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SOME THOUGHTS ON THE DELIMITATION OF AIR SPACE – OUTER SPACE AS PROPOSED BY DR. OLAVO BITTENCOURT[·]

This paper will use Dr. Bittencourt's excellent paper, "The Elusive Frontier: Revisiting the Delimitation of Outer Space,"[1] as a basis for this author's thoughts and comments on the issue of "delimitation" (of outer space from air space and other spaces).

Several conclusions and recommendations may be gleaned from Bittencourt's paper and from many other articles and reports. One of them is that there seems to be a growing consensus that the delimitation of air and outer space is at about 100 km above sea level. Another recommendation is that countries should enact national legislation regarding space activities, thus providing some legal certainty to entities engaged in them. The author of this paper offers a third recommendation: ratification of at least the Liability[2] and Registration Conventions[3] by countries that have launched, or plan to launch satellites or rockets. These would begin providing a basis for national legislation and regulation of space activities.

Delimitation of space(s)

There are various kinds of "spaces", some may be clearly defined / delimited, whereas others defy clear demarcation. One of the non-definable spaces is what this author calls "inner space", comprising our personal or "breathing space", our psyche, our mental abilities, our emotions, and spiritual states, all of which are intangible but nevertheless real. "Air space" and "outer space" likewise seem to defy definition / delimitation, yet they too are equally real.

Thus, it would seem that something tangible, such as land, water, or a body mass, is fundamental to delimiting physical space, i.e. a person's body or a nation's territory.

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[1] Olavo de O. Bittencourt Neto, University of São Paulo, Brazil. Presented at the 55th Colloquium on the Law of Outer Space, IAC-2012, Naples, Italy. This paper won the International Institute of Space Law's 2012 Diedericks-Verschoor Prize for an Outstanding Contribution by a Young Author. Note: no pagination is provided, as it will be changing upon publication.

[2] Convention on International Liability for Damage Caused by Space Objects (resolution 2777 (XXVI), annex, entered into force 1 September 1972. [Cited as the Liability Convention hereinafter].

[3] Convention on Registration of Objects Launched into Outer Space (resolution 3235 (XXIX), annex, entered into force 15 September 1976. (Cited as the Registration Convention hereinafter].

If one accepts that some kind of mass or territory is necessary for some sort of delimitation, air space would be included in this definition: air space is that area above the land or body mass, or in Bittencourt's words, the vertical extension of a State's territory.[4] The question then arises, how high does air space go, what is the delimitation of air space from outer space? Prof. von der Dunk rightly points out that while the "sky is the limit"[5], that limit seems ethereal.

This raises another question: what is meant by "delimitation", a concept that may vary according to the language and sector in which it is used?[6] "Delimitation" in air and space law has been widely written on, debated in scientific and legal articles and other fora since before aviation became commonplace, and particularly since the launch of the satellite, "Sputnik" in 1957, and the drafting of the Outer Space Treaty.[7] While the OST states that "the exploration and use of outer space …shall be carried out for the benefit and in the interests of all countries…and shall be the province of mankind," it left a lacuna – the lack of definition / demarcation/ delimitation of air space from outer space.

Some authors prefer a "functional" approach to the delimitation of air space from outer space, while others favour a "spatial" approach to this issue. The "functionalists" argue that a clear delimitation of air /outer space is not necessary.[8] The "spatialists" maintain that, from a scientific and technical viewpoint, such delimitation already exists and in some respects is accepted.

These disparate views raise another question, namely, is delimitation a physical or political issue? One author states that delimitation is "a process of determining land or maritime boundaries of a State, including the continental shelf and the Exclusive Economic Zone (EEZ) [of that State], generally based on geographic coordinates of latitude and longitude."[9] The delimitation would be at about 100 km. above sea level, give or take 10-20 km above or below the 100 km. delimitation, and could even be considered customary space law.[10] Bittencourt favours the 100 km delimitation of what he calls the "vertical frontier of national territories,"[11] as "it represents the point "where

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[4] Bittencourt, note 1.

[5] Von der Dunk, "The Sky is the Limit – but Where does it End?" Proceedings of the Forty-Eighth Colloquium on the Law of Outer Space. IAC-IISL, Fukuoka, 2005. pp.84-94.

[6] Webster's online dictionary: "Delimit": transitive verb: to fix or define the limits of…" Another online dictionary (en.wiktionary.org) states that "delimitation is the act of delimiting something" In Spanish "delimitación" is a feminine noun: "limitación y delimitación designan, en general, el establecimiento de límites o puntos más allá de los cuales no se puede ir." www.wordreference.com.

[7] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies. (General Assembly resolution 222(XXI) annex), entered into force 10 Oct. 1967. [Cited as Outer Space Treaty or OST hereinafter].

[8] The United States maintains the position it stated at the 40th session of the COPUOS' Legal Subcommittee (April 2001), namely that [its] "position continues to be that defining or delimiting outer space is not necessary. No legal or practical problems have arisen in the absence of such a delimitation."

[9] Gabrynowycz, Joanne, IISL/ECSL Symposium at COPUOS' Legal Subcommittee, "Legal Implications for Delimitation of Airspace and Outer Space", 28 March 2011.

[10] Perek, Lubos, "Is Customary Law a Source of Space Law? IISL/ECSL Symposium at COPUOS' Legal Subcommittee, "Legal Implications for Delimitation of Airspace and Outer Space", 28 March 2011. In recent years, the International Astronautical Federation (IAF) also has proposed that 100 km be the delimitation of air from outer space.

[11] Bittencourt, note 1.

aerodynamic lift decreases to critical levels and where the lowest perigees attainable by space objects in orbit can be reasonably identified."[12]

The issue of delimitation is not the purview of only international law; rather, as Bittencourt and other authors[13] note, national laws need to clearly delimit the space over which they claim to have [national] sovereign rights, and outer space, which is not subject to appropriation by any means.[14] National legislation and international law, however, seem to agree on one element: "outer space begins where orbital flight becomes possible."[15] In brief, there seems to be a growing consensus among the space community that air space can be delimited from outer space at an altitude of about 100 km above sea level, even though this delimitation is not included in national or international legislation.[16]

In Latin America, exceptions to this delimitation are found in the 1991 Colombian and 2008 Ecuadorian Constitutions, both of which claim that their national sovereignty extends to the geostationary orbit, and in the case of Colombia, to "the space in which it acts."[17] Interestingly enough, signing the 1976 Bogota Declaration did not prevent Ecuador from ratifying the 1967 Outer Space Treaty, the Rescue of Astronauts Agreement, or the Liability Convention.[18] Colombia, on the other hand, has not ratified any of the outer space treaties; rather, its premise of sovereign rights over "its" segment of the GSO has been the subject of much debate and even polemics. This position has hindered Colombia's aspirations to acquire a satellite, and to join the space community, as Art. 101 of the 1991 Colombian Constitution has been an obstacle to its ratifying the outer space treaties.[19] Perhaps at the end of this Workshop a solution will be found, enabling Colombia to ratify the space treaties, and to progress in harmony with the international space community.

Delimitation and the Liability Convention

The issue of national and international delimitation becomes important when considering the growing number of space activities conducted by private parties, including

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[12] Ibid. He cites several authors and delegations to COPUOS that also favour this delimitation.

[13] Pedrazzi, Marco, "Are there indications for upper and lower limits for air space and outer space in air law, space law and national legislation?" IISL/ECSL Symposium at COPUOS' Legal Subcommittee, "Legal Implications for Delimitation of Airspace and Outer Space", 28 March 2011. Pedrazzi cites the Australian Space Activities Act, 21 December 1998, which specifies the 100 km above sea level altitude, but Australia has stated that this "was not an attempt to define or delimit outer space." He also cites Mexican, French, Belgian, United States, and Austrian national legislation, and concludes that most nations do not have a precise or clear delimitation of air space and outer space.

[14] Article II, Outer Space Treaty, note 7.

[15] Pedrazzi, note 13.

[16] Bittencourt, note 1, provides information on national laws of several countries, regarding air - space delimitation, concluding that few of them are clear on the subject,

[17] Art. 101, Nueva Constitución Política de Colombia, 1991. This Article states that the Colombian territory includes, inter alia, its territorial waters, its air space, the Exclusive Economic Zone, the segment of the geostationary orbit, the electromagnetic spectrum, and the space in which it acts…" This wording is ambiguous, as it is not clear whether "it" refers to the geostationary orbit (GSO), or the radio frequency spectrum (RFS), both intangibles that are deemed to be in outer space. Neither Colombia nor Ecuador claims sovereign rights over other lower orbits.

[18] For the complete title and text of the treaties see www.unoosa.unvienna.org

[19] Jairo Becerra, a Colombian lawyer, proposed a solution that would not require amending the Colombian Constitution, an arduous and lengthy task. Since Art. 101 refers only to claims to sovereignty over part of GSO, using a non-GSO orbit for a national satellite would circumvent Art. 101's impediment, His proposals merit consideration. "A Survey of Colombia's New Outer Space Policy: Reforms in Colombian Law." Acta Astronautica, Vol 63, No, 1-4, pp.560-563. Washington, DC July-August 2008.

universities, and the increasing amount of space debris. Although their respective governments must sanction space activities conducted by private parties, these initiatives, rather than governmental ones, are spurring them on. These include suborbital flights; space tourism; the launch of small satellites by universities, among other activities. These activities raise questions regarding liability or responsibility for the potential damage they may cause.

Bittencourt and other authors note that the Liability Convention[20] essentially is a two-tiered liability / responsibility arrangement:[21] Article II provides for absolute liability for damage caused to the surface of the Earth [including the oceans?] and to aircraft in flight. Does the latter include interference with the communications necessary for the safety and /or navigation of the aircraft?

Art. III states that "In the event of damage being caused elsewhere 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 object of another launching State, the latter shall be liable **only if** [emphasis added] the damage is due to its fault or the fault of persons for whom it is responsible."[22]

One issue raised here is whether the origin of the space debris causing the damage can be identified with legal certainty. Further, is the Liability Convention applicable to all, or only some space debris? Attributing fault to a State or a private party may be difficult, if not impossible, as it may be equally difficult to identify the provenance of the space debris that caused the damage in the first place. Art. VIII of the Outer Space Treaty further complicates the removal of space debris. It states that the State Party retains jurisdiction and control over the object(s) carried on its registry, regardless of whether the object(s) are in space or if they are returned to Earth.[23]

Some proposals for removing space debris include its removal by methods and / or persons not belonging to or under the jurisdiction of the launching State. Could the persons engaged in such clean-up be held liable for incidental damages caused during the removal of the debris? Could they be accused of pilfering or otherwise interfering with the property rights of the launching State? Or, should space debris be treated like much terrestrial trash; i.e., once the garbage is placed outside the homeowner's property, the trash or garbage essentially becomes public property, and no longer is considered "private property."[24] If they fall in the high seas, or in the territorial waters of another State, are they still subject to the launching State's jurisdiction? Or, if they are removed from orbit by robotic means, would the robot be acting in and on "public property," since outer space does not "belong" to anyone? These hypothetical questions could become real issues to be decided either by the Claims Commission that would be

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[20] Liability Convention, note 2.

[21] English seems to be the only language which distinguishes between "liability" and "responsibility". The Spanish title for the Liability Convention is "Convenio sobre la responsabilidad internacional por daños causados por objetos espaciales." The French title Is "Convention sur la responsabilité internationale pour les dommages causés par des objets spatiaux." For a longer discussion on these differences, see S. Ospina, "International Responsibility and State Liability in an Age of Globalization and Privatization." Annals of Air and Space Law, Vol. XXVII (2002), pp. 479 - 493.

[22] Art. III, Liability Convention, note 2.

[23] Article VIII, OST, note 7.

[24] Several cases in the USA support the notion that once the garbage is placed outside private property, it may be considered "abandoned" or otherwise public property. (California v. Greenwood, 486 U.S.35). www.google.com/search; visited 28 Oct. 2012.

set up in case of disputes under the Liability Convention,[25] or some other venue yet to be established.

Delimitation and Suborbital flights

Bittencourt notes that for space objects to reach orbit and return from it, they may have to go through foreign air space, and advocates for the right of innocent passage,[26] i.e., "non-aggressive," to be in accordance with the OST. [27] He suggests that, as with aircraft flight plans, the launch of a space object should be notified to the State through whose air space the object will be traversing. However, he seems more concerned with the reentry than with the launch itself, as the Launching State may not have control over the object, such as space debris, that is being de-orbited. As he points out, "there is no treaty provision regarding the possible defensive actions that the territorial State [may take] regarding uncontrolled space debris crossing its air space."[28]

One question that arises is what kind of legal regime will be developed regarding suborbital flights, since at present there is no clear delimitation of air from outer space. On the one hand, European respondents to a recent survey of entities involved in suborbital flights suggest that "it may be necessary to delimit airspace and outer space", as that would help the marketability of space tourism.[29] On the other hand, the USA at this time seems more concerned about orbital flights than with suborbital flights.[30] The Federal Aviation Administration (FAA) also distinguishes between suborbital rockets and orbital ones: experimental rockets do not require licenses prior to launch, although they may be granted experimental permits.[31] Could the lack of delimitation of air from outer space could eventually pose a problem to the launchers of experimental rockets that go higher than suborbital flights?

Whatever delimitation and regulation of suborbital (and orbital) flights that may be proposed, whether in the USA, in Europe or other parts of the world, should be harmonized among neighbouring countries, to provide some legal certainty to the entities engaged in these activities. Their regulation should not be overly burdensome, but should be coherent.[32]

Bittencourt points out that even the countries that have some space legislation and / or have ratified the space treaties, do not have coherent national legislation regarding

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[25] Art. IX – Art.XXII, Liability Convention, note 2.

[26] In international law, "innocent passage" refers to a ship or aircraft's right to enter and pass through another's territory [or air space], so long as it is not prejudicial to the peace, good order or security of the other state. www.duhaime.org/LegalDictionary.

[27] Bittencourt, note 1.

[28] Ibid.

[29] Lentsch, A., Moro-Aguilar, R., Masson-Zwaan, T., "The Future Regulation of Suborbital Flight in Europe." IAC12-D2.9/D6.2.5. (Paper presented at the IAC-Naples, Italy, October 2012.)

[30] FAA Office of Commercial Space Transportation (AST) "Public Meeting on the Regulatory Approach for Commercial Orbital Human Spaceflight", Cocoa Beach, Florida, 26 May 2011.

[31] See the USA's Commercial Space Launch Amendments Act of 2004 (CSLAA), directing the Federal Aviation Administration (FAA) to grant experimental permits, rather than licenses prior to the launch and reentry of reusable suborbital rockets. (14 CFR Chapter III Part 440). www.faa.gov, "Experimental Permits for Reusable Suborbital Rockets."

[32] Lentsch et al, note 29; Bittencourt, note 1. These recommendations also are supported by the Report of Working Group on National Legislation Relevant to the Peaceful Exploration and Use of Outer Space. UNGA A/AC.105/C.2.101. (3 April 2012).

liability for space activities.[33] If they have ratified the Liability Convention, will they have to seek redress through diplomatic channels and the Claims Commission?[34] Where does this leave the Latin American countries, which do not have a national legal framework to deal with space activities, have not ratified the Liability Convention, or other outer space treaties, yet plan to launch or already have launched satellites? This concern goes beyond crowding of the geostationary orbit, allegedly part of Ecuador's and Colombia''s national territory, but is also of concern regarding other orbits and smaller spacecraft. A brief look at this subject follows.

The International Telecommunication Union, Small Satellites and Space Debris
The International Telecommunication Union (ITU) is primarily a technical organization, whose main responsibility is the allocation of the radio frequency spectrum (RFS) to the many communication services that use the RFS. In adhering to the ITU's *allocation* of frequencies to terrestrial and space-based services, national regulators *assign* certain frequency bands to national operators and service providers.[35] The majority of the ITU member countries adhere to the technical regulations of communications systems (including satellites) that use the radio frequency spectrum (RFS), but in many countries, regulation of satellite communications is the closest they come to dealing with the regulation of outer space activities.

The major satellite services are the Fixed-Satellite Service (FSS) (point-to-point), the Broadcast- Satellite Service (BSS) (point-to multi-point), provided by satellites in the GSO. Mobile-Satellite Service (MSS), is used primarily by mobile entities (maritime and aviation), and to provide personal communication services (GMPCS, such as Iridium, Globalstar. Regardless of the service that the satellite is intended to provide, its use of the RFS and orbital position(s) must be coordinated with other operating or planned systems that use the RFS, according to the ITU's Radio Regulations (ITU-RR). The ITU-RR and procedures are intended to avoid or prevent harmful interference among the RFS users and their systems.

The use of the geostationary orbit, its near-saturation and related issues are beyond the scope of this paper, and will not be addressed here. Suffice it to say that the ITU is inundated by requests / notifications of satellite systems that are looking for optimal orbital positions and use of the associated RFS. Thus, alternative systems, in non-GSO orbits are being proposed, and at present the collective launch of several small satellites is becoming more popular, due to the lower costs involved.

Many of these small satellites, whether "nanosats," "cubesats" or slightly bigger satellites, are built by student engineers, and launched together with commercial payloads. Many are experimental, or designed to monitor a specific facet of the Earth's

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[33] Bittencourt, note 1, mentions New Mexico's and Virginia's State laws regarding space flights from their spaceports. State laws are applicable only within that State, and not country-wide. A federal law would be needed to regulate in a harmonious way space flights in all the USA. These are only two of several spaceports under consideration and/or construction in the USA. Other countries are also considering building spaceports.

[34] Art. IX – Art.XXII, Liability Convention, note 2.

[35] The ITU *allocates* parts of the radiofrequency spectrum (RFS) to the three major Regions: Region 1 includes Europe and Africa; Region 2, the Americas, and Region 3 the rest of the world. The RFS is to be used for certain services on a world-wide basis. The principal ones are the Fixed-Satellite Services (FSS), Broadcast-Satellite Services (BSS), Mobile-Satellite Services (MSS), and Earth Exploration- Satellite Services (EESS). The Regions, in turn, *allot* frequencies for these services, and each nation *assigns* the frequencies to particular users. [Emphasis added to the ITU's "terms of art"].

environment or its atmosphere. Due to their small size, most of them have a short "useful life" in space, as they have limited fuel on board for station-keeping.[36] At the end of their useful life, they usually go into random orbits, where they present risks to other space objects and systems, or they may eventually fall back into the Earth's atmosphere.

A few years ago, the International Telecommunication Union (ITU) seemed to "welcome" the small experimental satellites,[37] but at the 2012 World Radiocommunication Conference (WRC-12), it seems to have modified its views. Thus, the ITU's Radiocommunication Bureau (ITU-BR) Resolution 757, adopted at the WRC-12, calls for the ITU to reexamine its procedures regarding these satellites, in view of the fact that more than 500 of them are under construction, and current ITU regulations (and radiofrequency bands) are not suitable to the nanosats, or cubesats.[38] Further, they impinge on the radio frequency bands used by the amateur radio service.[39] Neither the ITU information sheet nor the proponents of Resolution 757 mentions that these "swarms" of small satellites will become space debris in a matter of months or very few years, presenting a real risk to other satellites in orbit, since they will be drifting in space for much longer than their "useful life in orbit."

While the ITU, the UN, NASA, ESA, the US Federal Communications Commission (FCC), and other agencies have drafted guidelines for the mitigation of space debris created by large satellites, including measures to de-orbit them from their position in the GSO, these guidelines would seem to be unknown, and perhaps not applicable to the proponents of the small satellites. Thus, these objects end up in random orbits, increasing the amount of space debris, and the risk of collision with operational spacecraft and even with the International Space Station (ISS).[40]

Are Latin American universities increasing the risk of space debris with the launch of small satellites? Should the students (and other entities) involved in the construction and launch of small satellites become familiar with the guidelines on mitigating space debris, even if such guidelines are not legally binding, but good practice? Should they also be informed about the space treaties that govern these activities?[41]

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[36] The satellite's useful life in orbit depends on the fuel on board for station-keeping purposes: it can vary from a few weeks to several decades, depending on the size of the satellite. But its "useless life in orbit"—after station-keeping is no longer possible, can last several centuries. This author proposes that its uselessness in orbit needs to be considered, and planned for, to mitigate the increasing space debris.

[37] See June 29,2010 "ITU-R Sector Partnership with Academia, including research and communications development centers", wherein the ITU-R states that it has been actively encouraging a closer involvement of academia, research centers and communications development centers in the ITU-R's activities. The ITU Radio Bureau (BR) Director visited the UADE, Buenos Aires, Argentina in 2008. www.itu.int/ITU-R/information (visited 28 Oct. 2012).

[38] Oberst, Gerry: "Nano and Pico-satellites", Oberst provides a brief but comprehensive description of small satellites, and the challenge facing the ITU. VIA SATELLITE, October 2012: www.satellitetoday.com. (visited 28 Oct. 2012).

[39] ARRL, the national association for amateur radio, in its Sept. 18 2012 newsletter states its concern that the small [university-built] satellites are using the spectrum allocated to the amateur radio service, and the International Amateur Radio Union (IARU) will closely monitor this situation. The amateur radio users are usually the first responders in the event of natural disasters and catastrophes such as earthquakes or tidal floods. (See Tampere Convention on the Provision of Telecommunications for Disaster Mitigation and Relief Operations, entered into force January 2005).

[40] "Record space junk cloud could threaten ISS." SPACEDAILY Express, 26 Oct. 2012. http://www.spacemart.com/report/Record _space_ junk_ cloud_ could_ threaten_ ISS_report_999.html.

[41] This author advocates close cooperation and communication between lawyers and engineers, since they are involved in regulating these activities, albeit from different perspectives.

In brief, the launch of objects into space, whether for suborbital or orbital flights, or small satellites designed to carry out experiments or to provide services, is creating congestion and potential space debris in parts of outer space that until a few years ago were relatively uncluttered orbits. To mitigate these growing problems, perhaps legally binding resolutions (laws) need to be adopted at the international level. A Space Traffic Management[42] regime seems to be called for, beginning with an agreed-upon delimitation of air space from outer space.

Conclusions and Recommendations

In reviewing information on the space agencies / commissions in South America, in particular the four newest ones (the Agencia Boliviana del Espacio (ABE-2010); the Comisión Colombiana del Espacio (CCE - 2006), Ecuador's Agencia Espacial Civil Ecuatoriana (EXA-2007) and Venezuela's Agencia Bolivariana para Actividades Espaciales (ABAE-2008)), several themes recur:[43]

- Despite having space agencies or commissions, these countries lack comprehensive national legislation related to space undertakings. As noted earlier, in most countries, the ITU regulations are the closest they come to having legislation regarding space activities, but the ITU-RR apply only to systems that use the RFS. Thus, national legislation tends to focus on telecommunications matters, while issues related to launch, registration, liability and compliance with the outer space treaties are not addressed.
- National laws, such as the Bolivian Ley 164[44] and Venezuela's 2010 Organic Law[45] address issues related to telecoms development, since their satellites are or will be fundamental to achieving the national goals of connecting the populace and providing services in remote parts of the countries.
- The only national legislation that offers a wider framework and includes space activities beyond satellite telecoms is the Colombian decree establishing the CCE.[46] Several entities affiliated with the CCE make use of satellite imagery and data for the national GIS system, for natural resource monitoring and management. These activities come under the various Agreements (enabling legislation) issued in 2007. (Colombia has not ratified any of the space treaties.)
- Ecuador's EXA offers no information on the law leading to its creation, or to its affiliation with the Ecuadorian Air Force, other than to state that it has friendly relations with that entity.
- The desire to be technologically independent (Venezuela), to have their own satellites, both for communications and for remote-sensing / earth observation, or small experimental spacecraft (Colombia, Ecuador). However, none of the countries has an industrial infrastructure or sector capable of building or launching spacecraft,

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[42] The International Academy of Astronautics (IAA) drafted an "Outline of a Comprehensive Space Traffic Management Régime" that could serve as the basis for the coherent international regulation of space activities. See "Cosmic Study on Space Traffic Management", C. Contant-Jorgensen, P.Lala, K-U. Schrogl, editors. IAA 2006, pp.91-92.

[43] S. Ospina, "New National Space Agencies in South America: New Opportunities for Collaboration?" Paper presented at the International Congress (IAC), Naples, Italy, October 2012.

[44] See Bolivia's General Law on Telecommunications, Information Technologies and Communication, Law No. 164. Leyes del Sector de Telecomunicaciones. www.oopp.gob.bo/vmtel.

[45] See Venezuela's "Organic Law on Science, Technology and Innovation" (LOCTI is the Spanish acronym), enacted in December 2010, and repealing "Organic Law" of 2005. The 2010 Organic Law is part of the National Plan of Economic and Social Development, and seems to be all-inclusive. Ley Orgánica de Ciencia, Tecnología e Innovación." For the complete text in Spanish, see www.abae.gob.ve/files/mcti.

[46] Decreto Presidencial 2442 del 18 de julio de 2006 (Presidential Decree 2442, 18 July 2006.)

as compared to some Asian countries (Korea, Japan or China). (Brazil seems to be the only country that comes close to having the necessary facilities,[47] while Peru aims at further developing its "Paulet" rockets.)[48]

- The space agencies / commissions would do well to work together with the civil aviation authorities in their countries and neighboring countries, particularly in regard to the right of innocent passage through their airspace, and in reaching consensus as to its delimitation.[49]

From an international legal perspective, some work needs to be done before the South American countries are able to join the international space community as "equals." They need to ratify the space treaties, at least the Liability and Registration Conventions, in view of their plans to launch and operate satellites, or their already having them in orbit. Some provisions of the space treaties, if and when transposed to national legislation, could serve as the basis for a comprehensive national legislation on space activities. The regulations would need to go beyond the scope of the ITU-RR; they would act as a supplement and complement to the telecoms regulation, and include other facets of space activities.

Agreement on the delimitation of space(s), adherence to and some conformity with the outer space treaties are essential to the further development of space activities not only in the Americas, but worldwide. This author hopes that this Workshop will lead to the adoption of some, if not all, the space treaties by the South American countries that have not ratified them yet, as well as to consensus on the delimitation of air and space.

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[47] Brazil has the Instituto Nacional de Pesquisas Espaciaes (INPE) as well a launch site in Alcantara, in addition to a well-developed aircraft-manufacturing industry.

[48] Pedro Paulet is credited with developing the first rocket-plane. For an intriguing account of Paulet and his far-sighted inventions, see http://enperublog.com/2010/05/17/pedro-paulet-and-the-peruvian-rocket-plane/. (Visited 31 Oct. 2012).

[49] Bittencourt, note 1, also advocates such consensus. Perhaps greater involvement with the International Civil Aviation Organization (ICAO) would be useful in resolving the air –space delimitation issue.