

**THE RELEVANCE OF THE DELIMITATION DEBATE IN THE CONTEXT OF  
SPACE TOURISM AND SPACE TRAFFIC MANAGEMENT**

**by**

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## **ABSTRACT**

This study argues the relevance of the delimitation debate which has existed for over half a century. The study will show that a legally accepted boundary between air space and outer space would effectively close the existing gap within air and space law which has led to uncertain legal application over space activities. Technology changes in aircraft, spacecraft, combined with the growth of space activity, creates a sense of urgency to have the boundary issue resolved, a situation different from the early days of the space era when it was assumed that a boundary would be defined at a future indeterminate date. This study will examine the legal regime governing airspace and outer space and the growing pressures on questions of sovereignty resulting from the unknown delimitation line. To be followed by a background study of the delimitation debate, discussing the advantages and disadvantages of the approaches furnished in light of the emerging space technologies and space activities. The urgency to resolve the delimitation debate is put into context, by a discussion of the legal significance of the boundary issue in respect of problems arising in space activities and the regulation of space activities. The study will conclude by furnishing a preliminary proposal to resolve the delimitation debate.

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# 1 Introduction

Humankind has made great leaps since the start of the Space Age<sup>1</sup> with technological advancements related to space tourism and space exploration. The international community<sup>2</sup> has, however, failed to set a clear, legal and internationally approved delimitation line between airspace and outer space.

Scientists tell us that the earth's atmosphere is made up of five layers, which are the troposphere, stratosphere, mesosphere, thermosphere and exosphere, which dissipate increasingly into what is considered to be outer space.<sup>3</sup> The definitive boundary, the line that answers the question of where airspace ends and outer space begins, has, however, remained undefined.

Outer space is governed by international law whereby all nations share a common interest in outer space and where it is free for use by all.<sup>4</sup> Airspace, on the other hand, is governed by the fundamental international law principle that states exercise complete and exclusive sovereignty over their own airspace.<sup>5</sup> The differences in the international legal regimes governing airspace and outer space are so fundamental that they affect states in several ways,<sup>6</sup> especially in relation to the rules governing sovereignty and jurisdiction.<sup>7</sup> Advances in technology have resulted in space touristic activities taking place in both airspace and outer space, and the absence of a defined delimitation line raises questions relative to the applicable liability regime. The increase in space activity, especially activities occurring in the upper atmosphere, means that such activities need to be governed by uniform international rules. Uniform standards for space activities would ensure safety and equal access to space, and avoid conflict related to boundary amongst States.<sup>8</sup> The absence, however, of a delimitation line creates a stumbling block with regard to the recognition of the apposite legal regime governing

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<sup>1</sup> I H Ph Diederiks-Verschoor and V Kopal *An Introduction to Space Law* (2008) 17.

<sup>2</sup> The international community is comprised of states, space lawyers and scientists, for purposes of this study.

<sup>3</sup> *The Layers of the Earth's Atmosphere* [http://airs.jpl.nasa.gov/maps/satellite\\_feed/atmosphere\\_layers](http://airs.jpl.nasa.gov/maps/satellite_feed/atmosphere_layers) (accessed 13 May 2015).

<sup>4</sup> V Kopal *The Question of Defining Outer Space* (1980) J. Space L. 154 at 161.

<sup>5</sup> G Oduntan *Sovereignty and Jurisdiction in the Airspace and Outer Space-Legal Criteria for Spatial Demarcation* (2012) 59.

<sup>6</sup> K Gorove *The Delimitation Question and Aerospace Objects – Where is the Law?* (2000) J. Space L. at 11. These two regions, the atmosphere and outer space, have completely different legal regimes in terms of sovereignty, property rights, transit rights, and liability consequences.

<sup>7</sup> A Harris and R Harris *The Need for Airspace and Outer Space Demarcation* (2006) Space Policy 3.

<sup>8</sup> R Jakhu *et al Studies in Space Policy: Need for an integrated regulatory regime for Aviation and Space: ICAO for Space?* (2011).

all advances made in space tourism and space traffic management. A resolution of the boundary issue, therefore, becomes increasingly important and a fit topic for legal academic enquiry.

### **1.1 The urgency for a legal definition**

The absence of a legally defined delimitation line<sup>9</sup> has created difficulties in the necessary interpretation of the existing air law and space law and so creates uncertainty with regard to the application of relevant legal principles. Problems specifically arising from the unknown delimitation are such that the application of the existing law related to space activities is ambiguous, and this results in difficulties regulating space activity. This consequently highlights the latent flaw within the existing air and space law (specifically as regards the area of jurisdiction of each) and, therefore, results in inconsistency in regulating space activities.

The aim of this study is to show that the determination of the delimitation of outer space is relevant and necessary because of the lack of legal certainty created by the advances made in space technology and its consequent activities. This study proposes that the certainty of a delimitation line will provide clarity in the application of relevant legal principles, and, so, ensure the effective management of space activities. The problems arising from the lack of certainty about the delimitation line will be illustrated by a two-pronged examination of a) the existing air and space regime such as Chicago Convention and Outer Space Treaty, and b) the difficulty in regulating space activities, particularly with regard to space tourism and space traffic management.

### **1.2 Core terminology**

Space tourism refers to transporting paying passengers from a point on Earth to “outer space” and then returning them to Earth.<sup>10</sup> The transportation made by the space vehicle is such that it operates in the upper atmosphere and potential for collision is high.<sup>11</sup> The fact that there is no specific legally defined boundary between airspace and

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<sup>9</sup> The term ‘delimitation line’ in the context of this study means a non-physical line which separates the application of the airspace regime (state sovereignty) from the outer space regime.

<sup>10</sup> S Hobe *Legal Aspects of Space Tourism* (2007) NLR 439.

<sup>11</sup> S Freeland *Fly me to the moon: How will international law cope with commercial space tourism?* (2010) Melb J Int'l L 10.

outer space becomes relevant in the event of an accident where the applicable liability regime is uncertain.<sup>12</sup>

Space Traffic Management (“STM”) refers to the control of space traffic transporting into, through, and from outer space.<sup>13</sup> The establishment of an effective STM regime is necessary for the proper management of space traffic.<sup>14</sup> Its purpose would be to regulate traffic in outer space in order to maintain safe and sustainable space activities. Consequently, a precise definition of outer space is necessary to provide clarity with regard to such issues as space objects and space activities, which are necessary components of an STM regime.<sup>15</sup> In other words, if there is no known, legally-defined boundary, orderly space activities will be difficult to manage because one would not know which regimen applies to such activities.

### **1.3 Research methodology**

The relevance of the delimitation debate will be demonstrated by an overview of the legal issues associated with the undefined delimitation line (“UDL”). The reasons why states have been unable to establish the boundary will be examined and the resultant problems given in the application of existing law, arising from the unknown delimitation line, will thus be addressed. As a conclusion to the study, a preliminary proposal for a solution to the problems caused by UDL will be offered. The study will be based on the primary sources of international law and refer to diverse literature from prominent authors of international air and space law and will also try to compare different concepts throughout history where possible.

### **1.4 Delimitation of study area**

In respect of space tourism, this study will be limited to dealing with sub-orbital flights and how the undefined delimitation creates very real legal problems in view of the lack of clarity with regard to the apposite areas of the current liability legislative control governing airspace and outer space. The manner in which the UDL directly affects the regulation and management of space traffic will be assessed. The lack of precise

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<sup>12</sup> S Hobe *et al*, *Space Tourism Activities – Emerging Challenges to Air and Space Law?* (2007) JSL 363.

<sup>13</sup> Email from Prof. S Hobe dated 29 March 2015

<sup>14</sup> C Contant-Jorgenson (eds.) ‘Cosmic Study on Space Traffic Management’ International Academy of Astronautics (IAA) 2006, [www.iaaweb.org](http://www.iaaweb.org) (accessed on 20/03/2015).

<sup>15</sup> Gorove, *supra* n 6, at 27.

definitions, caused by the UDL, creates further uncertainty and causes difficulties in establishing an effective space traffic management regime

### **1.5 Structure of Argument**

The study will begin by analysing the international legal regimes governing airspace and outer space, particularly with respect to their underlying assumption that a boundary does, in fact, exist, which in itself creates legal problems.

The second chapter will examine the history of the delimitation debate and discuss the possible reasons why the delimitation line has never been decided upon.

The third and fourth chapters will address the problems resulting from the lack of a boundary by providing an analysis of the legal issues raised in space tourism and regulation of space activity. This analysis will show clearly that the delimitation line is essential to solving the problems arising within the relevant areas of space activity.

The sixth chapter will summarise the argument that the problems highlighted in the specific areas of space activity can be solved only by determining the delimitation line. It will also indicate how the delimitation line should be defined, which, in itself, will provide a topic for future study.



## 2 Legal framework: Airspace *versus* Outer Space

### 2.1 Airspace

The question regarding the extent of a state's sovereignty over its airspace existed before international air law was developed.<sup>16</sup> When the Romans developed the principle expressed in a maxim *Cujus est solum ejus usque ad coelum et ad inferos*<sup>17</sup> they did not foresee man taking to the sky and flying, although they were cognisant that ownership of the land included private control of the airspace above private property, and that this control of the airspace was not limited to low altitudes.<sup>18</sup> In 1784 when the Montgolfier Brothers transported passengers in a hot air balloon in the open sky it triggered an international legal response requiring the establishment of safety and security measures by defining the conditions under which balloon flights could take place.<sup>19</sup> When aircraft came onto the scene, states continued to uphold their right to exercise sovereignty over their airspace, and, this right was upheld in the first treaty on air law that was signed by France and Germany in 1913.<sup>20</sup> This created scholarly debate on the extent of states claim of vertical sovereignty of the airspace above their land and the recognition of the right of innocent passage.<sup>21</sup> The First World War increased the security concerns of States regarding airspace above their territory (including territorial waters). In 1919, states concluded a multilateral agreement which codified the rules of the air in the form of the Paris Convention.<sup>22</sup> The fundamental principle contained in the Convention was that each state exercised full and exclusive sovereignty over the airspace above its territory.<sup>23</sup> The second principle awarded the contracting states the freedom of innocent passage of civilian aircraft belonging to other contracting states in times of peace.<sup>24</sup> In 1944 states developed a new public international air law

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<sup>16</sup> F Lyall and PB Larson *Space Law: A Treatise* (2009) at 153.

<sup>17</sup> RIR Abeyratne *Frontiers of Aerospace Law* (2002) 47('...this maxim means that a right of land ownership brings with it rights own ownership of airspace above the land').

<sup>18</sup> Oduntan, *supra* n 5 at 59.

<sup>19</sup> Oduntan, *supra* n 5 at 61.

<sup>20</sup> *Ibid*, '...opinions held by Jurist during a meeting of the International Law Association in Madrid were that...while reserving this right to regulate traffic over their territory, this right should permit free transit of airships of all nations.'

<sup>21</sup> JC Cooper *Explorations in AeroSpace Law* (1968) 256.

<sup>22</sup> Convention Relating to the Regulation of Aerial Navigation signed at Paris on 13 October 1919 [*Paris Convention*].

<sup>23</sup> *Ibid*, Art 1 Paris Convention applies to every state, and is thus not confined to contracting states. This rule represents a well-recognised rule of customary international law.

<sup>24</sup> *Ibid*, Art 2 Paris Convention states "Freedom of peaceful transit for private planes of the contracting States in times of peace." The Paris Convention did not provided for a right of innocent passage but rather encouraged states to allow innocent passage. See also Diederiks-Verschoor and Kopal, *supra* n 1 at 158.

instrument, the Chicago Convention, due to the changes in political climate and advances made in technology.<sup>25</sup> It reinforced the fundamental principle of the Paris Convention and became the cornerstone of the public international air law treaty governing civil aviation.<sup>26</sup> The Chicago Convention established rules and principles which would encourage world order, peace and security over airspace and related civil aviation activity.<sup>27</sup> In respect of safety, the Chicago Convention established the International Civil Aviation Organisation (“**ICAO**”) to oversee the safety of civil aviation.<sup>28</sup> As liability is regarded as being of the greatest importance to ICAO, issues relative to it have arisen and have been regulated by both the Warsaw<sup>29</sup> and Montreal Conventions<sup>30</sup>.

The issue of clarity with regard to the extent of airspace, however, remains unanswered, potentially resulting in confusion and conflict in a situation where, for example, State A assumed that it was conducting activities in outer space, whilst State B saw those same activities as infringing on its territorial airspace.

## 2.2 Outer Space

In 1957, Sputnik 1, the first satellite to orbit the earth, was successfully launched and became the precursor of the space regime by means of establishing international customary law of the freedom of access to outer space.<sup>31</sup> This resulted in the Outer Space Treaty (“**OST**”), also known as the *Magna Carta* of the space regime as it sets out the applicable regime and determines the legal status of outer space and regulates relations between states pertaining to their outer space activities.<sup>32</sup> Article 1 of the OST provides that outer space “shall be the province of all mankind” and “shall be free for exploration and use by all States”. Article 2 of the OST further provides that “outer space, including the moon and other celestial bodies, is not subject to national

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<sup>25</sup> Convention on International Civil Aviation, signed at Chicago on 7 December 1944 [*Chicago Convention*].

<sup>26</sup> IH Ph Diederiks-Verschoor *An Introduction to Air Law* (2001) 5-7.

<sup>27</sup> International Air Services Transit Agreement, 7 December 1944, 84 U.N.T.S. 389, 59 Stat. 1963 [*Transit Agreement*]; International Air Services Transport Agreement, 7 December 1944, 171 U.N.T.S. 387, ICAO Doc. App. IV-2187 [*Transport Agreement*].

<sup>28</sup> Chicago Convention, *supra* n 25 at Chapter II.

<sup>29</sup> Convention for the Unification of Certain Rules Relating to International Carriage by Air signed at Warsaw on 12 October 1929 [*Warsaw Convention*].

<sup>30</sup> Convention for the Unification of Certain Rules Relating to International Carriage by Air, signed at Montreal on 28 May of 1999 [*Montreal Convention*].

<sup>31</sup> Diederiks-Verschoor and Kopal, *supra* n 1 at 17.

<sup>32</sup> Treaty on 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 [*OST*].

appropriation by claim of sovereignty, by means of use or occupation, or by any other means". These provisions show that territorial airspace does not continue indefinitely upwards and at some point territorial airspace must end. The international community drafted specific legislation to expand on some of the principles contained in the OST and these took the form of the Liability Convention<sup>33</sup>, the Registration Convention, and a variety of other conventions and principles.<sup>34</sup> Within the body of existing space law treaties, the concepts of 'province of mankind' and 'Common heritage of Mankind' are cemented, yet the 'space area' in which they can be applied is unclear. The space law treaties failed to define outer space.

At the time of the drafting of the OST, the majority of the international community did not consider the unknown delimitation line question to be a priority and felt it unnecessary to agree about a legally defined boundary separating airspace from outer space.<sup>35</sup> The issue of the unknown delimitation remains unresolved to this present day as States have not been able to agree on a precise, legal, technical or political definition of the boundaries separating airspace from outer space, largely, it would seem, for political and economic reasons.

### 2.3 Conclusion

The airspace regime recognises that every state has complete and exclusive authority over the airspace above its territory<sup>36</sup>. The outer space regime guarantees the freedom of access to outer space, and this consequently indicates that, at some point or area in airspace, the state's control over its aerial territory must come to an end in order for every state to gain access to outer space. It speaks for itself then that, where two legal regimes are adjacent in their spatial scope of application, especially when activities destined for one area (outer space) must necessarily traverse the other (airspace), there

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<sup>33</sup> Convention on the International Liability for Damage Caused by Space Objects signed on 29 March 1972 [*Liability Convention*].

<sup>34</sup> Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space signed on 22 April 1968 [*Rescue Agreement*]; Convention on Registration of Objects Launched into Outer Space signed on 10 November 1974 [*Registration Convention*]; Agreement Governing the Activities of States on the Moon and Other Celestial Bodies signed on 18 December 1979 [*Moon Agreement*]. V Kopal, *supra* n 4 at 159.

<sup>35</sup> B Cheng *Studies in International Space Law* (1997) at 101.

<sup>36</sup> Art 1 Paris Convention, *supra* n 22; Art 1 Chicago Convention, *supra* n 25.

needs to be at least an implicit understanding that determines when one or the other applies.<sup>37</sup>

It is accepted that no major problems or disputes between states have yet arisen because of the lack of a legally recognised boundary, but should the law not provide exact parameters within which it can regulate human activities *vis-à-vis* a specified environment and prevent legal problems associated with space activities? <sup>38</sup>

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<sup>37</sup> R Hansen *An inductive approach to the Air-Space Boundary Question* (2015) IIL at 11.

<sup>38</sup> S Hobe and J Cloppenburg *Towards a New Aerospace Convention - Selected Legal Issues of "Space Tourism"*, Proceedings of the 47th Colloquium on the Law of Outer Space (2004) IISL at 378.

### 3 The History of the Delimitation Debate

The analysis of the principles governing airspace and outer space in the previous chapter shows that legislators failed to provide a solution to the finding of an adequate delimitation line between the areas in which they have jurisdiction.<sup>39</sup> Space lawyers, states and scientists have deliberated over the delimitation issue but as yet there are no signs of a resolution of the issue or even consensus about whether the unknown delimitation is a problem.

The earth's atmosphere is made up of layers that increase in density, starting with troposphere which extends to a height of 6-20km from the surface of the Earth and contains 75% air mass.<sup>40</sup> The stratosphere begins at the top of the troposphere and extends to up to approximately 50km.<sup>41</sup> The troposphere and stratosphere combined contain approximately of 99% of what constitutes "air". The mesosphere is the coldest part of the atmosphere and reaches a height of about 85km.<sup>42</sup> In the next sphere, the thermosphere, the temperature rises and gases continue to thin with a rise in altitude to a maximum of 600km. Subsequently, the exosphere consists mainly of near-negligible quantities of helium and hydrogen extending to an altitude of approximately 10 000 km.<sup>43</sup> It can, therefore, be deduced that airspace is part of the atmosphere, but also that airspace and atmosphere are not one and the same thing.

Passenger aircraft operate optimally in the troposphere, as seen with commercial aircraft cruising at an altitude of approximately 10.6km, whereas a military aircraft, such as the SR-71 Blackbird, currently holds the record of reaching a height of 26km reaching slightly into the stratosphere.<sup>44</sup>

It is evident that there is no distinct line dividing atmosphere from outer space, as the atmosphere gradually dissipates into space at the end of the exosphere. It can therefore be deduced that outer space and the atmosphere are not mutually exclusive owing to the many 'space' activities that have taken place within the technical confines of the

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<sup>39</sup> Diederiks-Verschoor and Kopal, *supra* n 1 at 15.

<sup>40</sup> [http://airs.jpl.nasa.gov/maps/satellite\\_feed/atmosphere\\_layers](http://airs.jpl.nasa.gov/maps/satellite_feed/atmosphere_layers), *supra* n 3.

<sup>41</sup> *Ibid.*

<sup>42</sup> *Ibid.*

<sup>43</sup> *Ibid.*

<sup>44</sup> SJ Trepczynski *Edge of Space: Emerging technologies, the new space industry and the continuing debate on the delimitation of outer space* (2006) unpublished LL.M thesis McGill University, Montreal at 38-39.

Earth's atmosphere since the successful launch of Sputnik1.<sup>45</sup> For example, in the U.S. 'Astronaut wings' are given to those who fly beyond the 50 mile (80 km) mark, which is near the boundary between the stratosphere and thermosphere.<sup>46</sup> At the same time, however, outer space is host to satellites and other activities which take place in the Geostationary and Medium Earth Orbit situated at altitudes outside the exosphere of 35786 km and 20 000 km respectively.

The fundamental differences between the application of the two legal regimes governing air space and outer space make it necessary for a legal boundary to be established between the two areas. International law is burdened that States uphold their territorial integrity peacefully.<sup>47</sup> The issue of territorial integrity is important and, therefore, the determination of the delimitation of outer space (which is beyond the states aerial territory) is vital and needs to receive universal agreement by states.<sup>48</sup>

The United Nations Committee on Peaceful Use of Outer Space (“**UNCOPOUS**”) was established in 1967 and since then one of its main purposes was to consider the issue of the boundary between outer space and airspace.<sup>49</sup> Initially, the committee came to the majority conclusion that no priority should be given to the question of delimitation, and presently this question is still being considered within the UNCOPUS, as various opinions and theories are advanced in an attempt to delimit and define outer space.<sup>50</sup> Some opinions are that a delimitation line is unnecessary and premature because it has not caused any major conflicts thus far and a boundary would hinder technological progress for the further exploration of outer space.<sup>51</sup> Those in favour of the delimitation line foresee the practical issues created by not addressing the issue, which include the protection of states aerial sovereign rights versus the extent to which the space regime governs in sub-orbital flights, space shuttles, and in regulating space activities.<sup>52</sup> Despite the work conducted by a special working group to examine the delimitation question to assist the UNCOPUOS, the matter is not any closer to reaching a solution. The two

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<sup>45</sup> *Ibid* 41.

<sup>46</sup> Y Su *The delimitation between airspace and outer space and the emergence of aerospace objects* (2013) JALC 362.

<sup>47</sup> Lyall and Larson *supra* n 16 at 162.

<sup>48</sup> Gorove, *supra* n 6 at 7.

<sup>49</sup> *Historical Summary on the Consideration of the Question on the Definition and Delimitation of Outer Space*, UN Doc A/AC.105/769 (2002).

<sup>50</sup> CQ Christol *The Modern International Law of Outer Space* (1982) 438 - 442.

<sup>51</sup> *Ibid* at 438 - 442.

<sup>52</sup> Diederiks-Verschoor and Kopal, *supra* n 1 at 15 - 16.

background papers on this problem which were issued by the Secretariat of the UNCOPOUS in 1970 and 1977 respectively proposed theories which can be categorised into two main approaches, namely, the spatialist approach and functional approach.<sup>53</sup>

### 3.1 Spatialist approach

The Spatialist approach attempts to establish a particular boundary based on scientific and technical criteria, and also on security and arbitrary theories. Space is both physically and legally different to airspace. Legally, airspace is that part of space subject to the sovereignty of a state whilst space law has developed the concepts of 'province of mankind' and 'Common heritage of Mankind', thereby establishing outer space as an international public benefit. The implication of these two different regimes is to differentiate airspace from outer space with a clear border. This means that both air law and space law would, respectively, govern the space above the Earth's surface split into two slices by a delimitation line and this would define the applicable law based on the area, despite the nature of the activity.<sup>54</sup> In order to achieve this delimitation line, the spatialist approach attempts seeks to establish a lower boundary for outer space, through at least eight possible criteria, founded on scientific reasoning, that have been identified in the background papers prepared by the UNCOPOUS.<sup>55</sup> They are as follows:

- I. Demarcation based upon the equation of the upper limit of national sovereignty with the concept of atmosphere;
- II. Demarcation based on the division of atmosphere into layers;
- III. Demarcation based on the maximum altitude of aircraft flight (theory of navigable airspace);
- IV. Demarcation based on the aerodynamic characteristics of flight instrumentalities (von Kármán-line);
- V. Demarcation according to the lowest perigee of an orbiting satellite;
- VI. Demarcation based on Earth's gravitational effects;
- VII. Demarcation based on effective control; and
- VIII. Demarcation based on the division of space into zones.

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<sup>53</sup> *The Question of the Definition and Delimitation of Outer Space*, Background Paper prepared by the UN Secretariat (CUPOUS), UN Doc. A/AC.105/C.2/7 of 7 May 1970 and Addendum A/AC.105/C.2/7/ Add 1 of 21 January 1977.

<sup>54</sup> Christol, *supra* n 50 at 440.

<sup>55</sup> Background Paper prepared by the UN Secretariat, *supra* n 53.



The von Kármán line theory has gained popularity in the past. Its method suggested a boundary at the theoretical limit of aerodynamic flight at an altitude where aerodynamic lift is exceeded by ascensional pressure.<sup>56</sup> This theory is linked to the maximum altitude of aircraft flight in which the characteristics of flight instrumentalities attempt to establish the boundary where aerodynamic lift becomes irrelevant and centrifugal force takes over.<sup>57</sup> This places the boundary line to be set at an altitude of approximately 100km.<sup>58</sup> The problem with this line is that it is subject to change owing to technological progress<sup>59</sup> where the theoretical limit of the height of air flight may increase as the result of the developments of aircraft.<sup>60</sup> The main advantage of the von Kármán line is that it has enjoyed wide acceptance as the established boundary between aeronautics and astronautics for international standard setting and record keeping by the *Federation Aeronautique Internationale* (FAI).<sup>61</sup>

The boundary set by the lowest perigee of satellites has so far gained the greatest acceptance over time.<sup>62</sup> This criterion would set the boundary at the lowest point at which any satellite could operate; it would, therefore subject all space activities to the current space regime. To date, the lowest unchallenged perigee achieved by an artificial satellite is that of the United Kingdom's Skynet-IIA (1974); it operated at an altitude of 96 km.<sup>63</sup> This boundary can be supported by the Registration Convention that requires an object that is launched into Earth's orbit or beyond it to be registered.<sup>64</sup> If a state is required to register anything in orbit, and the lowest orbit achieved was 96 km above sea level, then any object travelling beyond that orbital altitude should be considered as being in outer space and consequently subject to the space law regime. This criterion can also be strongly supported by the argument that, when the launch of the first satellite occurred, states never claimed that a satellite orbiting the Earth was infringing their national airspace. This formed the principle of the freedom of movement into

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<sup>56</sup> Diederiks-Verschoor and Kopal, *supra* n 1 at 18

<sup>57</sup> *Ibid.*

<sup>58</sup> *Ibid.*

<sup>59</sup> Diederiks-Verschoor and Kopal, *supra* n 1 at 17.

<sup>60</sup> E.g. improved cooling techniques or more heat-resistant materials. See generally G Oduntan *The Never Ending Dispute: Legal Theories on the Spatial Demarcation Boundary Plane between Airspace and Outer Space* (2003) HLJ 74.

<sup>61</sup> Diederiks-Verschoor, *supra* n 1 at 18.

<sup>62</sup> Oduntan, *supra* n 60 at 79 (the principle of the 'lowest perigee demarcation' was adopted by the International Law Association at its meeting in 1968 in Buenos Aires).

<sup>63</sup> Cheng, *supra* n 35 at 396.

<sup>64</sup> Art 1 Registration Convention, *supra* n 34.



outer space, which is recognised as customary law.<sup>65</sup> The International Court of Justice holds that a rule of customary law comes into existence only if the state practice of the states most affected gives evidence of an *opinio iuris* that such a rule exists. As no state has ever tried to assert its sovereignty over its territorial airspace at that altitude and prevent the over-flight of a satellite, it seems likely that, under customary international law, the maximum altitude of territorial airspace is equivalent to the lowest perigee of satellites.<sup>66</sup> This criterion is not, however, without problems as the advances in technology could lead to changes in what height satellites could decrease to as the extent of the scientific limit of the lowest orbit of a satellite has not yet been truly discovered. For example, development of a so-called 'tethered' satellite TSS43 that is a joint US/Italian project, is a satellite (sub-satellite) that will be reeled upwards or downwards from a Space Shuttle cargo bay on a tether that is 100km long causing it to fly approximately 20 km above the earth but especially 100km *lower* than the shuttle, even possibly at the lowest perigee line.<sup>67</sup> Arguments against the lowest perigee based approach are minimal and unconvincing at best, and so far science has shown only that satellites burn up upon re-entry into the atmosphere. Problems aside, it is viewed as the most sensible approach evidenced by its adoption by the International Law Association.<sup>68</sup>

### 3.2 The Functional Approach

This approach claims that a boundary is not necessary because the location of an activity is irrelevant.<sup>69</sup> It argues that the application of the air law or space law should rely solely on the purpose of the activity and the characterisation of the object involved, air law for aircraft and aeronautical activity, space law for space objects and space activity.<sup>70</sup> As a result, any boundary line drawn would necessarily have to be arbitrary and the legality of space activities should be determined solely by the nature of the

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<sup>65</sup> *Continental Shelf Case* (Federal Republic of Germany v. Denmark; Federal Republic of Germany v. Netherlands), 1969 ICJ 3, 230 (Feb 20, 1969), dissenting opinion by Judge Manfred Lachs.

<sup>66</sup> *Ibid*, conversely, states have complained (or taken more drastic measures) through the Bogota Declaration about high altitude aircraft violating their sovereign airspace, showing a recognition that sovereign rights were applicable at such altitudes.

<sup>67</sup> R Monahan 'The Sky's the Limit? Establishing a legal delimitation of airspace and outer space' unpublished LLM thesis, Durham University 2008 46-47.

<sup>68</sup> Oduntan, *supra* n 60 at 79 - 80.

<sup>69</sup> SN Hosenball and JS Hofgard *Delimitation of Airspace and Outer space: Is a boundary needed now?* UCOLR (1986) 887.

<sup>70</sup> *Ibid*.

activity or purpose of the vehicle because of the difficulties in finding a reliable physical or technological criteria in determining a boundary.<sup>71</sup> One of the arguments in support of the functionalist approach is said to be demonstrated in the definition of *aircraft* in the Annexes to the Chicago Convention which provides ‘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’.<sup>72</sup> All other vehicles passing through and beyond the atmosphere should, therefore, be classified as ‘spacecraft’.<sup>73</sup> The approach enjoys theoretical simplicity in the uniform application of a single legal regime to a single activity; it does, however, raise a number of practical issues that preclude its straightforward implementation. It is tricky to determine whether an activity falls under a certain category of law from merely looking at the external form of the object, such as where aircraft fly is airspace and where space objects operate is outer space.<sup>74</sup> An example of the problem is space shuttles used for space tourism activities. The space shuttle operates from a rocket launch on the way to it being placed in orbit above the Earth, and it is, therefore, a spacecraft, but on the way back to the Earth’s surface it uses aerodynamic lift, and would be classed as an aircraft according to functionalists.<sup>75</sup> The problem still remains with reference to which regime governs the space shuttle, air law or space law. If a spaceplane were to make a flight through space for the purpose of travelling from one terrestrial point to another, the functionalist analysis would change. In such a scenario, the nature of the activity and the vehicle would likely be equated with that of air transport because functionally the space plane was performing the task of an aircraft, and this would mean that air law would apply to the entirety of the flight, even to that portion occurring in outer space.<sup>76</sup> Under the functionalist approach, therefore, the same craft could be subject to separate laws (for separate flights), depending on the particular purpose of a given flight. On the other hand, adopting a functional approach to space law would mean, for instance, that there would be a ‘a right of innocent passage’ of such space objects through foreign airspace when it has

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<sup>71</sup> *Ibid.*

<sup>72</sup> Chicago Convention, *supra* n 25.

<sup>73</sup> Oduntan, *supra* n 60 at 73.

<sup>74</sup> Harris and Harris, *supra* n 7 at 6.

<sup>75</sup> *Ibid* at 6.

<sup>76</sup> PE Sikorska *The Mission (Im)Possible: Towards a Comprehensive Legal Framework Regulating Safety Issues of Point to Point Sub-Orbital Flights* (2014) *Jurisprudence* 1056-1057, (Point-to-point sub-orbital flights is described by the author as “a special category of flights above the surface of the Earth (an altitude between 100 and 200 kilometers), performed by the suborbital vehicle below the orbital velocity where the place of departure (point one) and the place of destination (point two) are situated in at least two jurisdictions).

been established that such space objects are engaged in a space activity which is considered lawful, and their innocence has been established.<sup>77</sup>

### 3.3 State Practise

Partly owing to the absence of a legally defined delimitation line, a handful of equatorial countries claimed, in 1976 through the famous Bogota Declaration, that those parts of the geostationary orbit (at an altitude of some 35,800 km) which were 'above' their respective territories were subject to their respective sovereignty.<sup>78</sup> Today more countries and agencies are dealing with the unknown delimitation by determining their own jurisdiction through the enactment of domestic space legislation.

The South African space legislation<sup>79</sup> defines outer space as the space above the surface of the earth from a height at which it is in practice possible to operate an object in an orbit around earth.<sup>80</sup> The definition indicates that a fixed boundary exists and it bases the location of that boundary on the ability of an object to orbit, thus effectively placing its national definition in line with the lowest perigee of an orbiting satellite definition proposed by some spatialists.<sup>81</sup>

The Australian Space Activities Act of 1998 (1998 Act)<sup>289</sup> does not explicitly define the term "outer space," but it effectively places the lower limit of outer space at 100 km by including that distance in the definitions of "launch," "space object," "launch vehicle," and "payload".<sup>82</sup> Through the incorporation of the 100 km distance into its domestic space legislation, Australia has ensured that, at least with respect to domestic space activities, no confusion will arise as to whether air or space law is applicable in a given situation?

The USA enacted legislation establishing NASA defines "space" making a reference to "space activities" as the area "outside the earth's atmosphere".<sup>83</sup> It is clear that numerous states have taken it upon themselves to delimit and define outer space for

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<sup>77</sup> Diederiks-Verschoor and Kopal, *supra* n 1 at 19. See also HA Wassenbergh *Principles of Outer Space in Hindsight* (1991) at 18.

<sup>78</sup> Oduntan, *supra* n 60 at 77.

<sup>79</sup> Space Affairs Act 84 of 1995.

<sup>80</sup> FG von der Dunk *The Sky is the Limit-But Where Does it End?* (2005) at 89.

<sup>81</sup> *Ibid.*

<sup>82</sup> *Ibid*, see also Space Activities Amendment Act 2002 (Cth.) s. 2-4.

<sup>83</sup> von der Dunk, *supra* n 80 at 89.

purposes of dealing with the public and private space activities occurring within their territories.

### 3.4 Conclusion

The argument that a boundary is not necessary because it would hinder technological progress and the exploration of outer space is no longer a reasonable argument.<sup>84</sup> The delimitation debate has created inconsistencies in the exercise of state sovereignty versus freedom of access to outer space.

Whilst arguments for and against the various approaches to establish a boundary between airspace and outer space exist, the major obstacle is the non-existent universal consensus as to how the delimitation issue should be treated. No matter which theory is finally adopted by the international community, it will always lead to criticism and potential drawbacks.<sup>85</sup> The debate does, however, need to come to a resolution as decades have already been spent on it. The approaches put forward as a result of the debate show that it is possible to come to a scientific and academic reasoning to establish a boundary. The problems related to unknown delimitation are not going to disappear, but they are instead going to become more complicated as activities in space increase and technology becomes more advanced.<sup>86</sup> These problems will be discussed in subsequent chapters to show that a legally defined boundary is necessary.<sup>87</sup>

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<sup>84</sup> von der Dunk *supra* n 80 at 90-91.

<sup>85</sup> Oduntan, *supra* n 60.

<sup>86</sup> Kopal, *supra* n 4 at 160.

<sup>87</sup> *Contra* Hosenball and Hofgard, *supra* n 69 at 885-893.

## 4 Space Tourism: Sub-orbital Flights

### 4.1 Introduction

Space Tourism can be described as a commercial activity offering paying customers the opportunity to experience space travel.<sup>88</sup> This can be categorised into two broad categories, orbital flights<sup>89</sup> and sub-orbital flights. This research study will focus on sub-orbital flight activity and the implication that the UDL has for such an activity.

Scaled Composites' SpaceShipOne was a milestone in the history of human flight as it completed two sub-orbital flights and subsequently won the Ansari X-Prize.<sup>90</sup> Since then, important steps have been taken in realising humankind's ambitious plans for safe and affordable access to the Earth's sub-orbit.<sup>91</sup>

ICAO described a sub-orbital flight as one which reaches a very high altitude without accelerating to the velocity needed to escape Earth's gravitational pull, thus not sending the vehicle into orbit.<sup>92</sup> Its functionality is based on space craft that are either air launched or rocket launched, transporting passengers to experience a few moments of weightlessness for touristic purposes.<sup>93</sup> Sub-orbital flights make a passage through airspace or, alternatively, launch in the air using an aircraft as a launch platform. The launch of the space vehicle in the air using an aircraft as the launch platform is considered an *air-launch*<sup>94</sup>, as witnessed in the case of SpaceShipOne. SpaceShipOne was successfully launched from its mother plane (a jet), White Knight, and reached the altitude of 112 km, and the re-entry, including a few minutes of weightlessness, was not in a normal, fully-controlled mode, but rather was something like a 'sycamore leaf floating down'.<sup>95</sup> Once it was back at 55,000 feet, the SpaceShipOne finally transformed into a glider, descending from there under pilot control.<sup>96</sup> It is, therefore important to

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<sup>88</sup> Hobe and Cloppenburg, *supra* n 38 at 377.

<sup>89</sup> Freeland, *supra* n 11 at 98, ('Orbital flight has been defined as a flight in which 'orbital velocity' is achieved for the vehicle to keep flying along the curvature of the Earth, and orbital velocity itself depends on the altitude of the orbit').

<sup>90</sup> The SS1 vehicle was launched twice, travelling up to 102.9 km and 112km, respectively. See 'Overview of Virgin Galactic and its Project' at <http://www.virgingalactic.com/overview/> (accessed on 14 May 2015).

<sup>91</sup> *Ibid.*

<sup>92</sup> ICAO Council 175th Session *Concept of Sub-Orbital Flights*, C-WP/ 12436, (30 May 2005) at 1.2.

<sup>93</sup> *Ibid.*

<sup>94</sup> Hobe and Cloppenburg, *supra* n 38 at 378.

<sup>95</sup> FG von der Dunk *Passing the Buck to Rogers: International Liability Issues in Private Spaceflight* (2007) NERL 405.

<sup>96</sup> <http://www.virgingalactic.com/overview/>, *supra* n 90.

note that the performance of sub-orbital flights has the characteristics of both aircraft and space craft.

The flights offered and operated by private operators as evidenced in SpaceShipOne raise a number of regulatory issues which may not be readily resolved by existing law<sup>97</sup>, as the vehicles providing sub-orbital flights reach the border of airspace and outer space, of which there is not yet any legal definition or demarcation.<sup>98</sup>

The situation of the undefined delimitation between air and outer space makes it complicated to decide which liability regime should apply over the sub-orbital flights and illustrates the ambiguities and legal uncertainty shown in the existing legal framework.

## 4.2 Issues of Liability

Liability is an issue which concerns the safety of passengers and has serious financial implications for operators and possibly for states (the space regime provides that states assume liability).<sup>99</sup> It raises the question as to who is liable for damage caused in a sub-orbital flight transporting passengers for touristic purposes in the case of an air-launch.<sup>100</sup> In other words, to what extent will the international air and space liability regime be applicable to sub-orbital flights?

### 4.2.1 Airspace and liability regime

Air carrier liability, which is contractual, pays regard to the liability of the carrier *vis-à-vis* the passenger.<sup>101</sup> In international air law, passenger liability is governed by a series of private international law instruments that place liability upon the carrier such as the Warsaw Convention of 1929<sup>102</sup> and the Montreal Convention of 1999.<sup>103</sup> In space law, however, no international rules on passenger liability exist. Liability for space objects is governed by public international law space law treaties which place liability upon the launching state.<sup>104</sup>

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<sup>97</sup> FG von der Dunk *Beyond What? Beyond Earth Orbit? . . . The Applicability of the Registration Convention to Private Commercial Manned Sub-Orbital Spaceflight* (2013) CAWILJ 270.

<sup>98</sup> *Ibid.* These issues include nationality and registration, licensing and certification, safety, security, liability, and traffic management systems.

<sup>99</sup> Hobe *et al*, *supra* n 12 at 359 – 360.

<sup>100</sup> *Ibid.*

<sup>101</sup> Hobe and Cloppenburg, *supra* n 37 at 378.

<sup>102</sup> Warsaw Convention, *supra* n 29.

<sup>103</sup> Montreal Convention, *supra* n 30.

<sup>104</sup> Hobe and Cloppenburg, *supra* n 38 at 380.

The Warsaw Convention was the first international liability regime specifically applicable to international civil aviation.<sup>105</sup> The goals of the Warsaw Convention were both the unification of law applicable to international aviation disputes and the limitation of liability faced by air carriers.<sup>106</sup> The original purpose of the Warsaw Convention was to limit the liability faced by the new aviation industry, and, to that end, liability ceilings were established.<sup>107</sup> The Warsaw Convention was, however, subject to amendments and supplements, and this made it difficult to establish which regime applied in any given case.<sup>108</sup>

In 1999, the Montreal Convention was created to modernise and consolidate the Warsaw Convention and effectively updated the system of liability with regards to passengers and cargo.<sup>109</sup>

The Montreal Convention is applicable to all international carriage of persons by *aircraft* and it places liability directly on the air carrier in cases of personal death or injury, damage to cargo and delay.<sup>110</sup> The state where such air carrier is registered is never held liable, because the liability arises from a contract in which the air carrier has the obligation to transport the passenger in a safe manner.<sup>111</sup>

The substantive liability provisions are contained in Chapter III of the Montreal Convention.<sup>112</sup> Its two-tier liability system covers death and injury taking place on board the aircraft or in the course of the operation of embarking and disembarking.<sup>113</sup> The first-tier prescribes strict liability<sup>114</sup> for damages not exceeding 113,200 Special Drawing Rights (“SDRs”) whereby the air carrier is not able to exclude or limit its liability except to where it can prove the contributory fault of the passenger. The second-tier prescribes fault-based liability<sup>115</sup> for damages exceeding 113,200 SDRs if

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<sup>105</sup> A Caley *Liability in International Law and the Ramifications on Commercial Space Launches and Space Tourism* (2014) Loy. L.A. Int'l & Comp. L. Rev at 246.

<sup>106</sup> Diedericks-Verschoor *supra* n 26 at 5.

<sup>107</sup> *Ibid.*

<sup>108</sup> Hobe and Cloppenburg, *supra* n 38 at 378.

<sup>109</sup> *Ibid* at 381.

<sup>110</sup> Art 1 Montreal Convention, *supra* n 30.

<sup>111</sup> Trepczynski, *supra* n 44 at 83.

<sup>112</sup> Art 17 – 19 Montreal Convention, *supra* n 30.

<sup>113</sup> Hobe, *supra* n 10 at 449.

<sup>114</sup> A Kerrest and LJ Smith ‘Art VII’ in S Hobe, B Schmidt-Tedd and K-U Schrogl (eds.) *Cologne Commentary on Space Law* (2009) 126 – 145.

<sup>115</sup> *Ibid.* (Negligence or fault must be proved. In this type of liability, the claimant must prove that the defendant owed him a duty of care, that the defendant breached that duty of care and that there is causation between the breach and the damage caused).



the air carrier proves that the damage was not due to the negligence or other wrongful act or omission of the carrier or its servants or agents or that such damage was solely due to the negligence or other wrongful act or omission of a third party.<sup>116</sup>

In order to assess the applicability of the Montreal Convention in the field of space tourism, one needs to ask whether the vehicle used to conduct “sub-orbital” flights can be considered to be an “aircraft” and whether the flight is *international*. The applicability of the international air law regime is dependent on the classification of the vehicle and its scope of application.

#### 4.2.1.1 Status of the vehicle

The Montreal and Warsaw conventions do not describe the meaning of the term *aircraft*. The public international law definition of *aircraft* can be found in Annex 2 of the Chicago Convention.<sup>117</sup> It defines *aircraft* as “any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface.”<sup>118</sup> The mere fact that the preamble of the Montreal Convention states that its desire is for “an orderly development of international air transport operations ... in accordance with the principles and objectives of the [Chicago Convention]” is an indication that it would be bound by the Chicago Convention’s definition of *aircraft* which would then be applicable to the Montreal Convention.<sup>119</sup> The classification of the aircraft is dependent on exact technical features.

The definition of *aircraft* is broad enough to include anything that “can derive support” from the air within its scope. This definition could allow technology not actually intended as *aircraft* technically to fall within the definition if they were able, due to design particulars, to derive support from the air (regardless of whether they actually are doing so during flight).<sup>120</sup> Whilst the majority of states have adopted the ICAO’s definition of aircraft in their national legislation, the Canadian’s included rockets in their definition of aircraft.<sup>121</sup> Technically, some rockets could derive support from the

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<sup>116</sup>Hobe, *supra* n 10 at 449.

<sup>117</sup> Annex 2 to the Chicago Convention (*supra* n 25), International Standards: Rules of the Air, ICAO Doc. AN 2, at chapter 1.

<sup>118</sup> *Ibid.*

<sup>119</sup> Diederiks-Verschoor, *supra* n 26 at 5.

<sup>120</sup> *Ibid.*

<sup>121</sup> Aeronautics Act, R.S.C. 1985, c. A-2, s. 3(1). JC Hogan *Legal Terminology for the Upper Regions of the Atmosphere and for the Space Beyond the Atmosphere* (1957) AIJL 362.



air though they do not do so during flight.<sup>122</sup> In the case of the SpaceShipOne, the White Night, together with the space vehicle, would theoretically qualify as an aircraft until separation.<sup>123</sup> The space vehicle is completely dependent on the aircraft until separation and thus can be understood to be an additional cabin.<sup>124</sup> After the separation of the aircraft (White Night) from the space vehicle, the released space vehicle would no longer “derive support in the atmosphere from the reactions of the air”, and could thus be considered a space object.<sup>125</sup> When the space vehicle returns to the Earth, it does so without the assistance of an aircraft. It, however, uses the “reactions of the air” to land safely.<sup>126</sup> So it is possible that the journey back to earth can be governed by the air liability regime in the case of an accident.

#### 4.2.1.2 Location of flight

The scope of application of the Montreal Convention is the international carriage of persons by aircraft.<sup>127</sup> The Chicago Convention defines an “international air service” as “an air service which passes through the air space over the territory of more than one State”.<sup>128</sup> The Montreal Convention defines international carriage as “any carriage in which . . . the place of departure and the place of destination . . . are situated either within the territories of two Contracting Parties, or within the territory of a single High Contracting Party, if there is an agreed stopping place within [the] territory” of another state, even if that state is not a Contracting Party.<sup>129</sup>

In the case of the air-launch described above, it seems possible for the convention to be applicable only if the position where the separation (air-launch) takes place would constitute a 'place of destination', provided that this place of destination is located in a different state to make the transportation international and passengers are on board during the mission.<sup>130</sup> Should the separation take place over a territory not under the jurisdiction of a state party to the Montreal Convention (such as the high seas),<sup>131</sup> as well as there being no passengers on-board during the flight mission, the air carriage

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<sup>122</sup> Diederiks-Verschoor, *supra* n 25 at 5 (noting that "Second World War flying bombs (V -1)" were capable of deriving support from the atmosphere).

<sup>123</sup> Freeland, *supra* n 11 at 14.

<sup>124</sup> <http://www.virgingalactic.com/overview/>; Hobe, *supra* n 108 at 449-450

<sup>125</sup> Hobe *et al*, *supra* n 12 at 364.

<sup>126</sup> von der Dunk, *supra* n 95.

<sup>127</sup> Hobe, *supra* n 10.

<sup>128</sup> Chicago Convention, *supra* n 25.

<sup>129</sup> Article 1 Montreal Convention, *supra* n 30.

<sup>130</sup> Hobe and Cloppenburg, *supra* n 38 at 379 - 380.

<sup>131</sup> Art 1(2) Montreal Convention, *supra* n 30.

cannot be regarded as international, and the Montreal Convention would then not be applicable.

It is submitted that the Montreal convention aims at harmonising the liability provisions of national air laws, so, even if the convention is not applicable to the transportation of the aircraft in question, the flight of the aircraft would be covered by the relevant provisions of national air law.<sup>132</sup>

In respect of the third party liability related to the operation of aircraft the Rome Convention could be applicable before separation of an air-launched sub-orbital flight.<sup>133</sup> The convention assigns absolute liability to the aircraft operator for damage caused by an aircraft and sustained on the surface of the earth.<sup>134</sup> Absolute liability is a type of liability incurred where the defendant (air carrier) is liable without the need to prove any fault except simply proving that the damage exists and that it has been inflicted by the defendant.<sup>135</sup> According to the Rome Convention, "any person who suffers damage on the surface shall, upon proof that the damage was caused by an aircraft in flight or by any person or thing falling therefrom, be entitled to compensation".<sup>136</sup> In order for the Rome Convention to be applicable, damage must exist and be caused by an aircraft whilst *in-flight*.<sup>137</sup> Like the Montreal Convention, the Rome Convention does not give a definition of *aircraft*, so, for purposes of this study, we shall presume that the definition afforded by the Chicago Convention is still applicable.<sup>138</sup>

Chapter 2 of the Rome Convention provides limits of liability for damage based on the weight of the aircraft. Liability is limited to 500,000 francs per person in cases of death or injury.<sup>139</sup> In the event that damage was caused "by a deliberate act or omission of the

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<sup>132</sup> Hobe and Cloppenburg, *supra* n 38 at 378.

<sup>133</sup> Convention on Damage Caused by Foreign Aircraft to Third Parties on the Surface signed at Rome on 7 October 1952, ICAO Doc. 7364 [*Rome Convention*].

<sup>134</sup> *Ibid*, Art 2 and Art 24. Diederiks-Verschoor, *supra* n 25 at 97.

<sup>135</sup> Diederiks-Verschoor, *supra* n 25 at 97.

<sup>136</sup> Art (1) 1 Rome Convention, *supra* n 133.

<sup>137</sup> LS van der Laan *The Aerospace Plane: Collisions and Damage to a Third Party on the Surface of the Earth: Which Liability Regime will Rule?* (1991) LJIL 249-280 (*in-flight* means that the period in time between the moment power is applied for the purpose of actual take-off until the moment when the launching ends).

<sup>138</sup> Diederiks-Verschoor, *supra* n 25 at 98.

<sup>139</sup> *Ibid*.

operation, his servants or agents, done with intent to cause damage," liability is unlimited.<sup>140</sup>

None of the international conventions applicable to aviation, including those discussed above, makes any mention of liability that could be placed upon a State for certain aviation related incidents. In other words, states are not made liable for any activities relating to international civil aviation or aircraft.

#### **4.2.2 Outer Space and liability regime**

After the separation of the aircraft from the space vehicle, the second stage of the sub-orbital flight comes into play, *viz.* the detachment from the jet. This makes the Montreal Convention, Rome Convention or any other international aviation convention no longer applicable to the second stage and there is a need to turn the solutions provided in space law. The international space regime, in contrast to the international air regime, places liability directly on the state for both space objects and space activities, including liability for activities undertaken exclusively by private entities.<sup>141</sup> In Article I of the Liability Convention, the definition of "launching state" is what places all responsibility and liability for space activities on the nation state.<sup>142</sup>

Liability follows from the International State Responsibility imposed on member states for the activities of their private entities engaged in space activities in Art 4 of the OST.<sup>143</sup> The liability principles are featured in Art 5 of the OST and further expanded on in the Liability Convention. The concept of the international space law liability system is based on compensating parties that suffer damages as a result of activities conducted by government and non-governmental entities and states assuming responsibility for such damage.<sup>144</sup> The extent of liability is detailed in the Liability Convention, for instance where damage was caused by states or its private actors as a result of their space activities. Art 2 provides absolute liability for a launching State that caused damage caused by its 'space object' on the surface of the earth or to aircraft in flight."<sup>145</sup> If damage is caused elsewhere other than on the surface of the earth to a space object of one launching State or to persons or property on board such a space object by a space

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<sup>140</sup> Art 12 Rome Convention, *supra* n 133.

<sup>141</sup> von der Dunk *supra* n 95 at 400.

<sup>142</sup> A Caley *supra* n 105 at 246.

<sup>143</sup> Art VI OST, *supra* n 32.

<sup>144</sup> Cheng, *supra* n 35 at 612 - 615.

<sup>145</sup> Art 2 Liability Convention, *supra* n 33.

object of another launching State, the launching State shall assume fault-based liability.<sup>146</sup> It is clear that the basis of liability depends upon where, geographically, the damage occurred and what was damaged.

Consequently, the space liability regime is triggered by damage being caused by 'space object' 'launched into', or intended to be launched into outer space.<sup>147</sup>

#### 4.2.2.1 Space Object

The problem is that 'space object' is not defined properly under the Liability Convention, which describes the term space object as including component parts of a space object as well as its launch vehicle and parts thereof.<sup>148</sup> The OST simply describes 'space object,' as "an object launched into outer space".<sup>149</sup> It is interesting to note that the Rescue Agreement refers to object and spacecraft, and uses these terms interchangeably insofar as making a distinction between the two terms is based on whether the craft is manned or not.<sup>150</sup>

The Registration Convention describes space object in exactly the same manner as the Liability Convention. The Registration Convention does, however, make a distinction between a *space object* and *objects launched into space*, implying that not all objects in space are necessarily 'space objects'.<sup>151</sup> This adds further uncertainty to the scope of the definition of 'space objects,' as well as to how 'spacecraft' fits within that definition and international space law.

Art 31(1) of the Vienna Convention<sup>152</sup>, provides general rules of interpretation in order to give ordinary meaning to terms of treaty, and thus the term *space object* is designed broadly to encompass all objects *launched* into outer space (as well as their component parts).<sup>153</sup>

Put differently, whether an object is, in fact, a *space object* is *dependent* on whether or not the object has been launched into outer space. The answer to this question requires an assessment of whether a sub-orbital flight constitutes a launch or attempted launch.

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<sup>146</sup> Cheng, *supra* n 34 at 600 – 602

<sup>147</sup> *Ibid.*

<sup>148</sup> Art 1(d) Liability Convention, *supra* n 33; Art 1 Registration Convention, *supra* n 33.

<sup>149</sup> OST, *supra* n 32.

<sup>150</sup> Art 1-5 of Rescue Agreement, *supra* n 34. Cheng, *supra* n 35 at 599.

<sup>151</sup> B Schmidt-Tedd and S Mick 'Art VIII' in *supra* n 114 at 150.

<sup>152</sup> The Vienna Convention on the Law of Treaties of 1969.

<sup>153</sup> Cheng, *supra* n 35 at 599.

Taking this further, it then becomes obvious that the question of where outer space begins is also necessary.<sup>154</sup>

#### 4.2.2.2 'Launching' or 'attempted launching' of object into Outer Space

Art 1 (b) of the Liability Convention makes it clear that the term 'launching' includes attempted launching.<sup>155</sup> If a space vehicle does not reach orbit or falls short of the space trajectory, can this be considered as *attempted launching*? Legally, the intention and purpose of the object in question would be the decisive factor in determining whether its activity falls under the definition of launch or launching, in order for the object to be considered a space object.<sup>156</sup> Convincingly, legal experts provide that the space vehicle has the objective of reaching outer space owing to such flights being advertised as spaceflights or space travel.<sup>157</sup> As a result, the space vehicle, after separation, can be classified as a space object and the space liability regime should apply to the sub-orbital vehicle after separation from its carrier aircraft. It could also be argued that the space vehicle of a sub-orbital flight is not designed to reach outer space and does not reach outer space.<sup>158</sup> In fact, the intention of sub-orbital is to give passengers an experience of what it would feel like to be in outer space, and this can be viewed as taking place in outer space as these have surpassed the lowest orbital altitude achieved by a satellite which is currently at 96 km above sea level.<sup>159</sup> These opposing views result in a fair amount of uncertainty as to whether a space vehicle is indeed a space object given the absence of a firm and agreed delimitation line.

### 4.3 Conclusion

The regimes governing air carrier liability differ significantly from those governing liability for space objects, making it critical to be able to determine which liability regime will apply when damage occurs.

To date there have been no significant problems with regard to the issue of liability. The emergence of new technologies and the nature of space activity (sub-orbital flights), however, blur the distinction between *aircraft* and *spacecraft* which affects the certainty

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<sup>154</sup> *Supra* Chapter 2, it addresses the concept and definition of outer space.

<sup>155</sup> Cheng, *supra* n 35 at 599.

<sup>156</sup> *Ibid.*

<sup>157</sup> Hobe, *supra* n 10.

<sup>158</sup> von der Dunk, *supra* n 95 at 11 ('Sub-orbital flights reach a very high altitude without accelerating to the velocity needed to escape Earth's gravitational pull').

<sup>159</sup> <http://www.virgingalactic.com/overview/>, *supra* n 90.

of legal application. Clear rules are required in this emerging industry of sub-orbital flights and resolving the issue of an undefined delimitation is a much needed start.

## 5 Space Traffic Management

### 5.1 Introduction

Space traffic is considered to consist of motion and the interaction of space debris, space vehicles and the use of the radio frequency (RF) spectrum in outer space.<sup>160</sup> The number of actors conducting space activities has increased dramatically, and the manufacturing of spacecraft is gradually being transferred to many countries.<sup>161</sup> Today, more than fifty countries have accessed space, either using their own indigenously developed launchers or with those developed by other countries, and they have had assets on-orbit.<sup>162</sup> The use of a state's space-based assets has been, first and foremost, an integral part of a state's military plan, hence the codification of the principle of the peaceful use of outer space principle in the OST.<sup>163</sup> The use of satellites by states has evolved to include geographical and scientific purposes.<sup>164</sup> Even the commercial sector has expanded its technology and business development competition in outer space activities.<sup>165</sup> Amongst other activities undertaken, the international community has borne witness to the emergence of space tourism in the form of orbital and sub-orbital flights, and international point-to-point sub-orbital flights.<sup>166</sup> The growth in space activities taking place over the years has caused a substantial increase in space debris.<sup>167</sup> The anti-satellite (ASAT) weapon test conducted by China in 2007 had a large impact on space security as well as on the space environment, as it generated a population of more than 2 000 trackable pieces of space debris.<sup>168</sup> The first collision between large satellites, which occurred in 2009, also generated similar amounts of space debris.<sup>169</sup> The fact it is that outer space is a highly contested area and yet it is not an unlimited resource.<sup>170</sup> As a result, the space community is faced with the challenge of designing policies and regulations for space traffic management in

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<sup>160</sup> H Cukurtepe and I Akgun *Towards Space Traffic Management System* (2009) Acta Astronautica at 871.

<sup>161</sup> Jakhu *et al*, *supra* n 8.

<sup>162</sup> *Ibid*.

<sup>163</sup> [http://airs.jpl.nasa.gov/maps/satellite\\_feed/atmosphere\\_layers](http://airs.jpl.nasa.gov/maps/satellite_feed/atmosphere_layers), *supra* n 3.

<sup>164</sup> *Ibid*.

<sup>165</sup> *Ibid*.

<sup>166</sup> PE Sikorska, *supra* n 76.

<sup>167</sup> Jakhu, *supra* n 8.

<sup>168</sup> "Chinese Debris Reaches New Milestone", 15 October 2010, <http://orbitaldebris.jsc.nasa.gov> (accessed 10 September 2015).

<sup>169</sup> "Russian and US Satellites Collide", 12 February 2009, <http://news.bbc.co.uk> (accessed 10 September 2015)

<sup>170</sup> US Department of Defense & Office of the Director of National Intelligence, National Security Space Strategy (Unclassified Summary) (2011).

order to ensure free access to outer space and its exploitation.<sup>171</sup> This requires balancing sustainable space activities without restricting the potential growth of the space industry.<sup>172</sup>

## 5.2 Legal Implications of Air Traffic versus Space Traffic

Research on how to cope with maintaining space for safe use brought about an in-depth study on the issue of STM by the International Academy of Astronautics (IAA), which is one of the very few comprehensive works in this field.<sup>173</sup> The resultant report derived from the study defines STM as “the set of technical and regulatory provisions for promoting safe access into outer space, operations in outer space and return from outer space to Earth free from physical and radiofrequency interference.”<sup>174</sup> While space traffic is unique and is not exactly comparable to air traffic, it is, however, necessary to discuss aspects of the air traffic regime as certain space objects make passage through airspace to reach outer space.

### 5.2.1 Air Traffic

It is a fundamental air law principle that territorial airspace is under the sovereign control of the subjacent state, and international air traffic rules exist to take into consideration the rights of the sovereign state. The Chicago Convention is the main treaty setting out the rules for international air traffic and establishes the ICAO, which is responsible for overseeing the safety of civil aviation.<sup>175</sup> Detailed rules of civil aviation can be found in Annexes to the Convention.<sup>176</sup> These Annexes, which take the form of standards and recommended practices (“SARPS”), are adopted and amended by the ICAO Council. Contracting states are not under any obligation to conform to such SARPS; they merely undertake to comply with them so far as they find it practicable to do so.<sup>177</sup> A state that does not comply with the SARPS must file a difference with the ICAO, such that the differences between its own practice and that established by the international standard are made known.<sup>178</sup>

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<sup>171</sup> KF Schwetje *Space Law: Consideration for Space Planners* Computer & Tech. L.J. (1986) 245.

<sup>172</sup> K-U Schrogl *Space traffic management: The new comprehensive approach for regulating the use of outer space—Results from the 2006 IAA cosmic study* (2008) *Acta Astronautica* 272 – 276.

<sup>173</sup> Contant-Jorgensen (eds.), *supra* n 14

<sup>174</sup> *Ibid.*

<sup>175</sup> Jakhu, *supra* n 8.

<sup>176</sup> Art 37 Chicago Convention, *supra* n 25.

<sup>177</sup> *Ibid.*

<sup>178</sup> Art 38 Chicago Convention, *supra* n 25.



## 5.2.2 Space Traffic

In contrast to airspace and the regulation of air traffic, the movement of traffic through outer space is unregulated. The current regime governing outer space has remained the same since its original inception during the 1960s and 1970s when the UN space treaties were adopted.<sup>179</sup> In order to keep up with technological advances, the international community has attempted to supplement the old system by adopting various “soft laws”.<sup>180</sup> Space law has thus developed without there being any single rule with a binding legal obligation to regulate the movement of objects in outer space.<sup>181</sup> In establishing a regime that would create orderly space activity, it is necessary that states and private actors know what rules apply to these activities and, especially, where these rules apply.

## 5.3 The need to establish the STM regime

In the report to the IAA, the rationale for establishing a new STM regime was, firstly, to create a unified basic rule to allow traffic flow in outer space which is essential in order to achieve effective and safe spacecraft operations.<sup>182</sup> Secondly, unified basic STM rules are necessary to determine the basis of liability. Since the sovereign states are the governors of today’s international community, it is necessary to clarify liability rules to strengthen legal control over the states by *ex post facto* regulation.<sup>183</sup> This expands the compliance with international law in the community. Thirdly, the establishment of an STM regime will enable the application of safe and sustainable operation rules in outer space.<sup>184</sup>

The STM regime is a new concept that has not yet featured in the current space regime. The IAA report provided a set of recommended regulations and evaluated necessary topics for the management of space activities, which included the delimitation debate and the uncertainty the UDL creates.<sup>185</sup>

It is noted that some legal scholars claim that, whilst STM is an endeavour that would require an objective set of rules and universal application to be effective, the issue of

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<sup>179</sup> S Hobe *The International Legal Order for Outer Space Activities*, ECSL Proceedings (1993) 28.

<sup>180</sup> S Hobe *International Space Law in its First Half Century*, Proceedings of the 49<sup>th</sup> Colloquium on the Law of Outer Space (2006) 1-9.

<sup>181</sup> Jakhu, *supra* n 8.

<sup>182</sup> *Ibid.*

<sup>183</sup> *Ibid.*

<sup>184</sup> *Ibid.*

<sup>185</sup> *Ibid.*

delimitation between air space and outer space is not *per se* critical to establishing the STM regime.<sup>186</sup> In contrast to this view is the argument that space activity is central to STM, and, without the proper legal definition of outer space, the precise definition of space activity remains vague and insufficient to establish an STM regime.<sup>187</sup>

The definition of space activities is vital to characterise the uses of airspace, air navigation and space activities.<sup>188</sup> Space activities are generally unregulated, except for individual state controlled activities. The emerging space technologies which can operate in air and/or outer space and has made delimitation line necessary. Airspace is an area which is expertly regulated as the primary concern of states is to protect their nation's security against any form of aerial intrusion.<sup>189</sup> The sovereign rights of states can also extend as far as necessary to protect them against direct threats to security by spacecraft.<sup>190</sup> It would appear that, without knowing where airspace ends, it is becomes necessary to question the extent to which aviation law will be applicable to space activity, commercial or otherwise.<sup>191</sup> It is the opinion of some legal authors that the application of aviation law on space activities is not viable as the regimes 'air' and 'space' are vastly different.<sup>192</sup> Space activities are unregulated, and this is based on the premise of Art 1 of the OST, which guarantees free access to outer space by all. State practice is such that their space activities are regulated by their own space legislation. This results in an unwanted fragmentary space traffic management system.<sup>193</sup> This re-enforces the opinion that, in order to create order in space activity, states must know what rules apply to them and where those rules apply. This then requires the knowledge and universal acceptance of what constitutes space activities and how these activities should be regulated.

There are overlapping issues that space traffic management and space tourism share, such as the definition of a space object and the passage of spacecraft over foreign airspace. The STM discussion will centre on the definitional crises within the current space regime and, to a certain extent, the air regime. These crises are created directly by

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<sup>186</sup> J-F Mayence 'A New Look on the Delimitation of Airspace and Outer Space' 50th Session of the UNCOPUOS Legal Subcommittee IISL/ECSL Space Law Symposium, Vienna 2011.

<sup>187</sup> Schwetje, *supra* n 171.

<sup>188</sup> *Ibid* at 256

<sup>189</sup> *Ibid* at 257.

<sup>190</sup> *Ibid*.

<sup>191</sup> RIR Abeyratne *Space Tourism - Parallel Synergies between Air and Space Law?* (2004) ZLW 184.

<sup>192</sup> Schwetje, *supra* n 171 at 257.

<sup>193</sup> von der Dunk *supra* n 80 at 91.

the lack of a defined air/space boundary and the concomitant introduction of new technologies.

## 5.4 The need for precise definitions

### 5.4.1 Space Object: Aircraft versus Spacecraft

Article VIII of the OST and the Registration Convention are the detailed provisions for the registration of space objects which is intended to promote the sustainable use of outer space.<sup>194</sup> Owing to the successful launch of Sputnik 1 in 1957, an *ad-hoc* committee was set up and tasked with developing a comprehensive international system for the registration of objects.<sup>195</sup> This resulted in a system implemented as Article VIII of the OST which, amongst other things, would oversee the facilitation of tracking space objects for the purpose of avoiding collisions between spacecraft and aircraft, as well as the identification of components of space objects during the de-orbiting phase.<sup>196</sup> The Article VIII pertaining to registration of objects later developed into a Registration Convention<sup>197</sup> and together they established a launching state-based “jurisdiction and control” system over space objects. Consequently, it is widely understood that the states parties in general retain responsibility over whatever the space activities may be being conducted in their jurisdiction, and that they are required to maintain “authorization and continuing supervision” for non-governmental activities (Article VI).<sup>198</sup> The current registration system is, however, insufficient to oversee a STM system as it relies on contracting states to furnish information on its launching activities as soon as it is practicable.<sup>199</sup>

In establishing a space traffic regime, the IAA study found, amongst other things, that a clarification of the definition of space object was required.<sup>200</sup> The term space object is commonly referred to as “an object launched into outer space”.<sup>201</sup> This definition reflects a tautological construction and as discussed previously, this definition is

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<sup>194</sup> B Schmidt-Tedd and S Mick, *supra* n 151 at 147.

<sup>195</sup> *Ibid* at 147.

<sup>196</sup> *Ibid* at 147.

<sup>197</sup> Registration Convention, *supra* n 34.

<sup>198</sup> *Ibid*.

<sup>199</sup> Schrogl, *supra* n 172 at 273.

<sup>200</sup> Contant-Jorgensen (eds.), *supra* n 14.

<sup>201</sup> Cheng *supra* n 35 at 599.

incomplete as it requires the knowledge of the demarcation of outer space.<sup>202</sup> The new technologies, such as aerospace planes and RLVs could technically fall part of either air traffic or space traffic owing to their functional capabilities of flying through airspace and outer space. The undefined delimitation line exacerbates the vagueness of the definition of space object. In principle, objects that have not reached outer space or do not intend to reach outer space do not fall under the definition of space object.<sup>203</sup> The type of object, be it an aircraft or spacecraft, has implications for the registration regime to which it would submit. The registration of aircraft provided for in the Annexes of the Chicago Convention and the registration of space objects in the REG establishes different requirements to satisfy necessary registration for airspace and outer space activity. According to the REG, an object that is launched into outer space qualifies to be registered with the UN Secretary General as soon as is practicable for the launching state to do so.<sup>204</sup> The registration of an aircraft is provided in Articles 17 – 21 and Annex 7 of the Chicago Convention provide that the registration of an aircraft shall be made in accordance with the national laws and regulations or any contracting state to the Chicago Convention.<sup>205</sup> The registration regulations related to aircraft are detailed and comprehensive and thus do not offer difficulties in their application.

The undefined delimitation line creates legal uncertainty in the case of space objects, such as the SS1, which uses an aircraft to lift the space cabin to a certain altitude and separation of cabin and aircraft occurs in order for the space cabin to continue on its sub-orbital flight, reaching a higher altitude. Determining the applicable registration regime is difficult because whether the SS1<sup>206</sup> is a space object is controversial as certainty here requires the demarcation of outer space. Space craft which are capable of flying through airspace and outer space need traffic management to regulate this form of transportation which functions within the controlled airspace and outer space.<sup>207</sup> The delimitation of outer space would provide certainty as to whether any given object is a space object and how it should be treated, i.e. registered for purpose of space traffic management system.

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<sup>202</sup> *Supra*, Chapter 3.

<sup>203</sup> *Ibid.*

<sup>204</sup> Art 3 Registration Convention, *supra* n 34; Lyall and Larsen, *supra* n 15 at 85 - 86.

<sup>205</sup> Hobe, *supra* n 10 at 446 - 448.

<sup>206</sup> [http://www.scaled.com/projects/tierone/041004\\_spaceshipone\\_x-prize\\_flight2.html](http://www.scaled.com/projects/tierone/041004_spaceshipone_x-prize_flight2.html) (accessed on 14 September 2015).

<sup>207</sup> Cukurtepe and Akgun, *supra* n 160 at 874.

#### 5.4.2 Right of Innocent Passage

The right of innocent passage (“ROP”) is an issue that would also need to be addressed by the STM regime.<sup>208</sup> An STM regime would provide details on how the right of innocent passage should be managed by balancing the sovereign rights of the subjacent state and the freedom of access to outer space by all. The STM regime would address the question of whether innocent passage should be granted to spacecraft through foreign airspace for the purpose of reaching orbit or returning to Earth.<sup>209</sup> Technically, under regular launch conditions, space objects which are launched by rockets into outer space from their launching state do not have to cross foreign airspace below an altitude of 100- 110 km.<sup>210</sup> The passage by a space object over foreign territory below 100 – 110km may, however, be necessary for the re-entry of space craft from outer space, both in regular and emergency situations.<sup>211</sup> The right of innocent passage is a principle initially recognised in the Law of the Sea, and it places an obligation upon a coastal State not to hamper the innocent passage of foreign ships within territorial sea.<sup>212</sup> As a result, a right ensues from the obligation that all States, whether coastal or landlocked, can claim that the coastal State does not hamper the passage of ships provided that the passage fulfils certain conditions.<sup>213</sup> It is an established legal principle that outer space is open for freedom of movement. Any space object or spacecraft capable of getting to outer space is, thus, entitled to enter it.<sup>214</sup> The entrenched freedom of access to outer space does not, however, imply a ROP through foreign air space despite the preponderance of the argument that customary law of the ROP through a foreign airspace to reach outer space came into existence after the launch of Sputnik 1.<sup>215</sup> In drawing an analogy to air law, the ROP in airspace over all parts of the national territory does not exist in either the Chicago Convention and nor under customary international

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<sup>208</sup> Contant-Jorgensen (eds.), *supra* n 14.

<sup>209</sup> M Benkö and E Plescher *Reconsidering the definition/delimitation question and the passage of spacecraft through foreign airspace* (2013) at 42 - 44.

<sup>210</sup> *Ibid.*

<sup>211</sup> *Ibid* (in some instances, states cross a neighbouring state's airspace without seeking prior consent).

<sup>212</sup> Convention on the Law of the Sea 1982, entered into force Nov. 16, 1994, [UNCLOS].

<sup>213</sup> Art 125 UNCLOS.

<sup>214</sup> Art 1 OST, *supra* n 32.

<sup>215</sup> C AL-EKABI *Revisiting ‘Envoys of Mankind’ in the Era of Commercial Human Spaceflight* 2012 ESPI Perspectives; M Lachs *The Law of Outer Space: An Experience in Contemporary Law-Making* 1972 60; Oduntan, *supra* n 5 at 158 (‘states have been known to use force against intruding aircraft. The downing of the Korean Airline flight 007 by the former Soviet Union in 1983 resulted in the death of 269 passengers and crew...article 3 *bis* (a) of the Chicago Convention was created to restrict the use of force against civilian airline’).

air law.<sup>216</sup> The intrusion of a civil or state aircraft over a foreign airspace is a violation of the subjacent state's sovereignty and jurisdiction. States are, therefore, required to negotiate passage rights for their aircraft to fly through foreign airspace in either bilateral or multilateral treaties. The right of transit by aircraft negotiated between States upholds the fundamental principle that states have complete and exclusive sovereignty over the airspace above their territory. It, therefore, follows legally that there is no right of innocent passage through the airspace of a foreign state in order to gain access to outer space. Even though Art 1 of the OST provides that "there shall be free access to all areas of celestial bodies", the article and the rest of the OST does not explicitly mention a ROP nor does it implicitly allow such passage. In 1988, the former Soviet Union's (USSR) Buran flew once and de-orbited over part of South Africa, North Africa and re-entered at Baikonur and, although there was no formal complaint about this trajectory, there could have been serious legal and diplomatic issues had it crashed.<sup>217</sup> In the UN Questionnaire<sup>218</sup> regarding the rights of passage of aerospace objects over foreign airspace, Korea expressed the view that when an aerospace object takes passage through territorial airspace of another state it maybe subject to the subjacent state's domestic law. Kazakhstan noted the existence of at least one precedent in which space objects of the Russian Federation passed through its airspace and it pointed out that such passage was provided for under the Agreement between the two countries, which implies that, without such an agreement, unrestricted passage through its airspace would not be tolerated.<sup>219</sup> Similarly, Germany, Argentina and the Syrian Arab Republic, found that no international customary law existed with respect to the passage of space transportation systems over foreign territory.<sup>220</sup> The Czech Republic found there to be insufficient evidence to support the right of innocent passage for an ascending or descending space object, but noted that such passage occurs and no protests against it have been raised to date.<sup>221</sup> Chile and Greece viewed the situation differently and stated that customary law existed with respect to aerospace objects like

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<sup>216</sup> Oduntan, *supra* n 5 at 158.

<sup>217</sup> Su, *supra* n 46 at 361.

<sup>218</sup> See generally UN Doc A/AC.105/C.2/L.249 U.N. Compilation of Replies Received from Member States to the Questionnaire on Possible Legal Issues with Regard to Aerospace Objects, available at [www.oosa.unvienna.org/oosa/en/SpaceLaw/aero/index.html](http://www.oosa.unvienna.org/oosa/en/SpaceLaw/aero/index.html) (accessed on 22 September 2015).

<sup>219</sup> Reply of Kazakhstan to Question 7 in U.N. Doc. A/AC.105/635/Add.3 (1996); Agreement between the Russian Federation and the Republic of Kazakhstan, 28 March 1994, on the Main Principles and Conditions for Utilization of the Baikonur Launch Site.

<sup>220</sup> U.N. Doc. A/AC.105/635/Add.3 (1996).

<sup>221</sup> *Ibid.*

the shuttle, whereby such objects are regarded as craft to which the norms of air law do not apply because there was no objection or opposition raised by third States.<sup>222</sup>

Even though there is disagreement among states as to whether aerospace objects enjoy the right of innocent passage, it is a predominant view that states would not tolerate foreign aerospace objects flying over their territorial airspace in instances of entry into outer space or re-entry into Earth's atmosphere.<sup>223</sup> It would appear that foreign aerospace objects traversing foreign airspace would have to comply with laws and regulations of the subjacent state.<sup>224</sup> The current practise consequently shows that, states conclude bilateral agreements whereby the conditions of passage of space objects over their territorial airspace are determined.<sup>225</sup>

To the extent that spacecraft have features in common with and perform similarly to an aircraft, the absence of a legal delimitation line makes determining the rules of innocent passage of an aerospace through foreign airspace difficult. New space transportation in certain instances needs to fly through the airspace of a neighbouring state when taking off and landing, and the existing rules of international air law cannot be applied to outer space activity. The IAA study recommended that a STM regime will have to determine where innocent passage for space objects commences and in doing so the issue of the unknown delimitation will have to be revisited.

## 5.5 Conclusion

As technology develops and an increase in space activity occurs, space traffic can no longer remain unmanaged. It, therefore, becomes necessary to identify and define all the components that constitute the scope of space traffic, and a legally-defined boundary would be beneficial to the achievement of a clearer definition of concepts that are necessary for the STM regime. The STM regime will have to determine where innocent passage for space vehicles commences, and delimitation is necessary in this regard. The basis on which to award the right of innocent passage to space objects cannot be determined by air law or the law of the sea. The definition of a space object is dependent on outer space itself being a defined area. As long as the boundary between

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<sup>222</sup> *Ibid.*

<sup>223</sup> Gorove, *supra* n 4 at 18-27; Oduntan, *supra* n 5 at 173 ('It is within the inherent jurisdiction of every state to determine when to exercise its right to self-defence').

<sup>224</sup> Su, *supra* n 46 at 364.

<sup>225</sup> *Ibid.*

airspace and outer space remains unsettled, any attempt to define space objects, space activities and other concepts in relation to establishing a uniform regime, such as the STM, will have at least some element of uncertainty.



## 6 Conclusion

Since the beginning of the space age, the development of space activity has continued without the existence of a legally recognised delimitation between airspace and outer space. The endeavours encompassing space tourism and increase in space activity which has the ability to traverse the airspace of subjacent state, has blurred the lines of distinction between the jurisdiction of air and space law. Outer space differs in many legal aspects from airspace, ranging between state's sovereignty and jurisdiction, and yet they both have one thing in common, the undefined delimitation line between them. The progress in science, has resulted in sub-orbital vehicles capable of short flights for tourist, vehicles operating at high altitude with intercontinental ranges poses a challenge to the current international space regime.

Owing to the absence of an international agreement difficulties arise in determining the applicable liability regime over sub-orbital flights. It has been shown that the term *space object* relies on a proper demarcation of outer space and therefore a definitive boundary would provide clarity to all treaties concerning space objects and related space activities.

The progress in space technology and increase in space activity makes it necessary to have delimitation line in order to create a uniform regulatory regime for space traffic. The STM regime would provide the exact scope of space activities that require governance, including overseeing the establishment of the rules for the right of passage of aerospace objects. Again, in the case of sub-orbital flights, a clearly defined delimitation line is essential to determine a permissible altitude for an overflight, when needed.<sup>226</sup> The required space traffic regime would further supplement the current space registration regime, and knowing where outer space begins would particularly aid in determining the applicable space technologies necessary to comply with the said registration regime. The current legal situation created by the undefined delimitation is unsatisfactory.

The delimitation debate, has created the impression that a demarcation of outer space is required as evidenced by the contested point of views between the functionalist and the spatialist.

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<sup>226</sup> Hobe *supra* n 10 at 383.

The functionalists provide a convincing argument for classifying outer space not as a place but as a focus of activities. When the nature and purpose of an activity is considered a *space activity*, it will remain a space activity even if the flight crosses sovereign airspace of a foreign state. This reflects conceptual clarity and the unitary application of a single legal regime to a single activity, it however raises a number of practical issues that preclude its straightforward implementation. First, the criterion of being "aimed at using or exploring outer space" is rather vague because space activities can and do cause consequences in airspace. Therefore international air law would be apply to such space activities. Secondly, states<sup>227</sup> in support of the functional approach also advocate the application of international and domestic air law and rules to aerospace planes located in the territorial airspace of a foreign state for safety and national security reasons.

Spatialist argument has gained support over the years, because it recognises that airspace and outer space are two separate realms, subject to two separate and distinctive sets of laws. It also eliminates the problem of determining the function of a particular vehicle on a particular flight, or whether a given activity is functionally a space activity. Therefore by fixing a boundary, it becomes possible to regulate an activity based on the objective factor of location, rather than a more subjective determination of function. This school thought has varied criteria but the commonality amongst these criteria is that a boundary exists somewhere. The criticism against this approach, is that the boundary could be set at the wrong place. However, to counter the argument would be that the Law of the Sea's demarcation of territorial seas may serve as an indicator as to similarly demarcate outer space in such a manner.<sup>228</sup> Physically it is impossible to have a fixed line due to the changes in the upper atmosphere leading up to the factual outer space. It is important to remember that the boundary would not necessarily be scientifically correct but rather satisfy the need to create a legal boundary between the legal regimes of airspace and outer space.

The increase in commercialised space activities and states developing their own space launch activities, states are confronted with the need to legally monitor and control such private activities and are developing national space laws to deal with them. This

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<sup>227</sup> Reply of Syrian Arab Republic, Turkey, and Lebanon to Question 6 in in U.N. Doc. A/AC.105/635/Add.3 (1996).

<sup>228</sup> Oduntan, *supra* n 60 at 64-84.

has resulted in states delineating the territory of jurisdiction where such laws would apply, resulting in the countries having to deal with the delimitation issue themselves. This creates an inconsistent determination of demarcation country to country.

It is clear that as long as the delimitation debate continues, states shall continue to struggle with the issue of legal application over space activities. The delimitation line needs to further the interest of mankind and therefore its resolution would require a balance of interest involving law, politics, science and technology.<sup>229</sup>

It is therefore proposed that a legal delimitation line be set at a 100km above mean sea level, so as to avoid uncertainty of legal application and potential international disputes. This proposal is based on the suggestion made numerous prominent legal scholars, scientist and delegations before the UNCOPOUS since it represents a singular zone where aerodynamic lift decreases to critical levels and where the lowest perigees attainable by space objects in orbit can reasonably be identified.<sup>230</sup> The 100km mark is also not too low, as this would put a space vehicle launcher at the mercy of surrounding states through whose airspace its vehicle must pass and not too high, disabling states to exercise control and jurisdiction over their airspace.<sup>231</sup> It is understood that this proposal is not without criticism and disadvantages however a decision is necessary to settle this gap in space law. A further in-depth research would be essential to justify the establishment of the boundary between airspaces and outer space at an altitude of 100km, following the considerable number of instances where this number has already been referred to.<sup>232</sup>

The delimitation debate which has taken place over a half of a century has gained urgent relevancy due to the complexity of the issues involved with the current and future technological developments. States, space lawyers and scientists need to deal with the boundary issue for the sake of international stability and growth of the space industry.

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<sup>229</sup> *Ibid.*

<sup>230</sup> *Ibid*; von der Dunk, *supra* n 80 at 92.

<sup>231</sup> Oduntan, *supra* n 60 at 64 -84.

<sup>232</sup> von der Dunk *supra* n 80.

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