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# Regulation of Commercial Space Transport The Astrocizing of ICAO



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# Regulation of Commercial Space Transport

The Astrocizing of ICAO

 Springer

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# Preface

*“If at first the idea is not absurd, there is no hope for it.”...*

Albert Einstein

On 4 September 2014, Raymond Benjamin, Secretary General of the International Civil Aviation Organization (ICAO) wrote to Commander Chris Hadfield, former Commander of the International Space Station, inviting him to get involved in a joint United Nations/ICAO initiative designed to plan and promote the safe and efficient development of commercial space flight. The Secretary General in his letter advised Commander Hadfield that in this context, ICAO will host a groundbreaking *UN/ICAO* Commercial Aerospace Symposium from 18 to 20 March 2015 at its world Headquarters in Montreal, stating further that the Symposium will focus on the technological, political, economic and social aspects of commercial space development that are fundamental to safe and efficient commercial space flight.

Typically, and not surprisingly, there was no mention of the most fundamental consideration—legal aspects of commercial space transportation—which would be the cornerstone of any discussion pertaining to commercial space flight. One of ICAO’s key functions is in the legal sphere of aviation both in treaty making and in acting as advisor on matters of air law to its member States. Yet, it has shown a feckless insouciance in delivering in this area, and its ineptitude has led to recent legal instruments adopted under ICAO’s auspices and guidance—such as the 2010 Beijing Convention and the 2014 Protocol to the Tokyo Convention of 1963—being fundamentally flawed. It also begs the question as to how ICAO could address *inter alia* political and social issues related to commercial space transport without inquiring into the legal possibilities of the Organization’s involvement.

ICAO addresses issues of international civil aviation under the Convention on International Civil Aviation (Chicago Convention)<sup>1</sup> and the Council of ICAO adopts Annexes to the Convention exclusively on subjects that pertain to

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<sup>1</sup> Convention on International Civil Aviation signed at Chicago on 7 December 1944. See ICAO Doc 7300/9: 2006.

international civil aviation. Also, ICAO does not have the structure to sustain an entirely different regime of transport. It barely survives under a meagre budget and is compelled to cut down on existing aviation work programmes. If it is the intent to bring in the regulation of commercial space transportation under ICAO (perhaps by renaming it the International Aerospace Organization) through a separate multilateral treaty; have separate funding and provide the relevant expertise, it might work, as the ICAO model has worked for aviation, and there is no reason that it would not work for commercial space transport regulation. As already mentioned, this approach seminally requires an inquiry into the legal issues involved.

The proposal by ICAO to convene the seminar may have been influenced by a book *The Need for an Integrated Regulatory Regime for Aviation and Space—ICAO for Space?* (Springer: 2011) co-edited by two professors of McGill University and a space scientist from The Netherlands. The book recognizes ICAO as a legislative body, which it is not. It also states that commercial space transportation can be brought into the Chicago Convention by amending the instrument. This is similar to saying that rail transport can be brought into the United Nations Convention on the Law of the Sea (UNCLOS) by just amending the Convention. The 19 Annexes to the Chicago Convention are entirely on civil aviation and there is no practical way in which they can be amended, or added on to or revised, or new Annexes adopted under the Chicago Convention (which is entirely and exclusively on civil aviation) to cover such areas as licencing of spaceports, human space flight, space traffic management, safety of personnel and astronauts and security.

The book then goes on to suggest *inter alia* that an international Space Traffic Management (STM) Organization must be established primarily for the civil and commercial use of outer space. This suggestion, while obfuscating the core claim that commercial space transportation should be regulated under ICAO, is diametrically opposed to a subsequent statement in the book which claims that in order to implement the above-suggested ICAO for space regulatory steps and mechanisms, it may be appropriate to follow an orderly and systematic approach. It bounces back and forth between the STM and ICAO concepts only to conclude that the ideal solution to accommodate space traffic management and other outer space safety requirements would be to amend the Chicago Convention thereby expressly extending ICAO's jurisdiction over space transportation.

If one were to make some sense of this dichotomy, the flirtation with two international organizations would have to be clarified. The most startling recommendation, however, is that ICAO could promulgate a new Annex on "Space Standards". The Study claims that there is precedent for this as well and cites Article 37 of the Chicago Convention which vests in ICAO the authority to promulgate Standards and Recommended Practices as Annexes to the Convention. Of course, Article 37 gives authority, through the ICAO Council to: "secure the highest practicable degree of uniformity in regulations, standards, procedures and organization in relation to aircraft, personnel, airways and auxiliary services in all matters in which such uniformity will facilitate and improve air navigation". There is no mention of spacecraft, space objects, navigation in space or aerospace vehicles in this provision. In the face of this explicit provision, one wonders how ICAO could,

without amending Article 37, and revising Article 44 which reflects the aims and objectives of ICAO, which exclusively pertain to aviation, adopt an Annex 20 (in addition to the 19 Annexes on air transport) on space standards.

This book inquires into the legal issues that may be relevant in “astrocizing” (a word coined by the author) ICAO into the commercial space transport regime. Hopefully, it conveys the fundamental message that, what needs to be done by ICAO at the outset is for it to determine its legal legitimacy and status and the circumstances under which it could aspire to take on the regulation of commercial space transport and accept the fact that former air traffic controllers, pilots and other technical staff should not be relied upon to determine ICAO’s legitimacy on this issue. It also addresses in some detail the changes that may be necessary to the existing structure of the regulation of civil aviation, both in terms of adapting the Chicago Convention principles and those of the Annexes to the Convention, when drafting a new multilateral treaty on the regulation of commercial space transportation. As part of this book, the author has drawn on and adapted some of his earlier writings as relevant to the subject of commercial space transport.

Unlike what others have provided, this book offers no magic formula. It only contains some thoughts for future consideration.

Montreal, October 2014

Ruwantissa Abeyratne



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# Chapter 1

## Issues Involved

### 1.1 Air Space and Outer Space

In 1944, when the war was coming to an end, President Roosevelt invited the nations of the world to a conference in Chicago with a view to establishing a global regime for the burgeoning commercial aviation sector that would flourish after the war. The President said in his invitation: “I do not believe that the world today can afford to wait several years for its air communications. There is no reason why it should. Increasingly, the airplanes will be in existence...”. At the present time, this message could be applied to commercial space transport with just a change of words to adapt to the increasingly developing space tourism sector.

It would not be true to say that ICAO has hitherto not addressed the issue of space transport. The ICAO Assembly, at its 16th Session held in Buenos Aires from 3 to 26 September 1968, adopted Resolution A 16-11 (Participation by ICAO in Programmes for the Exploration and Use of Outer Space). Recognizing that the events of the past years were of great interest to ICAO, since many of the activities affect matters falling within ICAO’s competence under the provisions of the Chicago Convention, and that the United Nations had recognized the competence of certain specialized agencies that could perform various useful functions and such interest had to be welcomed and encouraged, the Assembly resolved that ICAO be responsible for stating the position of international civil aviation on all related outer space matters and for stating international civil aviation’s particular requirements in respect of application of space technology.

Commercial space flight is here, and it is a foregone conclusion that it will take off in earnest within the next few years. The issue is whether we are prepared with the necessary legislative and infrastructural base to launch these flights in sustained progression. Unlike the Chicago Convention of 1944 which was adopted at the Chicago Conference pursuant to the initiative of President Roosevelt, there is no multilateral legal instrument that provides comprehensively for commercial space transportation. When commercial air transport was in its incipient stages the world

community took just over a month to develop, draft, and adopt the Chicago Convention that comprehensively provided for technical and commercial regulation. This treaty still serves air transport well.

We continue to use and explore outer space, take pictures, calculate trajectories of planets and determine who owns the moon and what the purpose of outer space exploration is. An added dimension is the use of aerospace in terrestrial transportation where an aerospace plane will take off as an aircraft, go into orbit, enter the atmosphere using the Earth's orbit into its destination, cutting the travel time significantly. It is said that by using this method, air travel time can be reduced drastically. For instance, a journey by air between Los Angeles and Sydney, which would now take 14–16 h by conventional air travel, could take 2 h or less.

It is well known that the newest and most expensive mode of transportation is commercial space travel which offers high-end suborbital flights to space tourists. Some consider it an extension of air travel, mostly on the basis that a spacecraft that operates suborbital flights would have to traverse airspace to go beyond it. This has encouraged some academics to suggest that this area of travel can easily be accommodated within the existing air transport regime, by incorporating the various safety principles that would be adopted for commercial space travel within existing treaty provisions with some adaptation and modification. Although there may be some commonality in both air travel and outer space travel, on the basis that a vehicle operating suborbital flights would go through airspace, it would be both unwise and impracticable to move a space travel regime lock stock and barrel into the existing air transport regime.

Given that a spacecraft traverses airspace before it goes into outer space, one would have to have a clear, internationally accepted definition of outer space. No multilateral treaty currently applicable to space transportation or the exploration and exploitation of outer space resources has this definition. This is both disconcerting and unsettling in an age where complex and advanced space exploration has been taking place well over 5 decades, with a man stepping on the moon in 1969. In this context, neither is airspace defined, although commercial air travel has been regulated for the past 67 years.

Given that a spacecraft traverses airspace before it goes into outer space, one would have to have a clear, internationally accepted definition of outer space. No multilateral treaty currently applicable to space transportation or the exploration and exploitation of outer space resources has this definition.<sup>1</sup> A State, according to the 1933 definition in the Montevideo Convention, has to be composed *inter alia* of a “defined geographic area”, which is controlled by its populace. Therefore, it goes

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<sup>1</sup> Another growing area of outer space activity is mining asteroids. See Ruwantissa Abeyratne, Mining Asteroids: Security Aspects, *Journal of Transportation Security*, published on line on 14 March 2013.

without saying that a State has sovereignty over its defined land area. Judge Huber noted in *the Island of Palmas Case*<sup>2</sup> that:

Sovereignty in the relations between States signifies independence. Independence in relation to a portion of the globe is the right to exercise therein, to the exclusion of any other State, the function of a State. The development of the national organization of States during the last few centuries and, as a corollary, the development of international law, have established this principle of exclusive competence of the State in regard to its own territory in such a way as to make it the point of departure in settling most questions that concern international relations. Sovereignty in relation to a portion of the surface of the globe is the legal condition necessary for the inclusion of such portion in the territory of any particular State.<sup>3</sup>

As for territorial waters adjacent thereto (which is considered as included in the territory of a State) this has also been recognized by multilateral treaty in Article 3 of the Convention on the United Nations Law of the Sea (UNCLOS) which stipulates that “Every State has the right to establish the breadth of its territorial sea up to a limit not exceeding 12 nautical miles, measured from baselines determined in accordance with UNCLOS”. Therefore, Article 2 of the Chicago Convention and its definition of “territory” is consistent with the aforementioned established principles of international law.

As per principles of public international law, air space does not constitute the territory of a State and should not be confused with the word “territory”. The reason is that the dimensions of airspace have not been defined either by treaty or by customary recognition (Australia has a domestic law which recognizes that airspace goes up to 100 km over its land and adjacent sea territory. Other instances of definition of airspace are hitherto unknown). Therefore States cannot *ipso facto* claim sovereignty over the airspace above their territory unless such is recognized by treaty and this is what the Chicago Convention does in Article 1.

The Permanent Court of International Justice, when requested for a definition of “air space” in the 1933 *Eastern Greenland’s Case*,<sup>4</sup> was of the view that the natural meaning of the term was its geographical meaning. The most fundamental assumption that one could reach from this conclusion is that air space is essentially geo-physical, meaning that it is space where air is found. Simplistically put, “air space” has been considered as going upwards into space from the territorial boundaries of a State and downwards to the centre of the Earth, in the shape of an inverted cone.

Recognition by States of their sovereignty over their airspace (as stated in Article 1 of the Chicago Convention) inevitably presupposes that this rule has already been entrenched in the annals of air law in an earlier instrument. The Convention Relating to the Regulation of Aerial Navigation signed by 26 States on 13 October

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<sup>2</sup> 2 RIAA (1928) 829.

<sup>3</sup> *Id.*, 832.

<sup>4</sup> PCIJ Series A/B, No. 53, at p. 53ff.

1919 established that *the High Contracting Parties recognize that every Power has complete and exclusive sovereignty over the airspace above its territory.*

As for outer space, at the time of writing, the aerospace community was considering such issues as sub-orbital flights and space tourism, both of which could further blur the boundaries between air space and outer space, while raising other issues of topical interest. As already mentioned, so far, there has not been a universally accepted definition distinguishing air space and outer space. Some years ago, when the legalities of an aerospace plane, which is a hypersonic single stage to orbit reusable vehicle that horizontally takes off and lands on a conventional runway were considered, it was thought that the transit through near space which is involved is incidental to the main transit which takes place within the airspace. Generally, the aerospace plane, which will be constructed with the use of aeronautical and space technologies and would be capable, and, indeed, required to fly both in airspace and outer space, would bring to bear the need to consider the applicability of and appropriateness of laws relating to the space plane's activities. It will be subject to the sovereignty of the State whose airspace it is in. This is an incontrovertible fact which need not be stated since any object within the airspace of a territorial State would indeed be subject to that State's sovereignty.

The United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS), which is the UN forum where technical and legal aspects of space activities with global impact are considered, has discussed the issue of the definition and delimitation of outer space from 1962 and no definite conclusion has been reached so far in this regard. In this connection, it is of interest to note that the Legal Subcommittee of UNCOPUOS, through its Working Group on Matters Relating to the Definition and Delimitation of Outer Space, has been considering possible legal issues with regard to aerospace objects. A questionnaire thereon was circulated to all U.N. Member States. A compilation of the replies received and an analytical summary of such replies, as well as a historical summary on the consideration of the question on the definition and delimitation of outer space, may be found on the OOSA website.<sup>5</sup>

As debated for decades in the framework of UNCOPUOS, it may be questioned whether the vertical limit of airspace would be critical to determine the scope of applicability of air law as opposed to international space law conventions (spatialist approach), or whether the type of activities at issue would determine which law should apply (functionalist approach) to sub orbital flights. The latter school of thought submits that flights which would be passing merely in transit through (sub) orbital space in the course of an earth-to-earth transportation would be in air space and therefore remain subject to principles of air law.

A sub-orbital flight is a flight up to a very high altitude which does not involve sending the vehicle into orbit. 'Sub-orbital trajectory', which a sub orbital flight would follow, is defined in the legislation of the United States as "The intentional

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<sup>5</sup> [www.oosa.unvienna.org/index.html](http://www.oosa.unvienna.org/index.html).

flight path of a launch vehicle, re-entry vehicle, or any portion thereof, whose vacuum instantaneous impact point does not leave the surface of the Earth.”

In 2004, SpaceShipOne was the first private vehicle to complete two sub-orbital flights within 2 weeks carrying weight equivalent to three human adults up to about 62.5 miles (100 km) to win the Ansari X Prize. It was carried during 1 h by an aeroplane up to nearly 50,000 feet (9.5 miles) from where it was released into a glide and then propelled vertically for 80 s by a rocket motor to an altitude of more than 62 miles at apogee, reaching a speed over Mach 3. Then falling back to return to earth, it re-entered the atmosphere and glided during 15–20 min before landing back on the runway of departure.

SpaceShipOne, strictly speaking, does not operate as an aeroplane or even as an aircraft during the ballistic portion of the flight while it is not supported by the reactions of the air, even though some degree of aerodynamic control exists throughout the trajectory from launch altitude until the craft enters the upper reaches of the atmosphere where the air density is no longer sufficient for aerodynamic flight. After apogee, during re-entry into the atmosphere the vehicle transitions to unpowered aerodynamic (gliding) flight for the return to earth. Consequently, depending upon some design and operational aspects, it could be considered operating as an aircraft in flight during this latter portion of the journey.

Therefore, such vehicles could fulfil the principal elements in the definition of aircraft and be used as such during a portion of their flights, but they offer some characteristics of a rocket as well. It is likely that other vehicles engaged in the future in such sub-orbital flights would similarly be of an hybrid nature, taking into account that developments to come may lead to a range of designs, some of which could be more clearly classified as aircraft. Should sub-orbital vehicles be considered (primarily) as aircraft, when engaged in international air navigation, consequences would follow under the Chicago Convention, mainly in terms of registration, airworthiness certification, pilot licensing and operational requirements (unless they are otherwise classified as State aircraft under Article 3 of the Convention).

Plans have been announced by Virgin Galactic for the development of a fleet of five sub-orbital vehicles to carry paying passengers, six per vehicle; it planned that the first of these will be ready for commercial operations in 2008 at the earliest. There are indications that at least one other company is planning to offer rival sub-orbital flights.

Manned and unmanned sub-orbital flights have been undertaken to test spacecraft and launch vehicles intended for later orbital flight, but some vehicles have been designed exclusively to reach space sub-orbitally: manned vehicles such as the X-15 and SpaceShipOne, and unmanned ones such as ICBMs and sounding rockets. Sub-orbital tourist flights will initially focus on attaining the altitude required to qualify as reaching space. The flight path will probably be either vertical or very steep, with the spacecraft landing back at its take-off site.

The spacecraft will probably shut off its engines well before reaching maximum altitude, and then coast up to its highest point. During a few minutes, from the point when the engines are shut off to the point where the craft begins to slow its descent for landing, the passengers will experience.

## 1.2 Suborbital Flights

A suborbital flight is known to be the next generation of commercial passenger travel. At the present time flight testing of commercial reusable launch vehicles (RLVs) is underway, making the availability of frequent suborbital flight closer than ever. As earlier mentioned sub orbital flights are considered missions that fly out of the atmosphere but do not reach speeds needed to sustain continuous orbiting of the earth. They allow passengers to look down at the brilliant curvature of the earth as they would from orbit.

One must not confuse a sub orbital flight with a space flight which is a flight *into* or *through* space. The craft which undertakes a spaceflight is called a spacecraft. It is often thought that orbital spaceflights are spaceflights and sub-orbital spaceflights are less than actual spaceflights. This is not entirely accurate as both orbital and sub-orbital spaceflights are true spaceflights.

The term *orbit* can be used in two ways: it can mean a trajectory in general, or it can mean a closed trajectory. The terms *sub-orbital* and *orbital spaceflights* refer to the latter: an orbital spaceflight is one which completes an orbit fully around the central body.

From the above discussion the conclusions that could be drawn are that for a flight from Earth to be a spaceflight, the spacecraft has to ascend from Earth and at the very least go past the edge of space. The edge of space is, for the purpose of space flight, often accepted to lie at a height of 100 km (62 miles) above mean sea level. Any flight that goes higher than that is by definition a spaceflight. Although space begins where the Earth's atmosphere ends, the atmosphere fades out gradually so the precise boundary is difficult to ascertain. Therefore one could argue that there is a need to accept the fact that vehicles which would effect earth-to-earth connections through sub-orbital space could incorporate the constitutive elements of aircraft and fly as such at least during descending phase while gliding. However, rocket-propelled vehicles could be considered as not falling under the classification of aircraft.

From a spatialist viewpoint, there is no clear indication in international law on the delimitation between airspace and outer space which would permit a conclusion on the applicability of either air law or space law to sub-orbital flights. On the other hand, it might be argued from a functionalist viewpoint that air law would prevail since airspace would be the main centre of activities of sub-orbital vehicles in the course of an earth-to-earth transportation, any crossing of outer space being brief and only incidental to the flight. UNCOPUOS, and more particularly its Legal Subcommittee, is considering the question of possible legal issues with regard to aerospace objects but no final conclusion has been reached yet.



### 1.3 Some Divergent Views

While there is a relatively well articulated legal regime governing activities of States and private entities,<sup>6</sup> including a regulatory arm in the form of UNCOPUOS which is a United Nations Committee answerable to the General Assembly with no law making or adjudicatory powers,<sup>7</sup> it has been said that the involvement of ICAO in space tourism should also be seriously considered.<sup>8</sup> *Jakhu* and *Battacharya* have anchored their argument in support of ICAO involvement in regulating outer space traffic on the fact that space traffic will have to be harmoniously blended with air traffic as space and air traffic management issues will be a major factor in the allocation of “air slots” to both aircraft and spacecraft. This is somewhat far-fetched, given the very high number of frequencies that may involve air travel in the future as against commercial space travel. They envision ICAO’s role to be critical in the near future as a regulator and arbiter resolving space traffic issues.<sup>9</sup> *Jasentuliyana*’s thinking on the regulation of outer space activities, published in 1995, introduces another dimension where he suggests that UNCOPUOS could draw on the work of ICAO:

...COPUOS could, by following the example of some of the specialized agencies of the United Nations, like the World Health Organization (WHO), the International Maritime Organization (IMO) and particularly the International Civil Aviation Organization (ICAO) seek to formulate international standards and recommended practices.<sup>10</sup>

*Wassenbergh* attempted in 1997 to answer the question as to whether there would be a need for a new global space organization to monitor the public law aspects of space activities or whether ICAO could act as such.<sup>11</sup> Although he did not answer the question directly, he offered the conclusion that regulation by a space organization would ensure the safety of the activities, orderly international competition and optimum protection of the Earth and space environment.<sup>12</sup>

Given its nature of work and its mandate, it would be unwise to devolve upon UNCOPUOS the responsibility of regulating space tourism. As to whether a separate Organization is created, or indeed whether regulation of space tourism is brought within ICAO will be decided as a matter of practicality. The only obstacle in the latter case is that ICAO does not have a mandate to involve itself in anything other than civil

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<sup>6</sup> See Manfred Lachs, *The Development and General Trends of International Law in Our Time*, 169 Recueil Des Cours (1980) Foreword at p. xii.

<sup>7</sup> See Ralph G. Steinhardt, *Outer Space, United Nations Legal Order*, Volume 2 (Oscar Schachter and Christopher C. Joyner ed) American Society of International Law: 1995, 753 at p. 757.

<sup>8</sup> *Jakhu* and *Battacharya* 2002, pp. 112 et seq.

<sup>9</sup> *Ibid.*

<sup>10</sup> N. Jasentuliyana, *A Survey of Space Law as Developed by the United Nations*, published in *Perspectives on International Law*, (Nandasiri Jasentuliyana ed.) Kluwer Law International: The Hague: 1995, Chapter 16, 349 at p. 380.

<sup>11</sup> *Wassenbergh* 1997, pp. 529–535.

<sup>12</sup> *Id.* 535.