory, with what experts see as a test of Chinese ability to blind spacecraft.[122] Strangely unconfirmed by the United States government[123], this highly provocative act is a clear indication of the beginnings of a new arms race in space.

There are so many concerns with the status of security with and in space that action needs to be taken. The issues range from policies of the leading space nations, the spread of the space race and even the first stages of the process today. For example, it may sometimes be impossible to distinguish between Anti Ballistic Missile directed-energy (laser) weapons and those deployed exclusively for anti-satellite purposes.[124] The possible stationing of elements of the missile defence in the UK, and especially in Poland and the Czech Republic, have alarmed Russia. The doubts of the US population have also been strong. The cost of new

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[120] In 2001, the first space battle exercises took place. Anti-satellite weapons, strategic missile defence systems and land-based laser weapons were envisaged in the exercise to attack targets in space. The scenario was set to happen in *2017*.

[121] UN Document CD/1569, 4 February 1999.

[122] http://wwwdefencenews.com/story.php?F=2121111. Also on 11 January 2007, China allegedly tested an anti-satellite (ASAT) weapon, using a ballistic missile to hit an aging Chinese weather satellite.

[123] This could be for one of several reasons from not wanting to increase tension militarily to the fact that China and the US are major economic partners

[124] Pamela L. Meredith, 'The Legality of a High-Technology Missile Defense System: The ABM and Outer Space Treaties', *The American Journal of International Law*, Vol. 78, No. 2. April (1984), pp. 418-423.

systems since 2001 has been between $7 billion and $9 billion a year on research and development and installation.[125] The problem at the moment is simply the lack of communication leading to fear and apprehension. Military commands have an overall interest in transparent communication as a way of preventing military incidents, and they are becoming increasingly anxious about their capability to determine the nature, be it commercial or military, of satellites on-orbit as its popularisation and miniaturisation increases.[126] The safety of the planet relies on sensible and mature diplomacy to ensure that death does literally not 'hang by a thread above our heads'. If the boundaries of national sovereign rights in space are brightly drawn, war will result only from acts of deliberate belligerence; if not, the strain of rival policies may precipitate war against the will of the participants and the interests of humanity. With the certainty of jurisdiction comes a set limit on a States actions and responsibilities. Delimitation would put a limit on the State and allow the international community to help begin to cool the steaming space powers. This author cannot explain the position any better than a statement made thirty years ago:

If indeed the human presence in outer space is to become more than a passing phenomenon, we must redouble our efforts to strengthen the basis, in international law, and most of all, in international treaties, of international cooperation for peaceful, and exclusively peaceful, uses of outer space, because the more outer space assumes the roles dreamers and utopians of former ages have suggested, which the scientists of outer time are now about to confirm, the more we shall feel obliged to protect this new environment from the ills, from the evils and from the burdens of our terrestrial spheres. We must make sure that outer space can be spared the fate of so many human discoveries of previous ages, namely, becoming a mere battlefield...[127]

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[125] Michael Evans, Defence Editor 'Downing Street offers to station US 'Son of Star Wars' missiles in Britain' *The Times* February 24, 2007

[126] Proposal for a New Regulatory Regime *An ICAO for Space?* International Association for the Advancement of Space Safety May 2007 At 90

[127] Following the development of anti-satellite weapons (ASATs) in the 1970's, the matter was brought to the attention of Ambassador Peter Jankowitsch of Austria, the United Nations when the Chairman of the committee on the Peaceful Uses of Outer Space (COPOUS). In his opening address to the committee in 1978, he warned passionately of the growing dangers in this field. Nandasiri Jasentuliyna, *International Space Law and the United Nations,* Kluwer Law International, The Netherlands (1999) At 74

V) Drawing a Line under Delimitation

Fifty years ago, at the dawn of space travel in 1957, the definition and delimitation of airspace and outer space became for many commentators "the central, even crucial, issue of public order of outer space."[1] In 1967 technical experts arrived at the conclusion that at that time 'no scientific and technical criteria could be found which would permit a precise and lasting definition of outer space'[2] and which would be acceptable to all states. This thesis has attempted to show why not only is delimitation a central issue, but an imperative one. Humanity now has both the technology and scientific understanding to establish a boundary between these two scientifically and legally distinct spheres. For half a century the international community has lacked the united political will to resolve the well-known problem, leading to a claim of it becoming 'the never ending dispute'. This conclusion does not assume that it will provide a definitive and all encompassing solution that will satisfy every interest in this space odyssey. Nevertheless, in hope of suggesting some answers to the boundary problem, there is below a collection of thoughts that have been in produced in this research and the opinions formed therein.

Firstly, one needs to dispense with the criteria that simply are inappropriate and unsatisfactory. On a spatial scientific plane, a boundary must not be too low as to inhibit the activities that have been long established and be easily changed in the advance of technology. Therefore, a limit based on the maximum height of *conventional* aircraft (i.e. 60 kilometres) would be too low for security and the sovereign concerns of States. Equally, the distance must not be too great as to confuse the activities of space objects and aircraft and be beyond the practical abilities of State control. Delimitation in relation to gravity would be such an example. The criterion based on the atmosphere could be just as distant and as uncertain with incalculable variations within its layers. Furthermore, if one attempted to divide space into 'zones' then the sheer perplexity of the changing rotating direction of control would render the theory unworkable. Demarcation options can also be impractical for political reasons. If one used the *terræ potestas finitur armorum vis;or ubi vis ibi jus* maxim, then the most advanced States would become more dominant, leading to a more aggressive international arena and conflict.

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[1] M.S. McDougal, H. Lasswell, I. Vlasik, *Law and Public Order in Space*, Yale University Press, New Haven (1963), at 323, in N. Grief, *Public International Law in the Airspace of the High Seas* (1994) Utrecht Studies in Air and Space Law, Martinus Nijoff Publishers, The Netherlands, at 37

[2] In the early work at the UN Committee on the Peaceful Uses of Outer Space the delegate from the USSR UN Doc. A/AC.105/39 of September, 6 1967, at 7

The problems with proposed criteria do not stop with the spatial theorists. The Functional Approach on in its current status is too basic in presumption and too complicated in practice. The functionalists have ignored both physical and political facts that would be vital to resolve the delimitation problem. The truth that air and outer space are different spheres is unavoidable. At some point a boundary would have to be set. Crucially, this follows on to the jealous nature of sovereign States. Even if passage rights could be resolved, an upper limit for territorial integrity would be needed as airspace is within the realm of nations. It is again disappointing to note this approach is appealing in a crude manner like calling a spade a spade. The attitude seems simple and attractive. However, the actual confusion that would ensue with functionalism would provide too many uncertainties and it would leave just as many questions as it would answer. The functionalist ideal is to regulate activity, as any future laws should be. Nevertheless, outer space is a place *and* a platform for activities, so any answer to the delimitation question should attempt to resolve both conditions, not just offer a half-hearted remedy. With the advent of hybrid craft like SpaceShipOne dividing laws to regulate space and air *activities* would just be too complex and yet vague.

When determining a boundary it must be practical, popular, proven, useful and definitive[3]. As Harris and Harris recognise, the demarcation line must be sensitive to technological advances and the possibilities of regulating national jurisdiction, it must not hamper space technology and must not be so high that national air space cannot be regulated.[4] In light of the information and opinions available, the most suitable altitude must be delimitation set at 100 kilometres. From so many angles this meets the specification to provide a workable, most accepted and appropriate option. The altitude is not simply a suggestion from one criterion but a convergence of the most admired choices. Demarcation based on the lowest perigree of a satellite and the von Karman Line meet at approximately 100 kilometres. The theory of navigable space also approaches this level. The tender of such a level is not new, but the fact that it is not a miracle or 'revolutionary' proposal is one of its most notable strengths. Supporters of the von Karman line and the lowest perigree of a satellite have ranged from Diedricks-Vershoor, Kopal, Jastrow, McNair, Johnson, Cooper and Goedhuis.[5] On one level of disappointment for originality, this author's thoughts were discovered to be actually reflective of the attitudes of Nicolas Grief:

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[3] *Caveat humana dominandi, quod omnes tangit ab omnes approbatur.* (What concerns all must be approved by all).
[4] Alexandra Harris and Ray Harris *Space Policy*, Volume 22, Issue 1, February 2006
[5] See the Spatial Approach above, at around 45

Although the final agreement has not yet been reached, the lowest orbiting altitude of satellites commends itself as a logical basis for delimitation. Furthermore, it would establish the boundary at a height similar to that suggested by the 'von Karman formula'. Such a criterion would determine the boundary between airspace and outer space and thus define the upper limit of airspace...'[6]

Goedhart also linked the two areas, giving support to the aerodynamic school and stated that 'this intermediate area which presents itself as a matter of nature, happens to coincide with the numerous proposals done in Western literature on international law: most of them are directed at choosing a height between 80 km and 100 km above mean sea level.'[7] He went on to say that 'there are very few convincing arguments against the (lowest perigee) boundary criterion... (And) it is hardly possible to exaggerate the acceptability of the lowest perigee criterion.'[8]

This KARLOS (von KARman and Lowest Orbit of a Satellite) delimitation has several other factors in is favour. The von Karman line has not simply been another arbitrary, useless theory that has had no practical use. This definition is accepted by the Fédération Aéronautique Internationale (FAI) as the separation between aeronautics and astronautics for international standard setting and record keeping. The X-prize flight of SpaceShipOne is such an example of its significance. In fact, because of sub-orbital flights any delimitation boundary, even as part of a layered theory, below 100km would be ineffectual and only confuse the regulation and management of airspace. Undoubtedly, when space tourism is firmly established, it is very possible that the von Karman line would become a recognised 'boundary' between air and space. Additionally, there are many reasons for supporting the lowest perigree of a satellite as part of the delimitation boundary. Obviously, as it is the lowest point in which any satellite could operate, it therefore would cover all space activities under current law. Unlike other criterion, such as the atmospheric boundary, no satellites could operate beneath it without re-entry or destruction. Furthermore, as current conventional aircraft do not operate above approximately 60 kilometres, there would be no serious conflict of interest, especially *if* there was a right of passage. A right of peaceful passage for

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[6] N. Grief, *Public International Law in the Airspace of the High Seas* (1994) Utrecht Studies in Air and Space Law, Martinus Nijoff Publishers, The Netherlands at 45

[7] Robert F.A. Goedhart, *Forum For Air and Space Law: The Never Ending Dispute: Delimitation of Air Space And Outer Space* (1996) Vol. 4 Editions Frontieres, France, Marietta Benko, Willem de Graaff (eds.) 59-60.

[8] Goedhart, *Ibid* at 50-51.

'spacecraft' take-off and landing[9], with a similar boundary of 100-110 kilometres, has been proposed, or even claimed, before by the former USSR[10], and subsequent Russian Federation[11]. Also in support of the KARLOS line is the point that there has been no real long standing objection to satellite over-flights, apart from the Bogata Declaration[12], and this could lead to the presumption that satellites obviously operate outside of national airspace and therefore establish a boundary of 100 kilometres[13]. The lowest orbit of a satellite would in fact appeal to the encroaching and protective nature of States, as they could claim air 'territory' with a boundary well above the limit of conventionally used airspace, and it would probably be the maximum height which would be generally acceptable. Furthermore, with the certainty of jurisdiction comes a set limit on a States actions and responsibilities.

One problem that may be apparent from the benefits of the limit of 100-kilometre boundary is the issue of rights of passage. Supporters of free movement and the rights of passage draw reference to Art. I of the Outer Space Treaty that States space shall be *free for exploration and use by all States*. Writers such as Wassenbergh have advanced a 'right of innocent passage' of space objects through foreign airspace. [14] However, in relation to the law of the *air*, primarily justified on security and safety grounds, there has never been such a transit right

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[9] 'Peaceful' was explained by the USSR delegation as being a passage which does not cause adverse effects in the territory of the State whose airspace is crossed USSR Delegate B. Maiorski recorded in UN Doc. A/AC.105/C.2/SR.392.

[10] In 1979 the Soviet Union proposed that the boundary should be established at 100 or 110 kilometres above sea level. Bin Cheng, "The Legal Regime of Airspace and Outer Space: The Boundary Problem. Functionalism versus Spatialism: The Major Premises", *Annals of Air and Space Law*, vol. 5 (1980), at 323 and 326. Belgium and Italy have suggested heights of 100 and 90 kilometres, respectively. See further Cheng, "The Commercial Development of Space: The Need for New Treaties", *Journal of Space Law*, vol. 19 (1991), at 17 The claim was reiterated in UN Doc. A/AC.105/C.2/L.139 of April 4, 1983. Although the Soviet Union claimed such a right had been established through international practice, there has not been an acceptance of it into international custom.

[11] Russian Federation delegation replaced the USSR position and issued a new detailed working document A/AC.105/C.2/L.189 0f 30 March 1992. Instead of formulating a proposal especially with respect to passage rights this paper contains the following statement:
"...The practice has been established whereby a space object launched by a State may, when being placed in orbit, pass without hindrance over the territory of other States at virtually any altitude. To be sure, prior notification has been given in a number of cases when the altitude of the flight over the territory of a foreign State was approximately 100km or less. However, such notifications were voluntary and prompted by considerations of international courtesy."

[12] In the Bogota Declaration of 1976, participating equatorial states declared that with no current boundary between airspace and outer space they should have control over the geostationary orbits above their countries. Declaration of the First Meeting of Equatorial Countries 1976, the Bogota Declaration on the Geostationary Orbit. The international community however have rejected the proposal to date but do believe the matter needs attention.

[13] See *Question of the Definition/Delimitation of Outer Space*, Background paper prepared by the Secretariat, UN Doc. A/AC.105/C.2/7 of May 7, 1970, para 31

[14] H.A. Wassenbergh, *Principles of Outer Space in Hindsight*, Martinus Nijhoff Publishers, London (1991) at 18

of 'innocent passage' for foreign *aircraft* to fly over sovereign territory.[15] As such, with spacecraft and objects being less safe than aircraft, why should States not be hesitant to grant rights of passage to space for essentially gigantic bombs? States have exclusive sovereignty over their airspace and will never relinquish control over such a vulnerable sphere of influence without guarantees or agreement. There is no customary right of passage of spacecraft, and although there are signs of provisions for containing sub-orbital space tourism within the current 'aviation' framework[16], the delimitation of where space begins would limit the control of the State and nations are obviously apprehensive; They want to ensure the safety and security of their population. It is likely that any immediate rights of passage regarding 'pure'[17] spacecraft will arise from bilateral agreements. If the possibility of a general right of free passage is secured it will probably only be after further space enfranchisement and progress of space law currently led by developed countries. It is however extremely unlikely that any State would protest stringently at over-flights for the purposes of reaching space or re-entry. If one State prohibited over-flights then the other may return the compliment, leading to stagnation. This fact forced States to cooperate in relation to the development of air travel so why would it be different with brief transits of spacecraft?

Ideally, to guarantee the rights of all, there does need to be a system to accommodate access to, and regulation of, space. This is in fact the basis of the second element of the delimitation solution of this research. As well as proposing the KARLOS limit to State sovereignty and the beginning of international space, the authority of the International Civil Aviation Organisation, or a similar body, would be extended out to the Geostationary Orbit, at 36,000 kilometres. Admittedly, this claim appears at first to be unclear and irregular. Nonetheless, necessities dictate the regulation of 'Near Space' by the international community, ideally through the UN and all related bodies. There would therefore be the KARLOS sovereignty limit and the Near-Space Area (NSA) to be regulated for the benefit of all mankind and directed as a truly public utility. The need for such regulation is necessary and vital. If the increasing use of space were not checked then the freedom of use[18] guaranteed within the Outer Space treaty would contrast with the resulting activities 'interfering'[19] with activities of other States. With the advent of commercialisation and the dawn of space tourism, the problem of space debris, increasing numbers of space states, saturation of the geostationary orbit, the threat of weaponisation of space and the present dominance shown by some space

[15] Prasert Ponpongsuk, 'Transit Rights over Territorial Airspace; Reflections on the Practice of Thailand' *Thai Law Forum, Law Jourant*, June 2002
[16] See the FAA and US position on Space tourism and Space Traffic Management above.
[17] As in space objects destined for orbital space
[18] Article I of the Outer Space Treaty
[19] Article IX of the Outer Space Treaty

powers, it is important for countries to see the urgency of the situation and the collective benefits that would stem from increased cooperation and consensus.

The problems with the current status quo cannot be understated. For example, in October 2006 the United States issued a new U.S. overall civil, commercial and military space policy[20]. This policy made overnight the previous concept of common 'outer space' obsolete, or at least pushed it somehow beyond the geostationary orbits, while a sort of free for all 'near space' has taken shape. If the present dominance were allowed to continue, a space nation would have the right to exploit for its own interest and no more as an ambassador of mankind and for the benefit of all. The new US space policy is not revolutionary but it is just a factual picture of what space has become. As Oduntan notes,

'they (developed space States) must realise that it is not sufficient to offer humanity a perpetual promise of respecting outer space and its celestial bodies as the common heritage of mankind. There is a basic obligation upon all states capable of exploring and exploiting space now to be responsive to the interests of developing states.'[21]

An excellent example of this inadequacy has been the geostationary orbit, which as a 'limited natural resource', where 'equitable access' *should* be guaranteed.[22] From the very real threat of the space powers taking exclusive advantage of such a position, the 1976 Bogata Declaration made an assertion claiming sovereignty above their countries up to the geostationary orbit, 36,000 kilometres. Obviously this was impractical for national appropriation but an indication of the inequality felt by those not yet able to access space. As the International Telecommunication Union now is meant to involve the developing countries

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[20] *An ICAO for Space?* International Association for the Advancement of Space Safety May 2007 at 9

[21] It is in this light that the General Assembly Declaration on International Co-operation in the Exploration and Use of Outer Space for the Benefit and in the Interest of all States, Taking into Particular Account the Needs of Developing Countries, adopted in 1996 (resolution 51/122) G. Oduntan, 'The Never Ending Dispute: Legal Theories on the Spatial Demarcation Boundary Plane between Airspace and Outer Space', *Hertfordshire Law Journal* 1 (2003) (2) at 84

[22] Between 1963 and 1982, 126 satellites were placed in the geostationary orbit on a 'first come, first served' basis. See *UN Chronicle*, vol. XIX (No7) (1982) at 58. Article 44(2) of the 1992 Constitution of the International Union enshrines the principle of equitable access. See further J.M. Smits, *Legal Aspects of Implementing International Telecommunication Links*, Martinus Nijhoff Publishers, London (1991) at 72 to 78; G.C.M. Reijnen and W. de Graff, *The pollution of Outer Space, in particular of the Geostationary Orbit*, Martinus Nijhoff Publishers, London, (1989), at 3; Sir R. Jennings and Sir A. Watts (eds), *Oppenheim's International Law*, vol.I (Peace), 9th Ed. British Yearbook of International Law (1992), Parts 2-4, Ch. 7, para.371. See N. Grief, *Public International Law in the Airspace of the High Seas* (1994) Utrecht Studies in Air and Space Law, Martinus Nijoff Publishers, The Netherlands at 40-42

when managing the geostationary orbit[23], it seems logical to equally secure for the international community the space that has become so regularly used as well.

Another reason for greater supervision is the example of remote sensing, which highlights the sectional and self-interest attitudes surrounding the benefits from space. If national laws were the preferred method of advancing the regulation of space activities, although it is a positive action, it would only serve to reinforce the conflicting interests of those who have and have not. The hypocrisy of space policy and practice is shown by those who are apparently leading the way forward for the benefit of mankind, but are simply winning in the race for space. The lack of a truly fair Treaty to protect the common heritage of mankind is concerning. Delimitation would not immediately solve all of the issues surrounding the use and exploration of space. Instead, as stated before, it would clarify the limits of State sovereignty and allow the progression of *international* law in space. When the boundary between airspace and outer space is secured, it would force the actors, both public and private, to address the pressing concerns of the NSA that include remote sensing and the geostationary orbit.

One of the compromises that might be suggested to the current space powers would be a distinction on a *functional* basis, not of whether an activity is air or space related, but whether the activity was public or private. To reflect the trends in sea and air law, spacecraft would carry the registered flag of the State but not be under as direct control. Today for example, a fundamental difference in air and space law is that with planes owned by the private sector, the State exercises a supervisory role and maintains responsibility, without financial risk. In space law States accept the financial risk *and* liability[24] inherent to their responsibility. If one released States from such burdens of *financial* responsibility and liability, it would free-up industry and truly modernise the State-centric nature of current space law. Admittedly, the full scope of this particular subject is beyond the confines of the delimitation question. Concerns over red tape, developing technology, the criteria for distinguishing activities, especially if they can be considered public and private, and the founding of such an important institution would be hotly debated. However it is a suggestion that would eventually help define who is responsible for what activities and where they are permitted. The registration, regulation and separation of functions, be it civil commercialism or tourism, or State (and military), would fall under the jurisdiction of the new international Space Traffic

[23] Agreement on Utilization of and Equitable Access to Geostationary Orbit UN Outer Space Legal Subcommittee Concludes Thirty-Ninth Session in Vienna, 27 March to 6 April UNIS/OS/216

[24] This reflects the responsibility of all states to any space activity and the consequences therein Article II of the Liability Convention

Management system established within the Near Space Area by the new International Civil *Air and Space* Organisation. This would help in the development of commercial adventures into space, establish clarity between nations in matters of security, give guidelines for domestic law and firmly secure space for the benefit of all mankind. One must be careful however not to smother the industry while it is still in it's infancy, so only basic regulations would probably be needed initially.

Finally, the fact that 'airspace is that part of space subject to the sovereignty of a state'[25] an effective limit could be drawn on each side of its jurisdiction. Since the largest portion of the earth is covered by the sea[26], which is not subject to State sovereignty, with the establishment of a comparable international space 'area', where the governing of space law has developed the concepts of 'province of mankind', there would be no need to establish a boundary between international air and space, because the one would be regarded as an extension of the other. The prospect of two spheres of 'space', sovereign and non-sovereign, would form part of the future international law. This distinction between two areas of law would provide clarity, certainty and benefit all nations and people.

Although advocating the establishment a need for delimitation at 100 km immediately, the consequences of its imposition would justify suggesting options to resolve the related issues. This research summarises its position in four points:

1. The KARLOS line at 100 kilometres would be the limit of State sovereignty and the beginning of the final frontier for mankind. It would be the effective 'Thin Blue Line.'

2. A second line would encompass all of the space up to the geostationary orbit, at 36,000 kilometres. Regulating the Near-Space Area as a true public utility would be an international organisation set up through international consensus based on the International Civil Aviation Organisation, and include partners such as the International Telecommunications Union.

3. Space activities would be developed and distinguished similarly to the law of the sea and air law. The function of each could be categorised into sections based on their

[25] Seara Vazquez, *Cosmic International Law*, Wayne State University Press, Detroit (1985) at 27
[26] The continental territories, to which this sovereignty applies, account for only about 29 per cent of the earth's surface, while the remainder is covered by the oceans.

State or Civil nature. States would maintain the responsibility of supervision over private craft but not be burdened with the financial risk.

4. The status of the Near-Space Area would be developed to reflect the position and regulation of the high seas and international airspace. As such there would only be two forms of territory, sovereign and non-sovereign.

In 1959 Jessup and Taubenfeld[27] assumed a vertical air space limit to territorial sovereignty would be agreed at some point and theorised that eventual practical necessities would lead to its definition[28]. Those practical necessities have been realised. It is not good enough to wait and see and complain that the debate would open a 'quagmire of claims'. There will always be advances in science and technology threatening the perception of our world but the development of dominant military policies and adversarial politics is by far the greatest threat to the space sphere. Admittedly there have been no major problems, but surely it is better to prevent a disaster rather than save the world when it is engulfed by crisis and even war. The new space enfranchisement represents a space revolution that every nation has the right to enjoy. Delimitation is crucial, central and imperative for the successful, inclusive future of humanity in space. Space has been described as the high ground for conquest and communication; surely the high ground in this issue is conquering the barriers in communication?

[27] P.C. Jessup and H.J. Taubenfeld, *Controls for Outer Space and the Antarctic Analogy* (1959) Columbia University, New York

[28] See Alexandra Harris and Ray Harris *Space Policy*, Volume 22, Issue 1, February 2006, Pages 3-7

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Appendix Outer Space Treaty 1967

Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies

Signed at Washington, London, Moscow, January 27, 1967
Entered into force October 10, 1967

Article I

The exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind.

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.

There shall be freedom of scientific investigation in outer space, including the moon and other celestial bodies, and States shall facilitate and encourage international co-operation in such investigation.

Article II

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

Article III

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

Article IV

States Parties to the Treaty undertake not to place in orbit around the Earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner.

The Moon and other celestial bodies shall be used by all States Parties to the Treaty exclusively for peaceful purposes. The establishment of military bases, installations and fortifications, the testing of any type of weapons and the conduct of military manoeuvres on celestial bodies shall be forbidden. The use of military personnel for scientific research or for any other peaceful purposes shall not be prohibited. The use of any equipment or facility necessary for peaceful exploration of the Moon and other celestial bodies shall also not be prohibited.

Article V

States Parties to the Treaty shall regard astronauts as envoys of mankind in outer space and shall render to them all possible assistance in the event of accident, distress, or emergency landing on the territory of another State Party or on the high seas. When astronauts make such a landing, they shall be safely and promptly returned to the State of registry of their space vehicle.

In carrying on activities in outer space and on celestial bodies, the astronauts of one State Party shall render all possible assistance to the astronauts of other States Parties.

States Parties to the Treaty shall immediately inform the other States Parties to the Treaty or the Secretary-General of the United Nations of any phenomena they discover in outer space, including the Moon and other celestial bodies, which could constitute a danger to the life or health of astronauts.

Article VI

States Parties to the Treaty shall bear international responsibility for national activities in outer space, including the Moon and other celestial bodies, whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty. The activities of non-governmental entities in outer space, including the Moon and other celestial bodies, shall require authorization and continuing supervision by the appropriate State Party to the Treaty. When activities are carried on in outer space, including the Moon and other celestial bodies, by an international organization, responsibility for compliance with this Treaty shall be borne both by the international organization and by the States Parties to the Treaty participating in such organization.

Article VII

Each State Party to the Treaty that launches or procures the launching of an object into outer space, including the Moon and other celestial bodies, and each State Party from whose territory or facility an object is launched, is internationally liable for damage to another State Party to the Treaty or to its natural or juridical persons by such object or its component parts on the Earth, in air space or in outer space, including the Moon and other celestial bodies.

Article VIII

A State Party to the Treaty on whose registry an object launched into outer space is carried shall retain jurisdiction and control over such object, and over any personnel thereof, while in outer space or on a celestial body. Ownership of objects launched into outer space, including objects landed or constructed on a celestial body, and of their component parts, is not affected by their presence in outer space or on a celestial body or by their return to the Earth. Such objects or component parts found beyond the limits of the State Party to the Treaty on whose registry they are carried shall be returned to that State Party, which shall, upon request, furnish identifying data prior to their return.

Article IX

In the exploration and use of outer space, including the Moon and other celestial bodies, States Parties to the Treaty shall be guided by the principle of co-operation and mutual assistance and shall conduct all their activities in outer space, including the Moon and other celestial bodies, with due regard to the corresponding interests of all other States Parties to the Treaty. States Parties to the Treaty shall pursue studies of outer space, including the Moon and other celestial bodies, and conduct exploration of them so as to avoid their harmful

contamination and also adverse changes in the environment of the Earth resulting from the introduction of extraterrestrial matter and, where necessary, shall adopt appropriate measures for this purpose. If a State Party to the Treaty has reason to believe that an activity or experiment planned by it or its nationals in outer space, including the Moon and other celestial bodies, would cause potentially harmful interference with activities of other States Parties in the peaceful exploration and use of outer space, including the Moon and other celestial bodies, it shall undertake appropriate international consultations before proceeding with any such activity or experiment. A State Party to the Treaty which has reason to believe that an activity or experiment planned by another State Party in outer space, including the Moon and other celestial bodies, would cause potentially harmful interference with activities in the peaceful exploration and use of outer space, including the Moon and other celestial bodies, may request consultation concerning the activity or experiment.

Article X

In order to promote international co-operation in the exploration and use of outer space, including the Moon and other celestial bodies, in conformity with the purposes of this Treaty, the States Parties to the Treaty shall consider on a basis of equality any requests by other States Parties to the Treaty to be afforded an opportunity to observe the flight of space objects launched by those States.

The nature of such an opportunity for observation and the conditions under which it could be afforded shall be determined by agreement between the States concerned.

Article XI

In order to promote international co-operation in the peaceful exploration and use of outer space, States Parties to the Treaty conducting activities in outer space, including the Moon and other celestial bodies, agree to inform the Secretary-General of the United Nations as well as the public and the international scientific community, to the greatest extent feasible and practicable, of the nature, conduct, locations and results of such activities. On receiving the said information, the Secretary-General of the United Nations should be prepared to disseminate it immediately and effectively.

Article XII

All stations, installations, equipment and space vehicles on the Moon and other celestial bodies shall be open to representatives of other States Parties to the Treaty on a basis of reciprocity. Such representatives shall give reasonable advance notice of a projected visit, in order that appropriate consultations may be held and that maximum precautions may be taken to assure safety and to avoid interference with normal operations in the facility to be visited.

Article XIII

The provisions of this Treaty shall apply to the activities of States Parties to the Treaty in the exploration and use of outer space, including the Moon and other celestial bodies, whether such activities are carried on by a single State Party to the Treaty or jointly with other States, including cases where they are carried on within the framework of international intergovernmental organizations.

Any practical questions arising in connection with activities carried on by international inter-governmental organizations in the exploration and use of outer space, including the Moon and other celestial bodies, shall be resolved by the States Parties to the Treaty either with the

appropriate international organization or with one or more States members of that international organization, which are Parties to this Treaty.

Article XIV

1. This Treaty shall be open to all States for signature. Any State which does not sign this Treaty before its entry into force in accordance with paragraph 3 of this article may accede to it at any time.

2. This Treaty shall be subject to ratification by signatory States. Instruments of ratification and instruments of accession shall be deposited with the Governments of the United States of America, the United Kingdom of Great Britain and Northern Ireland and the Union of Soviet Socialist Republics, which are hereby designated the Depositary Governments.

3. This Treaty shall enter into force upon the deposit of instruments of ratification by five Governments including the Governments designated as Depositary Governments under this Treaty.

4. For States whose instruments of ratification or accession are deposited subsequent to the entry into force of this Treaty, it shall enter into force on the date of the deposit of their instruments of ratification or accession.

5. The Depositary Governments shall promptly inform all signatory and acceding States of the date of each signature, the date of deposit of each instrument of ratification of and accession to this Treaty, the date of its entry into force and other notices.

6. This Treaty shall be registered by the Depositary Governments pursuant to Article 102 of the Charter of the United Nations.

Article XV

Any State Party to the Treaty may propose amendments to this Treaty. Amendments shall enter into force for each State Party to the Treaty accepting the amendments upon their acceptance by a majority of the States Parties to the Treaty and thereafter for each remaining State Party to the Treaty on the date of acceptance by it.

Article XVI

Any State Party to the Treaty may give notice of its withdrawal from the Treaty one year after its entry into force by written notification to the Depositary Governments. Such withdrawal shall take effect one year from the date of receipt of this notification.

Article XVII

This Treaty, of which the English, Russian, French, Spanish and Chinese texts are equally authentic, shall be deposited in the archives of the Depositary Governments. Duly certified copies of this Treaty shall be transmitted by the Depositary Governments to the Governments of the signatory and acceding States.

SpaceShipOne…The First Private Manned Space Program
Goal is **Affordable** Sub-orbital Space Flight

Scaled began designing concepts for sub-orbital manned spacecraft in 1996. In April 2001 an extensive development program began.

• **White Knight** - An airborne launch aircraft provides safety and performance. Ground-level rocket launches are considered too risky, and a ground-launched ship needs to be twice the weight of one launched at 50kft altitude. The White Knight's cockpit and systems are identical to the spaceship, allowing component flight-qualification testing and realistic pilot training.

• **SpaceShipOne** - A three-place, high-altitude research rocket, designed for sub-orbital flights to 100 km altitude. The unique configuration allows aircraft-like qualities for boost, glide, and landing. The ship converts (pneumatic-actuated 'feather') to a stable, high-drag shape for atmospheric entry. This "Care-Free" configuration allows a 'hands-off' reentry and greatly reduces aero/thermal loads. Designed for a 'shirt-sleeve' environment, the 60" diameter cabin has a space-qualified ECS and dual-pane windows. The ship uses three flight control systems - manual-subsonic, electric-supersonic and cold-gas RCS.

• **Hybrid Rocket Motor** - A new non-toxic liquid-nitrous-oxide / rubber-fuel hybrid propulsion system was developed specifically for SpaceShipOne. Its unique design simplifies mounting and reduces leak paths. The composite nitrous tank and case/throat/nozzle components were developed at Scaled, with Thiokol providing the tank's filament wound over-wrap, and AAE Aerospace supplying the ablative nozzle. Development of the 'rocket science'(fuel, bulkhead, controller, valve, injector, igniter and ground test program) is being competed with two rocket motor developers - eAc (Environmental Aeroscience Corp of Miami) and SpaceDev of San Diego.

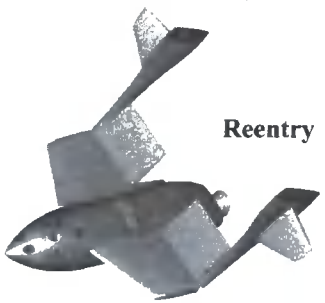
• **Mission Control** - A mobile ground station is used to monitor rocket motor tests and all flight tests. Staffed with flight test engineers, it provides real-time T/M data monitoring & recording of flight parameters. The spaceship's avionics displays are duplicated on a Mission Control monitor.

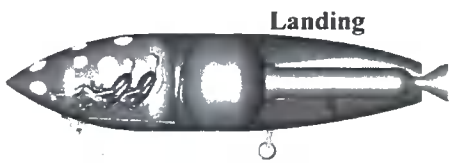
• **Simulator** - A research tool for aerodynamics and avionics, the simulator provides realistic pilot and engineer training. Video monitors at each window provide all-aspect views of boost, black-sky space, reentry, and landing. The simulator has the same avionics as the White Knight & SpaceShipOne.

• **Avionics** – A new INS-GPS Nav/Flight Director provides the pilot with the precise guidance information he needs to manually fly SpaceShipOne for boost and reentry. It also provides guidance for approach and landing and vehicle health monitoring. The unit stores flight test data and telemeters data to Mission Control. This system is developed jointly by Scaled Composites and FunTech (Fundamental Technology Systems of Orlando).

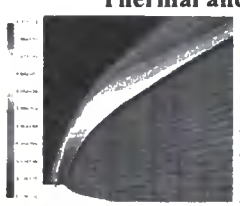
• **MONODS** - A mobile tanker is used for servicing liquid Nitrous Oxide to the spaceship and to the TST.

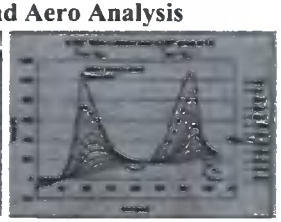
• **TST** - A mobile 'Test Stand Trailer' is used for instrumented, ground-based hot fire testing of the rocket motor. All development firings have used actual spaceship flight components including the nitrous tank and adjacent fuselage structure.

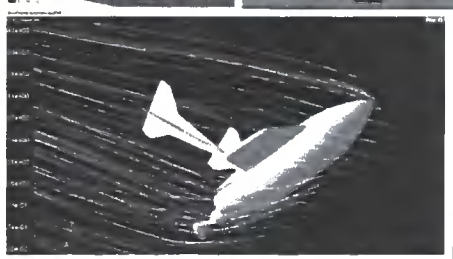


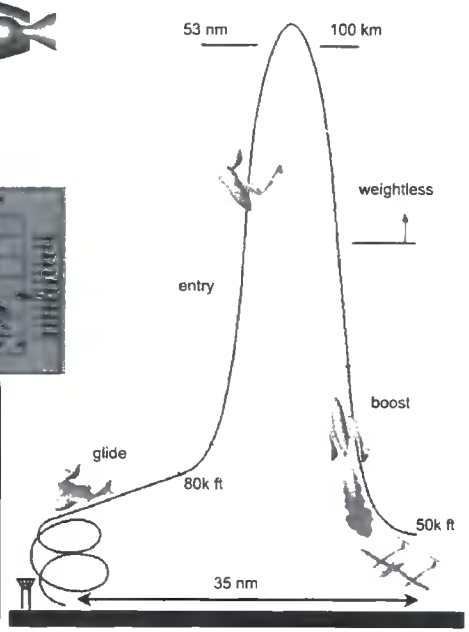


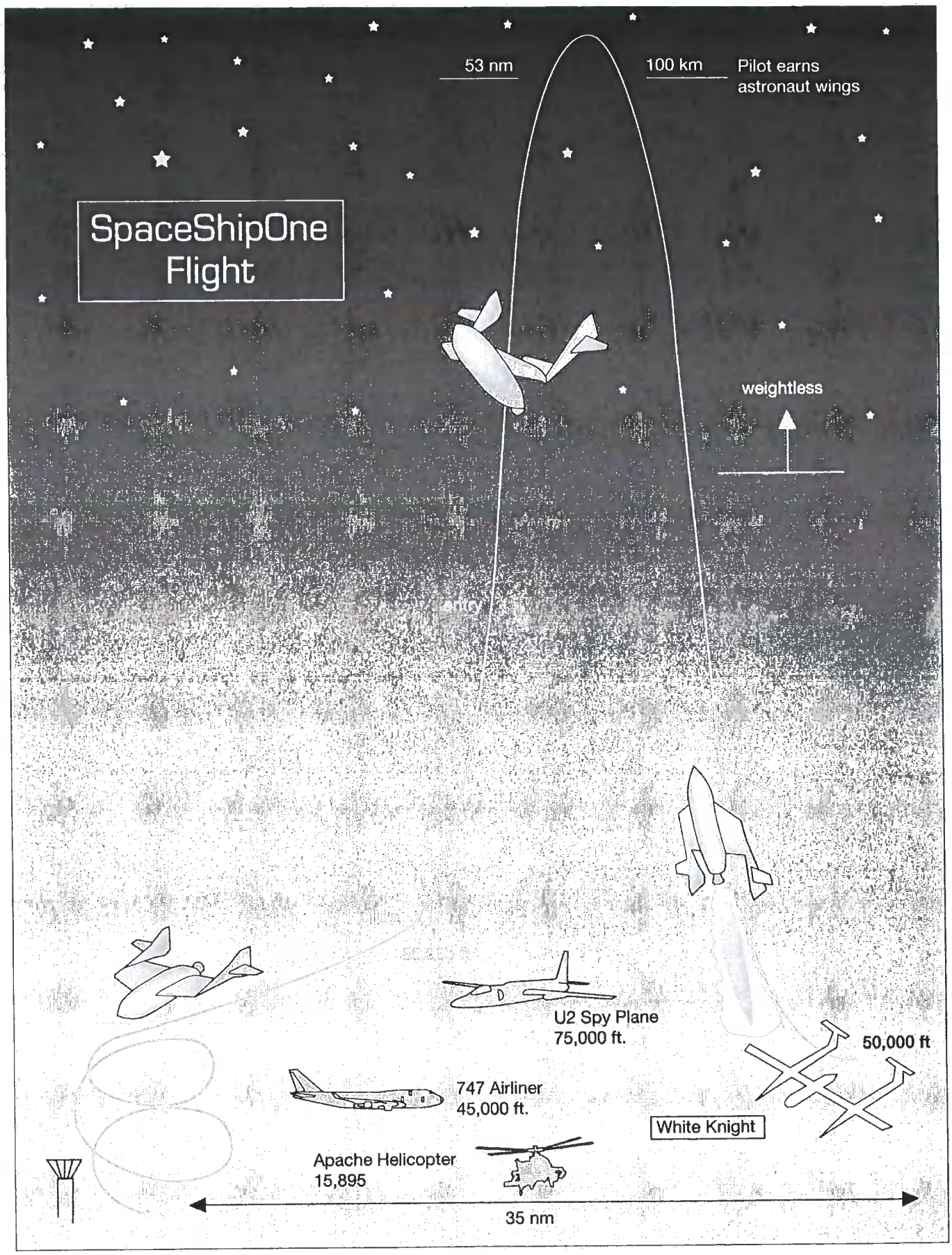
Thermal and Aero Analysis










SpaceShipOne Flight
53 nm
100 km
Pilot earns astronaut wings
weightless
U2 Spy Plane 75,000 ft.
747 Airliner 45,000 ft.
Apache Helicopter 15,895
50,000 ft
White Knight
35 nm

Appendix Bogata Declaration

DECLARATION OF THE FIRST MEETING OF EQUATORIAL COUNTRIES(Adopted on December 3,1976)

The undersigned representatives of the States traversed by the Equator met in Bogota, Republic of Colombia, from 29 November through 3 December, 1976 with the purpose of studying the geostationary orbit that corresponds to their national terrestrial, sea, and insular territory and considered as a natural resource. After an exchange of information and having studied in detail the different technical, legal, and political aspects implied in the exercise of national sovereignty of States adjacent to the said orbit, have reached the following conclusions:

1. The Geostationary Orbit as a Natural Resource

The geostationary orbit is a circular orbit on the Equatorial plane in which the period of sideral revolution of the satellite is equal to the period of sideral rotation of the Earth and the satellite moves in the same direction of the Earth's rotation. When a satellite describes this particular orbit, it is said to be geostationary; such a satellite appears to be stationary in the sky, when viewed from the earth, and is fixed on the zenith of a given point of the Equator, whose longitude is by definition that of the satellite.

This orbit is located at an approximate distance of 35,871 Kmts. over the Earth's Equator.

Equatorial countries declare 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, and that is why it must not be considered part of the outer space. Therefore, the segments of geostationary synchronous orbit are part of the territory over which Equatorial states exercise their national sovereignty. The geostationary orbit is a scarce natural resource, whose importance and value increase rapidly together with the development of space technology and with the growing need for communication; therefore, the Equatorial countries meeting in Bogota have decided to proclaim and defend on behalf of their peoples, the existence of their sovereignty over this natural resource. The geostationary orbit represents a unique facility that it alone can offer for telecommunication services and other uses which require geostationary satellites.

The frequencies and orbit of geostationary satellites are limited natural resources, fully accepted as such by current standards of the International Telecommunications Union. Technological advancement has caused a continuous increase in the number of satellites that use this orbit, which could result in a saturation in the near future.

The solutions proposed by the International Telecommunications Union and the relevant documents that attempt to achieve a better use of the geostationary orbit that shall prevent its imminent saturation, are at present impracticable and unfair and would considerably increase the exploitation costs of this resource especially for developing countries that do not have equal technological and financial resources as compared to industrialized countries, who enjoy an apparent monopoly in the exploitation and use of its geostationary synchronous orbit. In spite of the principle established by Article 33, sub-paragraph 2 of the International Telecommunications Convention, of 1973, that in the use of frequency bands for space radiocommunications, the members shall take into account that the frequencies and the orbit for geostationary satellites are limited natural resources that must be used efficiently and economically to allow the equitable access to this orbit and to its frequencies, we can see that both the geostationary orbit and the frequencies have been used in a way that does not allow the equitable access of the developing countries that do not have the technical and financial means

that the great powers have. Therefore, it is imperative for the equatorial countries to exercise their sovereignty over the corresponding segments of the geostationary orbit.

2. Sovereignty of Equatorial States over the Corresponding Segments of the Geostationary Orbit

In qualifying this orbit as a natural resource, equatorial states reaffirm "the right of the peoples and of nations to permanent sovereignty over their wealth and natural resources that must be exercised in the interest of their national development and of the welfare of the people of the nation concerned," as it is set forth in Resolution 2692 (XXV) of the United Nations General Assembly entitled "permanent sovereignty over the natural resources of developing countries and expansion of internal accumulation sources for economic developments".

Furthermore, the charter on economic rights and duties of states solemnly adopted by the United Nations General Assembly through Resolution 3281 (XXIV), once more confirms the existence of a sovereign right of nations over their natural resources, in Article 2 subparagraph i, which reads:

"All states have and freely exercise full and permanent sovereignty, including possession, use and disposal of all their wealth, natural resources and economic activities".

Consequently, the above-mentioned provisions lead the equatorial states to affirm that the synchronous geostationary orbit, being a natural resource, is under the sovereignty of the equatorial states.

3. Legal state of the Geostationary Orbit

Bearing in mind the existence of sovereign rights over segments of geostationary orbit, the equatorial countries consider that the applicable legal consultations in this area must take into account the following:

(a) The sovereign rights put forward by the equatorial countries are directed towards rendering tangible benefits to their respective people and for the universal community, which is completely different from the present reality when the orbit is used to the greater benefit of the most developed countries.

(b) The segments of the orbit corresponding to the open sea are beyond the national jurisdiction of states will be considered as common heritage of mankind. Consequently, the competent international agencies should regulate its use and exploitation for the benefit of mankind.

(c) The equatorial states do not object to the free orbital transit of satellites approved and authorized by the International Telecommunications Convention, when these satellites pass through their outer space in their gravitational flight outside their geostationary orbit.

(d) The devices to be placed permanently on the segment of a geostationary orbit of an equatorial state shall require previous and expressed authorization on the part of the concerned state, and the operation of the device should conform with the national law of that territorial country over which it is placed. It must be understood that the said authorization is different from the co-ordination requested in cases of interference among satellite systems, which are specified in the regulations for radiocommunications. The said authorization refers in very clear terms to the countries' right to allow the operation of fixed radiocommunications stations within their territory.

(e) Equatorial states do not condone the existing satellites or the position they occupy on their segments of the Geostationary Orbit nor does the existence of said satellites confer any rights of placement of satellites or use of the segment unless expressly authorized by the state exercising sovereignty over this segment.

4. Treaty of 1967

The Treaty of 1967 on "The Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies", signed on 27 January, 1967, cannot be considered as a final answer to the problem of the exploration and use of outer space, even less when the international community is questioning all the terms of international law which were elaborated when the developing countries 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.

There is no valid or satisfactory definition of outer space which may be advanced to support the argument that the geostationary orbit is included in the outer space. The legal affairs sub-commission which is dependent on the United Nations Commission on the Use of Outer Space for Peaceful Purposes, has been working for a long time on a definition of outer space, however, to date, there has been no agreement in this respect.

Therefore, it is imperative to elaborate a juridical definition of outer space, without which the implementation of the Treaty of 1967 is only a way to give recognition to the presence of the states that are already using the geostationary orbit. Under the name of a so-called non-national appropriation, what was actually developed was technological partition of the orbit, which is simply a national appropriation, and the equatorial countries must denounce this. The experiences observed up to the present and the development foreseeable for the coming years bring to light the obvious omissions of the Treaty of 1967 that force the equatorial states to claim the exclusion of the geostationary orbit.

The lack of definition of outer space in the Treaty of 1967, which has already been referred to, implies that Article II should not apply to geostationary orbit and therefore does not affect the right of the equatorial states that have already ratified the Treaty.

5. Diplomatic and Political Action

While Article 2 of the aforementioned Treaty does not establish an express exception regarding the synchronous geostationary orbit, as an integral element of the territory of equatorial states, the countries that have not ratified the Treaty should refrain from undertaking any procedure that allows the enforcement of provisions whose juridical omission has already been denounced.

The representatives of the equatorial countries attending the meeting in Bogota, wish to clearly state their position regarding the declarations of Colombia and Ecuador in the United Nations, which affirm that they consider the geostationary orbit to be an integral part of their sovereign territory; this declaration is a historical background for the defense of the sovereign rights of the equatorial countries. These countries will endeavour to make similar declarations in international agencies dealing with the same subject and to align their international policy in accordance with the principles elaborated in this document.

Signed in Bogota 3 December 1976 by the Heads of Delegations.

Brasil, Colombia, Congo, Ecuador, Indonesia, Kenya, Uganda, Zaire
http://www.jaxa.jp/library/space_law/chapter_2/2-2-1-2_e.html

Appendix Principles Relating to Remote Sensing of the Earth from Outer Space

From http://www.unoosa.org/oosa/SpaceLaw/rs.htm

Principles Relating to Remote Sensing of the Earth from Outer Space

Principle I

For the purposes of these principles with respect to remote sensing activities:

(a) The term 'remote sensing' means the sensing of the Earth's surface from space by making use of the properties of electromagnetic waves emitted, reflected or diffracted by the sensed objects, for the purpose of improving natural resources management, land use and the protection of the environment;

(b) The term 'primary data' means those raw data that are acquired by remote sensors borne by a space object and that are transmitted or delivered to the ground from space by telemetry in the form of electromagnetic signals, by photographic film, magnetic tape or any other means;

(c) The term 'processed data' means the products resulting from the processing of the primary data, needed to make such data usable;

(d) The term 'analysed information' means the information resulting from the interpretation of processed data, inputs of data and knowledge from other sources;

(e) The term 'remote sensing activities' means the operation of remote sensing space systems, primary data collection and storage stations, and activities in processing, interpreting and disseminating the processed data.

Principle II

Remote sensing activities shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic, social or scientific and technological development, and taking into particular consideration the needs of the developing countries.

Principle III

Remote sensing activities shall be conducted in accordance with international law, including the Charter of the United Nations, the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, and the relevant instruments of the International Telecommunication Union.

Principle IV

Remote sensing activities shall be conducted in accordance with the principles contained in article I of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, which, in particular, provides that the exploration and use of outer space shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and stipulates the principle of freedom of exploration and use of outer space on the basis of equality. These activities shall be conducted on the basis of respect for the principle of full and permanent sovereignty of all States and peoples over their own wealth and natural resources, with due regard to the rights and interests, in accordance with international law, of other States and entities under their jurisdiction. Such activities shall not be conducted in a manner detrimental to the legitimate rights and interests of the sensed State.

Principle V

States carrying out remote sensing activities shall promote international cooperation in these activities. To this end, they shall make available to other States opportunities for participation therein. Such participation shall be based in each case on equitable and mutually acceptable terms.

Principle VI

In order to maximize the availability of benefits from remote sensing activities, States are encouraged, through agreements or other arrangements, to provide for the establishment and operation of data collecting and storage stations and processing and interpretation facilities, in particular within the framework of regional agreements or arrangements wherever feasible.

Principle VII

States participating in remote sensing activities shall make available technical assistance to other interested States on mutually agreed terms.

Principle VIII

The United Nations and the relevant agencies within the United Nations system shall promote international cooperation, including technical assistance and coordination in the area of remote sensing.

Principle IX

In accordance with article IV of the Convention on Registration of Objects Launched into Outer Space 4 and article XI of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, a State carrying out a programme of remote sensing shall inform the Secretary-General of the

United Nations. It shall, moreover, make available any other relevant information to the greatest extent feasible and practicable to any other State, particularly any developing country that is affected by the programme, at its request.

Principle X

Remote sensing shall promote the protection of the Earth□s natural environment.

To this end, States participating in remote sensing activities that have identified information in their possession that is capable of averting any phenomenon harmful to the Earth□s natural environment shall disclose such information to States concerned.

Principle XI

Remote sensing shall promote the protection of mankind from natural disasters.

To this end, States participating in remote sensing activities that have identified processed data and analysed information in their possession that may be useful to States affected by natural disasters, or likely to be affected by impending natural disasters, shall transmit such data and information to States concerned as promptly as possible.

Principle XII

As soon as the primary data and the processed data concerning the territory under its jurisdiction are produced, the sensed State shall have access to them on a non-discriminatory basis and on reasonable cost terms. The sensed State shall also have access to the available analysed information concerning the territory under its jurisdiction in the possession of any State participating in remote sensing activities on the same basis and terms, taking particularly into account the needs and interests of the developing countries.

Principle XIII

To promote and intensify international cooperation, especially with regard to the needs of developing countries, a State carrying out remote sensing of the Earth from space shall, upon request, enter into consultations with a State whose territory is sensed in order to make available opportunities for participation and enhance the mutual benefits to be derived therefrom.

Principle XIV

In compliance with article VI of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, States operating remote sensing satellites shall bear international responsibility for their

activities and assure that such activities are conducted in accordance with these principles and the norms of international law, irrespective of whether such activities are carried out by governmental or non-governmental entities or through international organizations to which such States are parties. This principle is without prejudice to the applicability of the norms of international law on State responsibility for remote sensing activities.

Principle XV

Any dispute resulting from the application of these principles shall be resolved through the established procedures for the peaceful settlement of disputes.

Appendix Berlin Conference 2004

International Law Association
Space Law Committee
Professor Dr Maureen Williams

D. COMMENTS AND CONCLUSIONS FROM THE COMMITTEE CHAIR

In meeting the terms of reference of the Committee, the scholarly work carried out by the Special Rapporteurs on Remote Sensing and the sound contributions made by Committee members to the elucidation of this topic have certainly provided food for thought and reflection. In the following draft conclusions I shall attempt to draw some common denominators from the views and proposals submitted during the last two years.

1. The UN Principles on Remote Sensing (1986) are, at global level, the only international instrument providing specific rules and criteria on the subject. Most of them are nowadays declarative of customary international law and therefore binding.

2. Given that remote sensing technologies are today a commercial activity *par excellence*, and that space activities carried out by private entities are unrelentingly growing, it appears appropriate to begin the drafting of guidelines to cover certain gaps in the Principles and provide interpretation criteria to shed light on some of the general principles.

3. The definitions laid down in Principle I are not consistent with the present international context. The Principles are silent on significant aspects of remote sensing in today's world, *inter alia*, the distribution, dissemination and commercialisation of data collected by earth observation satellites and subsequently processed.

4. The Principles make no mention of the scope and implications of certain terms embodied therein such as, for example, "access to data on the part of sensed states", "needs of developing countries", "reasonable costs", "consultations" and "state responsibility".

5. There is no consensus within the Space Law Committee -nor within the doctrine at large- on the need to have a binding international instrument on remote sensing.

6. The general feeling, particularly at the inter-governmental level, is that premature solutions should be avoided, especially as no serious claims have been raised so far.

7. Consequently the political arena does not appear favourable for drawing up binding rules.

8. Thus a realistic course of action at this time would be the enactment of domestic law on remote sensing coupled with a revision by governmental bodies and private institutions of the most controversial and/or incomplete aspects of the UN Principles.

9. Domestic legislation should address, in a first stage, issues relating to the protection and distribution of data and licensing procedures, with a view to giving greater transparency to remote sensing activities.

10. Industrialised and developing countries provide today examples of national space legislation and bilateral and regional agreements on remote sensing, addressing issues on which the UN Principles remain silent.

11. As to the protection of data obtained by remote sensing it seems advisable that national laws, in the light of Article VI of the 1967 Space Treaty, deal with questions relating to the authorisation and supervision of private activities in space.

12. Having in mind the high number of States Parties to the 1967 Space Treaty, Article VI thereof may be seen as part of the domestic legislation of a good number of members of the international community.

13. International cooperation is called upon to play a major role in carrying out remote sensing activities, particularly in the ironing out of differences between industrialised and developing countries.

14. It appears timely, within the framework of commercial space activities and their various applications, to start considering guidelines and suggestions on the value of data collected by earth observation satellites and its value as evidence in international and national litigation. In this way the International Law Association would be making an important contribution to a debate which, in the first years of this millennium, is gradually gaining momentum.