

## Revisiting 'Envoys of Mankind' in the Era of Commercial Human Spaceflight

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*In the past half-century, access to outer space was limited to a select few that were deemed to have the right qualifications. Today, meeting these standards is no longer necessary in reaching the edge of Earth, as now affluent private individuals can participate in outer space travel. In theory, with sufficient funding, anyone can reach space via commercial spaceflight, and claim the title of 'astronaut' with qualifications that are no greater than the first creature that was launched into space. With this new entrant in outer space, should we still consider astronauts to be 'envoys of mankind', as described in Article V of the Outer Space Treaty; and can space tourists gain that title? From the Outer Space Treaty, in benefiting mankind, must that astronaut be working as an agent of a State Party; and is the answer dependant on the activity to be conducted? Next, where do sub-orbital flights fit within these international space instruments? And does that answer require a delimitation of airspace and outer space? Moreover, which approach is needed in determining the appropriate legal regime?*

### 1. Introduction

Over a half-century has passed since Yuri Gagarin made history by being the first person in outer space.<sup>1</sup> Within six years of that milestone, the 'Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies' (the 'Outer Space Treaty' or otherwise 'OST')<sup>2</sup> was drafted and brought into force under the UN framework. Article V OST requires State Parties to regard astronauts as 'envoys of mankind', stipulating that State Parties shall render to them 'all possible assistance in the event of accident, distress, or emergency landing on the territory of another State Party or on the high seas'. Article VIII OST states that a State Party on whose registry an object is launched into outer space is carried shall retain jurisdiction and

control over such object, and over any personnel thereof, while in outer space or on a celestial body and that ownership over objects launched into outer space is not affected by their presence in outer space or on a celestial body or by their return to Earth.

The UN 'Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space' (the 'Rescue Agreement' or otherwise 'RA')<sup>3</sup>, drafted shortly after the Outer Space Treaty, served to expand on Arts V & VIII OST with respect to astronauts and space objects that have landed outside the territory of the state of registry. In the Rescue Agreement the term 'personnel of spacecraft' was used in place of the term 'astronaut', and the description as 'envoy of mankind' was not included. This sparks a question as to whether the later-in-time designation intended a broader interpretation of astronaut, i.e. whether mere passengers are covered by the Rescue agreement as personnel of a spacecraft, and

<sup>1</sup> For actual audio of Yuri Gagarin's first flight, combined with original footage blended with scenes of the captured on the International Space Station, visit: <http://www.firstorbit.org/watch-the-film>.

<sup>2</sup> See Outer Space Treaty, available at: [http://www.oosa.unvienna.org/oosa/en/SpaceLaw/gares/html/gares\\_21\\_2222.html](http://www.oosa.unvienna.org/oosa/en/SpaceLaw/gares/html/gares_21_2222.html).

<sup>3</sup> See Rescue Agreement, available at: [http://www.oosa.unvienna.org/oosa/en/SpaceLaw/gares/html/gares\\_22\\_2345.html](http://www.oosa.unvienna.org/oosa/en/SpaceLaw/gares/html/gares_22_2345.html).

therefore entitled to the same treatment and care as a professional astronaut.

This Perspective attempts to address space tourism in respect of the humanitarian ideals of the Rescue Agreement, arguing that space tourists require equivalent protection under the multi-lateral space law treaties, i.e. humans in space, whether on orbital or sub-orbital missions, should be considered as 'astronauts' or 'personnel of spacecraft'; thereby covering them under these agreements.

The following Perspective discusses the various forms of space tourism and where that activity is conducted; the applicability of international and national space law to commercial human space flight; and the definition of envoy of mankind.

## 2. The Various Forms of Space Tourism & Where the Activity Takes Place

The terms 'space tourism'<sup>4</sup>, 'sub-orbital space tourism'<sup>5</sup>, and 'space tourist'<sup>6</sup> are not present in the five binding multi-lateral space law treaties, and none of these clarify the legal status of these tourists in outer space.

Space tourism can be separated into two broad categories, i.e. orbital spaceflight and sub-orbital spaceflight.

An 'orbit' can be described as a regular, repeating path that one object in space takes around another one under the influence of gravity.<sup>7</sup> The velocity needed to escape Earth's gravitational pull is about 11.3 km/s, i.e. about 40,680 km/hr.<sup>8</sup> However, in order to orbit at an altitude of 200 km above Earth, an orbital

velocity of 28,000 km/hr is required.<sup>9</sup> Although a very short period of time is spent travelling through air space, orbital spaceflight is governed by the current international space law framework.

Sub-orbital spaceflights reach a very high altitude without accelerating to the velocity needed to escape Earth's gravitational pull.<sup>10</sup> These spaceflights have been conducted since the dawn of the space era, in the form of unmanned sounding rockets.<sup>11</sup> And some sounding rockets have covered apogees well above the orbiting altitudes of the U.S. Space Shuttle and the ISS.<sup>12</sup>

In order to thoroughly assess space tourism, we must consider the region, or altitude, in which it is conducted. Outer space can be juxtaposed with airspace both in fact and in law; while these regimes physically and legally border each other, they were developed with contradictory goals and ideals. Air law is the set of national and international rules concerning aircraft, air navigation, aero-commercial transport, and all public and private relations arising from domestic and international air navigation.<sup>13</sup> Space law regulates relations between States, and private entities within those States, to determine their rights and duties resulting from all activities directed towards outer space and from outer space on the assumption that such activity is conducted in the interest of mankind as a whole, offering protection to terrestrial and non-terrestrial life, wherever it may exist.<sup>14</sup>

## 3. International and National Space Law applied to Commercial Human Space Flight

Sovereignty over the airspace above a State can be traced back to the Roman axiom '*cujus est solum, ejus est usque ad coelum et ad infernos*'; loosely translated as 'the owner of soil owns everything above it and below'.<sup>15</sup> This customary law principle of exclusive sovereignty over State airspace was later

<sup>4</sup> 'any commercial activity offering customers direct or indirect experience with space travel...'; see Stephan Hobe & Jürgen Cloppenburg, *Towards a New Aerospace Convention? – Selected Legal Issues of "Space Tourism,"* in PROCEEDINGS OF THE FORTY-SEVENTH COLLOQUIUM ON THE LAW OF OUTER SPACE 377, 377 (2005).

<sup>5</sup> 'the execution of suborbital flights by privately-funded and/or privately-operated vehicles and the associated technology development driven by the space tourism market'; see ESA's position on privately-funded suborbital spaceflight 1 (10 April 2008), [http://esamultimedia.esa.int/docs/gsp/Suborbital\\_Spaceflight\\_ESA\\_Position\\_Paper\\_14April08.pdf](http://esamultimedia.esa.int/docs/gsp/Suborbital_Spaceflight_ESA_Position_Paper_14April08.pdf).

<sup>6</sup> 'someone who tours or travels into, to, or through space or to a celestial body for pleasure and/or recreation'; see Steven Freeland, *Up, Up and ... Back: The Emergence of Space Tourism and Its Impact on the International Law of Outer Space*, 6 Chi. J. Int'l. L. 1, 6 (2005-2006).

<sup>7</sup> See generally NASA's Human Exploration and Development of Space Enterprise, *What is orbit?*, July 16, 2011, [http://www.nasa.gov/audience/forstudents/5-8/features/orbit\\_feature\\_5-8.html](http://www.nasa.gov/audience/forstudents/5-8/features/orbit_feature_5-8.html).

<sup>8</sup> *Id.*

<sup>9</sup> See Tanja Masson-Zwaan & Steven Freeland, *Between Heaven and Earth: The Legal Challenges of Human Space Travel*, 66 Acta Astronautica 1597, 1599 (2010).

<sup>10</sup> Cf. T. Sgobba, *Sub-orbital Space Tourism Regulation: The Safety Perspective*, ESA Independent Safety Office, 1, [http://download.esa.int/docs/ECSL/Space\\_Tourism-The\\_safety\\_perspective\\_plus\\_notesT\\_Sgobba.pdf](http://download.esa.int/docs/ECSL/Space_Tourism-The_safety_perspective_plus_notesT_Sgobba.pdf).

<sup>11</sup> *See id.*

<sup>12</sup> *Id.*

<sup>13</sup> See I. H. PH. DIEDERIKS-VERSCHOOR, *An Introduction to Space Law* 7 (3<sup>rd</sup> ed. 2008).

<sup>14</sup> *Id.*

<sup>15</sup> See B. F. HAVEL, *Beyond Open Skies: A New Regime For International Aviation* 99 (2009).

enshrined in the '*Paris Convention on the Regulation of Air Navigation*' (1919).<sup>16</sup> Article 1 crystallised the principle of sovereignty over State airspace stating "... every [State] Power has complete and exclusive sovereignty over the air space above its territory [including adjacent territorial waters]."<sup>17</sup> The '*Convention on International Civil Aviation*' (1944) (the 'Chicago Convention' or otherwise 'CC') later reaffirmed that basic principle.<sup>18</sup>

However, State practice evidences a customary law principle that has existed since the launch of Sputnik 1 when transitioning between the airspace and outer space regimes. As observed by Judge Manfred Lachs in the *North Sea Continental Shelf Cases*:

"The first instruments that men sent into outer space traversed the airspace of States and circled above them in outer space, yet launching States sought no permission nor did the other States protest. This is how the freedom of movement into outer space, and in it, came to be established and recognized as law within a remarkably short period of time."<sup>19</sup>

Hence, while States may limit the rights of civil and commercial aircraft entering their airspace under Arts 5 & 6 of the Chicago Convention (1944), air rights are not required for spacecraft that launch into outer space, or re-enter Earth's atmosphere. While orbital space tourism would be fully governed under the space law regime, for sub-orbital space tourism problems might result since the applicable regime has not yet been determined. In the case of Scaled Composite's Ansari X-Prize winning 'Spaceship One', while attached to 'White Knight', air law would likely apply to both vehicles; yet, upon detachment/launch, the applicable regime becomes uncertain.<sup>20</sup>

<sup>16</sup> *Id.* at 99-100.

<sup>17</sup> Art 1, Paris Convention on the Regulation of Air Navigation (1919), available at: [http://www.spacelaw.olemiss.edu/library/aviation/IntAgr/multilateral/1919\\_Paris\\_convention.pdf](http://www.spacelaw.olemiss.edu/library/aviation/IntAgr/multilateral/1919_Paris_convention.pdf).

<sup>18</sup> See Art 1 CC, available at: <http://www.mcgill.ca/files/iasl/chicago1944a.pdf>.

<sup>19</sup> See *North Sea Continental Shelf Cases* (Federal Republic of Germany v. Denmark; Federal Republic of Germany v. Netherlands), 1969 ICJ 3, 230 (Feb 20, 1969) (separate opinion of Judge Lachs).

<sup>20</sup> See Steven Freeland, *Up, Up and ... Back: The Emergence of Space Tourism and Its Impact on the International Law of Outer Space*, 6 Chi. J. Int'l. L. 1, 9 (2005-2006).

It is hard to determine which regime governs an activity when that activity occurs near outer space, but does not orbit the Earth. There might be agreement that the area above an altitude of 110 km above sea level belongs to outer space, while the area below the altitude of 80 km belongs in airspace.<sup>21</sup> However, the highest altitude an aircraft has reached was around 37.6 km, flown by a Soviet pilot Alexandr Fedotov in a MiG E-266M on 31 August 1977<sup>22</sup>; and except for sub-orbital experimental vehicles, no aircraft or spacecraft operates within the 37.6 km to 96 km range, other than in ascent or decent from outer space.<sup>23</sup> Indeed, this grey area between air space and outer space remains controversial. The answer to which normative regime governs depends on whether the State licensing the activity follows the functionalist or the spatialist approach to determining outer space activity.

Under the functionalist approach, objects launched into outer space and the component parts thereof are all subject to the space law regime, regardless of whether some stages are not meant to reach space. However, under the spatialist approach, only objects that reach beyond a certain altitude would be considered subject to the space law regime; generally, that altitude is regarded as being ~100 km, also known as the von Kármán Line.<sup>24</sup> Thus, spatialists might still argue that sub-orbital space flights are not outer space activity because they barely, if at all, reach beyond this threshold altitude; and hence, the space law regime would not be applicable.

Nevertheless, it is agreed that objects that orbit the Earth are considered to be in outer space. In fact,

"... since no State has ever claimed that a satellite orbiting the Earth was infringing its national airspace, it is possible to say that in international law, outer space begins *at least* from the height above the Earth of the lowest perigee of any existing or past

<sup>21</sup> Stephan Hobe et al., *Space Tourism Activities – Emerging Challenges to Air and Space Law?*, 33/2 J. Space L. 359, 362 (2007).

<sup>22</sup> Rebecca Maksel, *Who holds the altitude record for an airplane?*, Air & Space Smithsonian, May 29, 2009, <http://www.airspacemag.com/need-to-know/Need-to-Know-Who-holds-the-altitude-record.html>.

<sup>23</sup> Cf. Katherine M. Gorove, *Delimitation of Outer Space and the Aerospace Object – Where is the Law?*, 28/1 J. Space L. 11, 12 (2000).

<sup>24</sup> See I. H. PH. DIEDERIKS-VERSCHOOR, *An Introduction To Space Law* 18 (3<sup>rd</sup> ed. 2008).

artificial satellite that has orbited the Earth without encountering any protest.”<sup>25</sup>

The lowest unchallenged perigee achieved by an artificial satellite is that of the United Kingdom Skynet-IIA (1974); at the lowest point of its orbit, it operated at an altitude of 96 km.<sup>26</sup> Furthermore, the 'Convention on Registration of Objects Launched into Outer Space' (the 'Registration Convention' or otherwise 'RC')<sup>27</sup> requires an object that is launched into Earth orbit or beyond to be registered;<sup>28</sup> i.e. it is deemed to be in outer space. In the case where an ultra-high apogee parabolic flight extends beyond GEO and LEO altitudes, yet fails to make at least one complete revolution around the earth, there is little doubt that readers would consider this scenario to be outer space activity, despite not completing a full revolution. The key factor to note is that the object reaches beyond orbital altitude; the distance beyond is never discussed. If legal certainty is to be maintained, the conclusion should be the same when changing the variables to lower altitudes, so long as that altitude is at a distance above the lowest orbital altitude that can be reached. On a side note it seems that the Registration Convention has the unexpected consequence of delimiting outer space and air space through Article II(1) RC. If a State must register anything in orbit or beyond, and the lowest orbit achieved was at an altitude of 96 km above sea level, then in effect, any object travelling beyond that orbital altitude should be considered as occurring in outer space and subject to the space law regime.

Additionally, specific legislation has been enacted in Australian national law, under the Space Activities Act of December 21, 1998, specifying that a space object is any launch vehicle or payload, or part thereof that launches or attempts to launch an object "... into or back from an area beyond the distance of 100 km above mean sea level."<sup>29</sup> Also, the US Air

Force awards 'astronaut wings' to its rated officers who fly higher than 80 km above sea level (i.e. 50 miles); in the early 1960s, the US X-15 aircraft was flown up to 108 km.<sup>30</sup> Next, the Fédération Aéronautique Internationale (FAI), i.e. the World Air Sports Federation, adopts the 'von Kármán Line' which fixes the boundary at 100 km, "... where aerodynamic lift is exceeded by ascensional (sic) pressure."<sup>31</sup> As Spaceship One and Virgin Galactic's Spaceship Two will exceed this line, the burden should be placed on those opposed to classifying sub-orbital spaceflight as outer space activity to remove it from the field of space law.

Spaceship One reached an apogee of 103 km and 112 km in its test flights.<sup>32</sup> While legal authorities may quibble as to the *de iure* boundary of outer space; the State practice of not challenging orbits has the consequence of classifying the apogee of Spaceship One as having occurred *de facto* in outer space.

#### 4. Defining 'Envoy of Mankind'

Article V of the OST requires astronauts to be regarded as 'envoys of mankind'. In this respect, Judge Manfred Lachs stated that "[t]he mission they perform and the risks they incur justify the special standing and legal protection afforded to them."<sup>33</sup> Yet, rather than attaching jurisdictional immunities for astronauts, there is a historical consensus that the term was only intended as a figure of speech.<sup>34</sup>

The 'Agreement Governing the Activities of States on the Moon and Other Celestial Bodies' (the 'Moon Agreement' or otherwise 'MA')<sup>35</sup>, the final space law instrument to be adopted by the

<sup>25</sup> Christopher M. Petras, "Space Force Alpha": Military Use of the International Space Station and the Concept of "Peaceful Purposes", 53 A.F.L. REV. 135, 155 (2002).

<sup>26</sup> BIN CHENG, STUDIES IN INTERNATIONAL SPACE LAW 396 (Oxford University Press 2004) (1997).

<sup>27</sup> 3235 (XXIX). Convention on the Registration of Objects Launched into Outer Space, <http://www.oosa.unvienna.org/oosa/SORRegister/regist.html>.

<sup>28</sup> See Art II(1) RC.

<sup>29</sup> Cf. Sect. 8: Definitions - "launch vehicle", "space object", "return", SPACE ACTIVITIES ACT 1998, [http://www.austlii.edu.au/au/legis/cth/consol\\_act/saa1998167/s8.html](http://www.austlii.edu.au/au/legis/cth/consol_act/saa1998167/s8.html); *N.b.* Australia has specified that in identifying the 100 km altitude in the Act, it was not an attempt to define or delimit outer space, see reply by Australia on National legislation and practice relating to definition and delimitation of outer space,

[http://www.oosa.unvienna.org/pdf/reports/ac105/AC105\\_865A\\_dd1E.pdf](http://www.oosa.unvienna.org/pdf/reports/ac105/AC105_865A_dd1E.pdf).

<sup>30</sup> S. Sanz Fernández de Córdoba, *Presentation of the Karman separation line, used as the boundary separating Aeronautics and Astronautics*, Fédération Aéronautique Internationale, <http://www.fai.org/astronautics/100km.asp>.

<sup>31</sup> Cf. *id.* & I. H. PH. DIEDERIKS-VERSCHOOR, AN INTRODUCTION TO SPACE LAW 18 (3<sup>rd</sup> ed. 2008).

<sup>32</sup> See Scaled Composites, *Combined White Knight / SpaceShipOne Flight Tests*, [http://www.scaled.com/projects/tierone/combined\\_white\\_knight\\_spaceshipone\\_flight\\_tests](http://www.scaled.com/projects/tierone/combined_white_knight_spaceshipone_flight_tests).

<sup>33</sup> MANFRED LACHS, THE LAW OF OUTER SPACE – AN EXPERIENCE IN CONTEMPORARY LAW-MAKING 68 (Tanja Masson-Zwaan & Stephan Hobe eds., Martinus Nijhoff Publishers 2010)(1972).

<sup>34</sup> See Frans Gerhard von der Dunk & Gerardine Meishan Goh, *Article V*, in COLOGNE COMMENTARY ON SPACE LAW - VOLUME 1: OUTER SPACE TREATY 94, 98 (Stephan Hobe et al. eds., 2009).

<sup>35</sup> Listed under Resolution 34/68, it opened for signature on 18 December 1979 and entered into force on 11 July 1984; See Moon Agreement, <http://www.oosa.unvienna.org/oosa/en/SpaceLaw/moon.html>.

General Assembly of the United Nations, attempted to clarify the status of all persons in outer space. Under Art. 10(1) MA, 'any person' (emphasis added) on the moon is considered to be an 'astronaut' within the meaning of Art V OST, and as 'personnel on spacecraft' within the meaning of the Rescue Agreement.

The first 7 NASA 'Project Mercury' astronauts were military test pilots vetted out of the 110 test pilots deemed to meet the minimum standards.<sup>36</sup> Likewise, Soviet Cosmonauts were also military servicemen – specifically fighter pilots<sup>37</sup>; among them Yuri Gagarin was selected from a group of 20 to be the first person launched into outer space.<sup>38</sup> These people share a common quality with all subsequent space travellers, i.e. a daredevil attitude in undertaking a highly risky and relatively untested mode of travel into the harshest-known environment at speeds that reached around 40,680 km/hr.

Presently, 7 private individuals have successfully flown on 8 missions to the International Space Station.<sup>39</sup> These individuals are Dennis Tito (April 2001), Mark Shuttleworth (April 2002), Greg Olsen (October 2005), Anousheh Ansari (September 2006), Richard Garriott (October 2008), Charles Simonyi (April 2007, April 2009), and Guy Laliberte (September 2009). The first participants paid an estimated US\$20 million a piece for each flight<sup>40</sup>; that fee has since increased to around U.S. \$35 million.<sup>41</sup> The duration of their time in outer space ranged from 7 days (Dennis Tito) to a combined total of 25 days (Charles Simonyi).<sup>42</sup> Before travelling to the ISS, each participant underwent several months of extensive training at Russia's Star City

complex.<sup>43</sup> Another requirement was the approval of all other ISS Partners.<sup>44</sup>

Steven Freeland rhetorically suggests that these participants purchased "... the opportunity of participating in a mainstream space project involving actual orbital travel, including a stay in the world's most expensive 'hotel'."<sup>45</sup> In contrast to that idea of purchasing a hotel room, it would appear as though these participants, in fact, purchased the status of 'envoy of mankind' or at least 'personnel of spacecraft'. This idea of purchasing such a status seems right at home with the spirit of private commercial spaceflight, i.e. purchasing access to outer space.

However, if orbital spaceflight participants onboard the ISS are governed by the Outer Space Treaty and Rescue Agreement, then why should sub-orbital space flight participants be excluded? In launching to the ISS and re-entering Earth's atmosphere, the tasks applied to the orbital space tourist are comparable to those applied to the sub-orbital space tourist on a sub-orbital flight; i.e. they are not involved in flying the spacecraft, and do not receive the training to do so. Nevertheless, while some affluent private individuals have experienced the life of an astronaut for an extended duration, there are others that would be satisfied with a less expensive, significantly shorter in duration experience, i.e. a 5-7 minute experience. This is the service offered by sub-orbital spaceflight companies such as Virgin Galactic, and its expected competitors, *inter alia*, XCOR Aerospace with its LYNX Sub-orbital vehicle.<sup>46</sup>

In comparing orbital space flight to sub-orbital space flight, readers might conclude that orbital spaceflight is significantly more risky based on the altitude and velocity at which they orbit; thereby, reasoning that those personnel onboard orbiting space objects have greater entitlement to the treatment toward astronauts as 'envoys of mankind', than a sub-orbital space flight participant. However, this may not be the case, as far as the space insurance industry is concerned. There is currently no

<sup>36</sup> See Mercury Project Overview, *last visited* June 22, 2011, <http://www-pao.ksc.nasa.gov/kscpao/history/mercury/mercury-overview.htm>.

<sup>37</sup> BRIAN HARVEY, *RUSSIA IN SPACE – THE FAILED FRONTIER?* 5 (Praxis Publishing Ltd. 2001).

<sup>38</sup> *Id.*

<sup>39</sup> Client – Completed Missions, Space Adventures, <http://www.spaceadventures.com/index.cfm?fuseaction=orbital.Clients>.

<sup>40</sup> See Stephan Hobe et al., *Space Tourism Activities – Emerging Challenges to Air and Space Law?*, 33/2 J. Space L. 359, 370 (2007).

<sup>41</sup> See Tanja Masson-Zwaan & Steven Freeland, *Between heaven and earth: The legal challenges of human space travel*, 66 Acta Astronautica 1597, 1598 (2010).

<sup>42</sup> Client – Completed Missions, Space Adventures, <http://www.spaceadventures.com/index.cfm?fuseaction=orbital.Clients>.

<sup>43</sup> See Steven Freeland, *Up, Up and ... Back: The Emergence of Space Tourism and Its Impact on the International Law of Outer Space*, 6 Chi. J. Int'l. L. 1, 2 (2005-2006).

<sup>44</sup> *Id.* at 3; ISS Project Partners: US, Russia, Japan, Canada, and 11 ESA Member States (Belgium, Denmark, France, Germany, Italy, The Netherlands, Norway, Spain, Sweden, Switzerland, and the United Kingdom).

<sup>45</sup> Steven Freeland, *Fly Me to the Moon: How Will International Law Cope with Commercial Space Tourism?*, 11 Melb. J. Int'l L. 90, 96 (2010).

<sup>46</sup> See The Lynx Suborbital Spacecraft, [http://www.xcor.com/products/vehicles/lynx\\_suborbital.html](http://www.xcor.com/products/vehicles/lynx_suborbital.html)

sub-orbital space flight insurance; however, we can analyse the launch and in-orbit insurance rates that are currently applied to orbital space flight.

While insurance is required for every stage of space activity, launch insurance is the most expensive type of coverage available.<sup>47</sup> This is due to the extremely risky and volatile nature of launch services, since objects that are launched accelerate by way of controlled explosions to reach the velocity needed to escape earth's gravitational pull and enter into orbit (i.e. ~ 40,680 km/hr); note that in the case of sub-orbital spaceflight, they would only reach velocities shy of that mark. Yet, if an accident were to occur during the launch stage, the likely result would be the death of the spaceflight participant. On the other hand, the insurance premiums for objects that have been in-orbit for over a year are considerably lower than launch premiums.<sup>48</sup>

The ISS may orbit at a velocity of 28,000 km/hr; however this velocity is relatively static, maintaining a constant separation distance from all other space objects that follow the same trajectory. In essence, except for minor adjustments in altitude to compensate for space debris/weather and atmospheric drag, the ISS is following a track on cruise-control; in other words, its motion resembles an electron to an atom. Subsequently, an accident occurring at this stage might not result in the inevitable death of a spaceflight participant.

On the other hand, the nature of the sub-orbital spaceflight is one of constant dynamic change: in a duration of 2.5 hours, Spaceship Two will fly in airspace like an externally attached cabin on White Knight Two; at about 15.2 km it will detach in mid-air, and after gliding a short distance, it will ignite its hybrid rocket engines, hurdling it on a vertical path toward outer space for 80 seconds at the speed of Mach 3 (~ 3675 km/hr).<sup>49</sup> On reaching an altitude of around 100 km, the engines shut down, and the space flight participants experience 3 to 6 minutes of microgravity while Spaceship Two apogeese; the spacecraft then re-enters the atmosphere and

falls back to Earth, utilising its glider design for 15 to 20 minutes, returning either to its point of departure or a third location.<sup>50</sup> When released from White Knight Two, and throughout its vertical launch, Spaceship Two no longer "... derives support in the atmosphere from the reactions of the air, and should be considered a space object."<sup>51</sup> Yet orbit will not be achieved because the spacecraft will fall below the velocity required to escape Earth's gravitational pull.

## 5. Conclusion

The nature of space tourism is sometimes likened to the cruise industry with respect to the primary purpose of transportation; i.e. both industries offer a product that is a temporary experience that offers more than the mere transportation from one destination to another.<sup>52</sup> In this analogy, it is suggested that the space vehicle is more like a luxury cruise liner in that the ship is the destination.<sup>53</sup> This analogy fits better with the activity of orbital space tourism than it does with sub-orbital space tourism, since the goal of orbital spaceflight participants is to experience spaceflight in the guise of a crewmember aboard the ISS. On the other hand, with sub-orbital space tourism, Spaceship Two is not the destination for spaceflight participants; rather, it is the vehicle used to exceed 100 km in altitude, experience 3-6 minutes of microgravity, while also capturing remote Earth images, before returning to Earth within a period of 2.5 hours. In this case, sub-orbital space tourism is more like a suspicious-looking amusement park ride. And since rescue would be limited to cases where orbital and sub-orbital space vehicle conducted an emergency landing in a territory or alighting on the high seas (it is unlikely that rescue could be effected during the launch phase of a spaceflight due to the short duration involved), the risks these commercial spaceflight participants incur justify the same special standing and legal protection afforded to astronauts of the past half-century.

<sup>47</sup> See further Henk H.F. Smid, *Insuring Space Activities - A risky business*, 3, The 6<sup>th</sup> Iranian Aerospace Society Conference - Feb. 2007 - K.N.Toosi University of Technology, <http://www.irpds.com/FileEssay/havafaza-86-11-26-asy257.pdf>.

<sup>48</sup> Cf. Fig. 7 & 8 Henk H.F. Smid, *Insuring Space Activities - A risky business*, 8.

<sup>49</sup> See IAASS, *An ICAO for Space?* 28 White Paper (29 May 2007), <http://www.iaass.org/files/pdf/ICAO%20for%20Space%20-%20White%20Paper%20-%20draft%2029%20May%202007.pdf>.

<sup>50</sup> Cf. Stephan Hobe et al., *Space Tourism Activities - Emerging Challenges to Air and Space Law?*, 33/2 J. Space L. 359, 360 & 364 (2007), & Tanja Masson-Zwaan & Steven Freeland, *Between heaven and earth: The legal challenges of human space travel*, 66 Acta Astronautica 1597, 1599 (2010).

<sup>51</sup> See Stephan Hobe et al., *Space Tourism Activities - Emerging Challenges to Air and Space Law?*, 33/2 J. Space L. 359, 364 (2007).

<sup>52</sup> See Melanie Walker, *Suborbital Space Tourism Flights: An Overview of Some Regulatory Issues at the Interface of Air and Space Law*, 33/2 J. Space L. 375, 388 (2007).

<sup>53</sup> *Id.* at 389.



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