Policy Analysis: Air versus Space, Where do Suborbital Flights Fit Into International Regulation?

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Executive Summary: Suborbital flights are commercial activities that can be classified as both air and space activities. Currently there is no clear consensus regarding how to regulate these types of flights. This ambiguity opens the discussion on options to regulate suborbital flight. This paper aims to address the current regulatory situation and looks back to the history of suborbital flight for a better understanding of what these flights mean for the world now and what they will mean in the future. The paper also discusses the issue of the current problems with suborbital flight regulations. It details current problems with suborbital flight regulations including the inadequacy of its legal definitions, thus making it difficult to conclude exactly where space begins and ends, as well as the problem of 'antiquated' treaties. For example, the Chicago Convention came into force in 1944, and the main space treaty, the Outer Space Treaty came into force in 1967.

The analysis then details potential goals that could make fixing these problems more manageable and finds a suitable solution for suborbital flight regulation. These goals include topics covering safety, liability, registration, launching and aerospace traffic management. The paper concludes by making specific recommendations for suborbital flight regulations based on several existing air and space based models.

I. Introduction- The Current Situation

In 2000, International Civil Aviation Organization (ICAO) Council President Dr. Kotaite noted that, "laid out on the drawing boards of aircraft manufacturers and futurists are spacecraft that one day will carry passengers into the upper airspace and eventually into outer space. When that day comes, and it may not be that far away, real issues will need to be addressed by government regulators (p. 5)."[1] Not much more was said on the matter until 2005 when the 175th session of the ICAO Council created a working paper entitled 'Concept of Sub-Orbital Flights.' This paper "considers the concept of suborbital flights in relation to the Chicago Convention."[2] This paper was then presented at the Legal Subcommittee of Committee on the Peaceful Uses of Outer Space (COPUOS) in 2010 and it was put under consideration. No significant progress has been made since this time.

In 2012 the 'Report of the Legal Subcommittee on its fifty-first session', (A/AC.105/1003) Annex II, Paragraph 10

[1]Kotaite, Assad. 2000. "Formal Regulatory Framework Needed to Govern Expanding Operations in Outer Space." *ICAO Journal*. 55 (7): 5.

[2]International Civil Aviation Organization. 2005. "Concept of Sub-Orbital Flights."

invited members of the United Nations Office of Outer Space Affairs (UNOOSA) and COPUOS to reply to questions pertaining to the definition and delimitation of outer space and their relationship to suborbital flights for scientific missions and/or human transportation. At this time there is a working group on the definition and delimitation of outer space which houses the discussions on suborbital flights but not much progress has been made with the exception of some member states and observer-status members responding to the questions pertaining to suborbital flights.

Meanwhile, since the success of Scaled Composites' *SpaceShipOne* in 2004 the space industry has made progress towards the day in which spacecraft will carry passengers into the upper reaches of the atmosphere and outer space. There are now several companies working towards active commercial flights which have generated considerable public and political interest. According to Jakhu, Sgobba and Dempsey, "... there are at the moment more than 25 different concepts and vehicles under development, eight of which (including the hybrid Rocket plane XP based on a modified general aviation Learjet 25) are based on horizontal takeoff and landing capabilities."[3]

Currently suborbital flights are considered 'space tourism,' but in the future they intend to become point-to-point transportation for transnational flights. Jakhu, Sgobba and Dempsey add to this point by stating that, "the suborbital Earth-to-Earth transportation market likely presents a promising long-term commercial opportunity for aerospace vehicles. Over time, it is likely that commercial point-to-point space transportation will eclipse space tourism in commercial importance."[4]

[3]Jakhu, Sgobba, T., and Paul, Dempsey. (Eds.). 2011. The Need for an Integrated Regulatory Regime for Aviation and Space ICAO for Space? Vienna: Springer.
[4]Jakhu, Sgobba, T., and Paul, Dempsey. (Eds.). 2011. The Need for an Integrated Regulatory Regime for Aviation and Space ICAO for Space? Vienna: Springer.

At this time there are various key actors involved in this issue of suborbital flight regulation. Below is a listing of some of these actors. However this is not a complete list as there are more actors involved in this issue including other states, private actors, organizations, scholars, and experts. The key stakeholders that will need to be involved in any discussion and decisions regarding suborbital flight are as follows:

Key United Nations bodies:

- International Civil Aviation Organization (ICAO)
- United Nations Office of Outer Space Affairs (UNOOSA)
  - Committee on the Peaceful Uses of Outer Space (COPUOS)

Key states with interests in suborbital flights:

- United States
  - Federal Aviation Administration (FAA)
- UK
  - Civil Aviation Authority (CAA)

Private companies with interests in suborbital flights (some prominent examples are):

- Virgin Galactic- US
- XCOR- US
- Blue Origin- US
- Reaction Engines- UK

Relevant international or supranational regulatory bodies:

- International Air Transport Association (IATA)
- European Aviation Safety Agency (EASA)

II. Background

Suborbital flights are not new. NASA's first human space activity, the flight of Alan Shepard, was a suborbital flight. The United States Air Force had a parallel effort in the experimental X-plane series (X-1 and X-15 being the most notable members of this group) that were space planes. The X-15 was capable of going into 'space' and the US Air Force granted 8 pilots the status of astronaut as their flights flew higher than 50 miles. However,

NASA didn't recognize the Air Force's classification of these pilots as astronauts.[5]

In the United States the early debate regarding the definition and delimitation of outer space took on a hint of the 'rivalry' between the Air Force and NASA's control of the US space effort. US Air Force Chief of Staff, General Thomas White, argued that "there is no division, *per se*, between air and space. Air and space are an indivisible field of operations."[6] Of course, when General White said this he was trying to get NASA abolished and all US space efforts transferred to Air Force control.

The demise of the Air Force's space plane program combined with the reliance on 'traditional' ballistic rocket technology for access to space, lead to a shelving of much of the discussion relating to the definition and delimitation of outer space and the boundary between airspace and outer space. Since *SpaceShipOne* flew in 2004, the question of how to regulate suborbital flights has been reopened. Now that the prospect of suborbital flights, carried out using spaceplanes by companies such as Virgin Galactic, XCOR Aerospace, Stratolaunch Systems, Reaction Engines, et al. has arisen, it is time to reevaluate and act on the question of regulations governing these flights.

Under the current regime there are issues regarding the definitions of such basic terms as 'space objects' and 'aircraft' to name just two. There are also areas of conflict between the air and space legal and regulatory regimes, which could create an unnecessary and perhaps even prohibitory burden in the new commercial space arena. Additionally the international space law regime is exclusively targeted at States, inadequately addressing private efforts and entities.

[5]Hansen, James R. 2012. First Man: The Life of Neil Armstrong. London: Simon and Schuster. (Hansen 2012, 144-145)
[6]Logsdon, John M. 2010. John F. Kennedy and the Race to the Moon. New York: Palgrave Macmillan. (Logsdon 2010, 19)

III. Defining the Problem

Currently there is not any international regulation of suborbital flights. Most states do not have any regulations for these activities either. Since 2004, with the flight of *SpaceShipOne*, interest in suborbital flights has increased and the technology which supports them has advanced. As stated above, international law is not equipped to handle commercial space regulation as it currently stands. Therefore, it is essential that new regulations are created from scratch or from a collaboration of existing laws. The reason why this issue should be addressed now, instead of 'soon' or 'in the near future,' is because as more actors step onto the stage with suborbital flights there will be even more of a need for safety standards and aerospace traffic management to deal with additional flights, as well as misunderstandings over liabilities, registration and launching of said objects. This issue of suborbital flight regulation is also a matter of national security, economic development, and diplomacy. The interests at stake for the actors (international institutions, States, private actors) vary depending on the type of actor but overall it is a matter of safety, aerospace traffic management, national interests, economic factors, and concrete regulations on multiple aspects (detailed in the goals section of this analysis) acceptable to all parties involved.

The major considerations that should be addressed when formulating the final goals are:

- The need for international regulations
- Safety of air space and outer space
- Aerospace Traffic Management
- National Security/Interests/sovereignty
- Economic Development
- International diplomacy

However, there are three other important issues that need to be addressed before these considerations can be discussed at the international level. These issues are the inadequacy of definitions pertaining to suborbital flights, the antiquated treaties

pertaining to air and space, and the problem of overlapping regimes (i.e. air regime and space regime) with sizable gaps.

Issue 1 - Inadequacy of Definitions:

Currently within the air and space regimes there are many key terms that either have not been clearly defined or, for political reasons, have not been adopted or become legally accepted. These terms include, inter alia: space object, aircraft, airspace, and outer space.

Space Object: Anything object in space that is not a celestial body. This includes rockets, space debris, satellites, and potentially even asteroids, and so on. Under the treaties "the term 'space object' includes component parts of a space object as well as its launch vehicle and parts thereof."[7]

Aircraft: According to ICAO Annex 1, Annex 2, and Annex 6, an aircraft is "Any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the Earth's surface."[8]

Air Space: Air space has two categories: regulatory and non-regulatory. "Within these two categories there are four types: controlled, uncontrolled, special use, and other airspace."[9] "It is international practice to measure airspace in feet for altitude and nautical miles for distance."[10] With regards to sovereignty, Article 1 of the Chicago Convention states that, "the contracting States recognize that every State has complete and exclusive sovereignty over the airspace above its territory."[11] Article 1 does not actually detail out the technical boundary for the "airspace above its territory."

Outer Space: The definition and delimitation of outer space is an issue of large importance within COPUOS. Currently, there is no legal definition for where outer space begins and where air space ends. There is also no legal delimitation. Since 1967 in the Legal Subcommittee of COPUOS, the issue of the definition and delimitation of outer space has been considered an agenda item.[12] In the Legal Subcommittee of 1978, it was first discussed that the delimitation of outer space could be about 100-110 km above sea level, known as the von Karman line.[13] This delimitation would not, however, create a ceiling for airspace. Some delegations opposed this idea stating that "since space activities had been conducted for over 20 years without a definition or delimitation of outer space and neither the Scientific and Technical Subcommittee nor the Legal Subcommittee had identified any problem that would be solved by establishing an arbitrary altitude delimitation, there was no compelling need for a definition and delimitation of outer space."[14]

Spatial Approach: The spatial approach to the definition and

[7]United Nations. 1976. Convention on Registration of Objects Launched into Outer Space, *entered into force* Sept. 15, 1976, 28 U.S.T. 695, 1023 U.N.T.S. 15, Art. 1

[8]International Civil Aviation Organization. 2014. "Annex 1- Personnel Licensing International Standards and Recommended Practices, Chapter 1. Definitions and General Rules Concerning Licences. Annex 2- Rules of the Air International Standards Chapter 1. Definitions. Annex 6- Operation of Aircraft International Standards and Recommended Practices Chapter 1.1 Definitions."

[9]Federal Aviation Administration. 2014. "Chapter 14" Airspace. Accessed February 27. https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/pilot_handbook/media/PHAK%20-%20Chapter%2014.pdf

[10]Australian Government. Civil Aviation Safety Authority. 2014. "Airspace." Accessed March 6. http://www.casa.gov.au/scripts/nc.dll?WCMS:STANDARD::pc=PC_90449

[11]International Civil Aviation Organization. 1944. "Convention on International Civil Aviation." Accessed February 9. http://www.icao.int/publications/Documents/7300_orig.pdf

[12]United Nations. 2002. "Historical Summary on the Consideration of the Question on the Definition and Delimitation of Outer Space." A/AC.105/769. Accessed March 1. http://www.unoosa.org/pdf/reports/ac105/AC105_769E.pdf

[13] United Nations. 2002. "Historical Summary on the Consideration of the Question on the Definition and Delimitation of Outer Space." A/AC.105/769. Accessed March 1. http://www.unoosa.org/pdf/reports/ac105/AC105_769E.pdf

[14] United Nations. 2002. "Historical Summary on the Consideration of the Question on the Definition and Delimitation of Outer Space." A/AC.105/769. Accessed March 1. http://www.unoosa.org/pdf/reports/ac105/AC105_769E.pdf

delimitation of outer space is to set a specific boundary (100km being the popular choice for the location of this boundary) between the regions of airspace and outer space. Below this line vehicles would be subject to air law and anything from 100km and above it they would be subject to outer space law. The major issue with this approach is that 'space objects' would therefore be subject to two potentially different legal and regulatory regimes. It also faces hostility from states due to their reluctance to place a ceiling on their sovereignty. The spatial approach has been adopted by Australia.

Functional Approach: The functional approach would require considering the intent and the purpose of the object in question. If it is intended to reach and operate in outer space then it is to be classified as a 'space object' and be subjected to the laws and regulations stemming from the space treaties. However, if it is to act and behave as an aircraft, for example by transiting from London to Sydney, even if it were to do so on a parabolic trajectory that involved altitudes in excess of 100km, it would be treated as an aircraft and therefore be subject to the relevant laws and regulations. SpaceX's Dragon and Reaction Engines' Skylon would both be classified as 'space objects' using the functional approach as their function is that of 'space objects', i.e. ferrying cargo and/or people into space.

Skylon is a perfect example of the benefits of the functional approach, as Reaction Engines are also planning a hypersonic atmospheric version intended to be employed as a high speed jet liner. In this configuration, even if the vehicle used a suborbital trajectory which pushed it above the 'boundary' between airspace and outer space the vehicle would still be classified as an aircraft if it meets the ICAO definition. An advantage of the functional approach is that it would not require states to adopt an upper limit to their sovereignty as they can continue to claim jurisdiction over 'aircraft' regardless of altitude. There is though the issue that using the functional approach can create the absurdity of an 'aircraft' that 'flies' higher than the orbit of the International Space Station.

The functional approach is the basis for the French system of regulation; even a 'space object' that fails to reach space remains classified as a 'space object.'

There is also the issue, when specifically discussing suborbital flights, of whether the people on these flights would be considered astronauts, space tourists, space flight participants or passengers. Even with these key terms there are complications when defining or classifying who is considered what. Currently for these key terms there are no established legal definitions.

Astronaut: According to the Outer Space Treaty Article V, "States Parties to the Treaty shall regard astronauts as envoys of mankind in outer space …."[15] "The term [astronaut] has not been defined in any of the multilateral treaties on outer space sponsored by the United Nations. It is descriptive rather than technical and refers to any person who ventures into outer space or who travels on board a spacecraft."[16]

Space Tourist: Black's Law Dictionary states that a tourist is "one who makes a tour; one who travels from place to place for pleasure or culture."[17] Therefore a 'space

[15]United Nations. 2014. "United Nations Treaties and Principles on Outer Space, related General Assembly Resolutions and Other Documents." Accessed March 11. http://www.unoosa.org/pdf/publications/ST_SPACE_061Rev01E.pdf.

[16]Cheng, Bin. 1997. Studies in International Space Law. Oxford: Oxford University Press. (Cheng 1997, 457)

[17]Black's Law Dictionary. 1968. 4th ed. Rev. 1 vol. St. Paul, Minnesota: West.

tourist' would be someone who travels in space for pleasure. "People traveling in, to, or from a spacecraft, or space vehicle, or destination in space who have no operational responsibilities or employment relationship with the owner of the vehicle or the space object. Related Terms: Space Adventurism, Suborbital, Passenger."[18]

Space Flight Participant: NASA defines spaceflight participants as "crew members who are not career astronauts, but travel on government sponsored space missions. The concept of the space flight participant encompasses a broad spectrum of space explorer."[19]

Passenger: The Longman Dictionary of Law defines passenger as "one who is carried in a conveyance for compensation."[20] The Oxford Dictionary states that a passenger is "a traveler on a public or private conveyance other than the driver, pilot or crew."[21]

Issue 2 - "Antiquated" Treaty Regimes:

The Chicago convention was written before the space age and the Outer Space Treaty is on the cusp of attaining half a century of age. As a result they do not adequately address the issues affecting the modern world, specifically in regards to suborbital flights especially those of the commercial variety. The space law regime as established by the treaties is almost exclusively targeted towards state actors and single use launch vehicles on ballistic trajectories.[22] As a result there are gaps, grey areas, overlaps, and conflicts in the space law and air law regimes that cause at best confusion and at worst barriers to successful commercial suborbital flight operations.

Issue 3 - Overlapping Regimes With Sizable Gaps:

The Registration Convention requires that State parties register any space object launched into "Earth orbit or beyond."[23] While both the Registration Convention and the Outer Space Treaty use the term launch and its variants on several occasions there is no explicit definition of the term in the treaties. Frans G. Von Der Dunk has said that "the underlying assumption was that a launch constituted a vertical departure from the Earth into outer space using rocket engines."[24]

Most of the proposed suborbital vehicles currently take off in a horizontal aircraft like manner, though several like Virgin Galactic's *SpaceShipTwo* do involve separating from a 'parent vehicle' before igniting the rocket stage designed to enter 'space.' This raises several issues; taking *White Knight* as a specific example, does this constitute a launch as defined in the Outer Space Treaty and Registration Convention? If not then does that mean that suborbital flights utilizing horizontal take offs are not subject to the Registration Convention? So far the pattern, at least from a space law perspective, has been to treat such flights as launches.[25] If this is to be the case, as the albeit limited history of such flights suggests, then suborbital flights could be subject to dual classification as both aircraft and space objects. In the case of *SpaceShipTwo*, the parent vehicles could fall into the category

[18]Hertzfeld, Henry R. (ed.). 2012. "A Guide to Space Law Terms." Space Policy Institute, George Washington University, & Secure World Foundation.

[19]National Aeronautics and Space Administration. 2014. "Space Flight Participants in Government Space Programs." Accessed February 12. http://www.dsls.usra.edu/education/grandrounds/archive/2008/20080826/davis.pdf

[20]Longman Dictionary of Law. 2011. 8th ed. 1 vol. Harlow, Essex: Longman.

[21]Concise Oxford English Dictionary. 2011. 12th ed. 1 vol. Oxford: Oxford University Press.

[22]Von der Dunk, Frans G. 2013. "Beyond What? Beyond Earth Orbit...! The Applicability of the Registration Convention to Private Commercial Manned Sub-orbital Spaceflight." California Western International Law Journal 43: 269-341. (Von der Dunk 2013, 273)

[23]United Nations. 1976. Convention on Registration of Objects Launched into Outer Space, *entered into force* Sept. 15, 1976, 28 U.S.T. 695, 1023 U.N.T.S. 15

[24]Von der Dunk, Frans G. 2013. "Beyond What? Beyond Earth Orbit...! The Applicability of the Registration Convention to Private Commercial Manned Sub-orbital Spaceflight." California Western International Law Journal 43: 269-341. (Von der Dunk 2013, 273)

[25]Von der Dunk, Frans G. 2013. "Beyond What? Beyond Earth Orbit...! The Applicability of the Registration Convention to Private Commercial Manned Sub-orbital Spaceflight." California Western International Law Journal 43: 269-341. (Von der Dunk 2013, 273)

of an aircraft while the rocket could be classified as a 'space object' which could complicate matters. Skylon is a further example, as it will take off like an aircraft but it is a rocket powered craft intended to reach space. It meets the ICAO'S definition of aircraft and potentially meets the definition of 'space object,' though that depends on a) the actual definition of 'space object' and b) whether horizontal take off qualifies as a 'launch.'

There is another potential issue with dual registration that has the potential to affect multinational efforts, and indeed already affects Virgin Galactic. The UK's Outer Space Act[26] requires all British citizens (including British Overseas Territories Citizens, British Overseas Citizens, British Subjects, British Nationals overseas and British Protected Persons),[27] firms, and incorporated bodies to register with and be licensed by the British government if they are going to carry out any activity in outer space regardless of whether or not this activity will actually be carried out in the United Kingdom.[28] Sir Richard Branson is required to register with the British government regarding the activities of Virgin Galactic and he is also required to meet the requirements of the State the company actually operates in, which currently is United States. In the future other States may implement similar regimes as the United Kingdom in order to comply with their understanding of their obligations set by the space treaties.

Dual Registration would be a sizable problem with both ICAO and UNOOSA. As it stands now, all space objects must be registered with UNOOSA based on the Registration Convention, which requires that "when a space object is launched into Earth orbit or beyond, the launching State shall register the space object…"[29] From the aviation side, currently in the United States, for example, commercial space transportation would need to be licensed and have a permit filed[30] with the Federal Aviation Administration (FAA) according to the Commercial Space Launch Act of 1984.[31] This means that if the issue of regulating suborbital flights stays as it is today, the flight would need to be licensed and have a permit with the FAA and be registered with UNOOSA, thus making it both an air and space mission. Although this only applies to flights in the United States, the FAA regulation on commercial space transportation is considered to be a model example for other State's national regulations on commercial space endeavors.

Freedom of Access. The Outer Space Treaty promotes free access and exploration of outer space by all nations, regardless of their level of economic development.[32] The Chicago Convention, by contrast, protects State parties full sovereignty over their airspace, with the powers of exclusion. There is a potential conflict in these two goals. Smaller nations will mostly likely require access to other States' airspace in order to access outer space. Due to the provisions of the Chicago Convention, there is no presumption of free access to sovereign airspace in order to enter outer space regardless of the purpose of the access.[33]

Air Traffic Management and Space Traffic Management presents another problem for suborbital flights. Currently there are two traffic management systems--one for air and one for space. As it stands now, any

[26]United Kingdom. Outer Space Act 1986 c 38
[27]United Kingdom. Outer Space Act 1986 s 2(2)
[28]United Kingdom. Outer Space Act 1986 s 1
[29]United Nations. 1976. Convention on Registration of Objects Launched into Outer Space, *entered into force* Sept. 15, 1976, 28 U.S.T. 695, 1023 U.N.T.S. 15

[30]United States. 2014. e-CFR. Title 14, Volume 4, Chapter III. Accessed March 3. http://www.ecfr.gov/cgi-bin/text-idx?SID=2fc2fa800dccbec2049657c8f03c982e&tpl=/ecfrbrowse/Title14/14tab_02.tpl
[31]United States. 2004. "Commercial Space Launch Act," 14 U.S.C. Accessed March 8. http://uscode.house.gov/browse/prelim@title51/subtitle5/chapter509&edition=prelim
[32]United Nations. 1967. "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies", entered into force Oct. 10, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205, Art 1
[33]Terekhov, Andrei D. 1997. "Passage of Space Objects Through Foreign Airspace: International Custom?" Journal of Space Law 25: 1-16 (Terekhov 1997, 1-16)

space launch redirects air traffic and this would be a considerable amount of traffic redirects if space launches and suborbital flights were happening on a routine basis. Therefore it seems realistic to have some sort of aerospace traffic management plan for the safety of both air and spacecraft.

IV. From Problems to Manageable Goals

From the previous considerations discussed, the need for international regulations is the most pressing aspect facing suborbital flights. Below are six problems made into manageable goals.

Goal A - Safety Standards for Suborbital Flights: For safety standards for suborbital flights, it would be important to reference the International Air Transport Association (IATA) standards as well as discuss insight from other various references for safety standards on aviation flights. It would be a possibility to include the International Association for the Advancement of Space Safety into these safety standards discussions because they have already provided suggestions for commercial space safety. Dr. Pelton explains this by stating: "one suggestion that has been put forth is the creation an [sic] Independent Space Saftey Board (ISSB) that would provide international safety certification services to the space-tourism industry. This would operate on a commercial (but non-profit) basis. A draft technical standard IAASSISSB-S-1700, was issued at the end of August 2006 that sets forth the major elements that would be involved in such a safety certification process."[34]

Goal B - Safety Standards for Crew and Passengers: As it stands now, these safety standards for crew and passengers could be taken from aviation safety standards, ICAO, the Chicago Convention, and other various relevant reference points. Therefore, using aviation as the model for safety standards for crew and passengers would ease the addition of including safety standards to aerospace flights.

Goal C - Aerospace Traffic Management Plan: According to Hunter, "...aerospace leaders and experts from around the world have begun to publicly acknowledge an impending need for an effective STM [Space Traffic Management] capability and the expansion of ICAO aviation SARPs [Standards and Recommended Practices] which address activities through and above traditional ICAO atmospheric strata."[35] This is an important goal as it would help to create a safe environment for both air space and outer space activities. Under aerospace traffic management it would be important to consider outer space debris as well.

Goal D - Registration: Registration is necessary and desirable; any registration regime needs to avoid being onerous and redundant, taking into consideration current issues with dual registration.

Goal E - Liability: Again, the current liability regimes for aviation and space activities are rather different and would benefit considerably from reform, though the ideal would be harmonization, though harmonization is likely unachievable. This is certainly of importance for states as the current liability regime for space places the onus on them. For this reason, the existing liability regime in use for commercial aviation would serve as a good model for a liability regime tailored to commercial space operations.

Goal F - Launching: A clear definition of what constitutes a launch needs to be established, as the proliferation of non-traditional 'launch' vehicles may potentially result in air- and spacecraft falling through

[34]Pelton, J. No Date. "Space Planes and Space Tourism: The Industry and the Regulation of its Safety." SACRI Research Study. George Washington University.

[35]Hunter, Stephen. 2014. "How to Reach an International Civil Aviation Organization Role in Space Traffic Management." Paper presented at Space Traffic Management Conference, Daytona Beach, Florida, November 4-6. http://commons.erau.edu/stm/2014/wednesday/21.

the cracks of the existing regulatory regime. The biggest issue regarding the lack of the definition is the potential for, by following the functional approach, 'space objects' that are not 'launched' and therefore are potentially not subject to the registration convention but due to being classified as 'space objects' are also not subject to the aviation registration regime.

V. Policy Options

In this section five policy options are presented for moving forward toward suborbital flight regulation. Option one optimizes an aviation heavy approach with direction from ICAO. Option two relies on a space heavy approach with assistance from UNOOSA and COPUOS. Option three determines that suborbital flight regulations should be left to each state to determine and carry out. Option four relies on a hybrid or integrated approach of both the air and space regimes. Finally, option five considers an expert approach where there are experts from all perspectives and both the air and space fields working on regulations for suborbital flight.

Option 1 - Aviation Heavy Approach: ICAO would take the lead in developing regulations for suborbital flights, and the baseline assumption would be to treat suborbital vehicles falling within the definition of aircraft as aircraft and not as space objects. In favor of the aviation heavy approach, there is already an existing regulatory regime that would be easy to incorporate into suborbital flight regulations. The aviation community has over 100 years of experience in dealing with commercial and civil flights, has safety standards that are tried and tested, and enjoy popular confidence. Therefore it would be feasible to add suborbital flights to these standards with the least amount of changes or additions to the regime. However, the space community would lose the marketability of calling suborbital flights 'space tourism' and the idea of spending a significant amount of money for another air flight would lose its appeal. Potential oppositions would be from the emerging space players who would fear losing the influence they currently enjoy through COPUOS.

Option 2 - Space Heavy Approach: UNOOSA and COPUOS would take the lead in being responsible for the administration of an international system for the regulation of suborbital flights. The baseline assumption would be that since these vehicles are intended to and designed to go to 'outer space' no matter for how brief a timespan, they should therefore be regarded as 'space objects' and not 'aircraft'. In favor of the space heavy approach, this regulation would be new for the space industry so the space-faring nations could tailor their regulations specifically to suborbital flights and commercial space transportation.

However, this would be an untried and untested set of regulations that might also be held up in COPUOS in a long-winded debate that could also open up the long-standing questions over the delimitation of outer space. Potential oppositions would be from States regarding their sovereignty over airspace.

Option 3 - Leave it to the States Approach: This option would leave the situation much as it currently is and leave it up to States to determine how to regulate suborbital flights, and whether to subject them to the air or space regime or a combination of the two. At this level there could still be some coverage at the international level in the form of bilateral and multilateral agreements as there is for traditional air travel. This coverage would be bilateral or multilateral instead of controlled by the United Nations. In favor of leaving it to the States, the States would have control and their sovereignty would not be infringed. Additionally, associated legislation could potentially pass much faster through individual States than through an international body. Therefore the regulation would be more open to diversity and experimentation. However, this freedom could also be considered a downfall of this approach. Continuing with the difficulties of this

approach, if every State has its own regulation then a commercial entity would have more regulations to fly through that would be disorganized and non-uniform. In terms of safety, some states may not even regulate at all creating international difficulties and posing harm to passengers and crew as well as the overall reputation of the industry.

Potential oppositions would be from the international institutions and the space industry as a whole that might feel that an international approach would be the superior solution more in tune with general trends in international law.

Option 4 - Integrated/Harmonized Approach: This approach would see a joint regime worked out between ICAO and UNOOSA/COPUOS. Both institutions would devise a regime that integrates and harmonizes the space and air law regimes for the purposes of commercial space transportation, namely suborbital flights.

In favor of the integrated/harmonized approach, ICAO and UNOOSA would hold a joint solution that would be more in tune with the general trends in international law and relations. Working cooperatively would likely best ensure that both sides are represented when creating regulation.

However, getting all parties to cooperate would be quite time-consuming thus hindering the regulations from being created. Potential oppositions could be from either side thinking they would lose their exclusive control and from States concerned about their sovereignty in airspace.

Option 5 - Expert Approach: Experts from various organizations, private industry, agencies, and so forth would come together and create an expert committee that would address the issues regulating suborbital flights. These experts would come from both the air and space fields and would be nominated by ICAO and UNOOSA members but selected by leaders within these institutions. A benefit of the expert approach would be that there would be people with valuable expertise leading the discussions on regulations from both air and space communities as well from science, technical, and legal fields.

However, no one with the authority to choose this approach will choose this approach because it means giving up their influence to a small group of experts. On top of this, States may decide to send experts or scholars that would function under the states' interests and could alter the group's outcomes.

VI. Feasible Policy Solution and Recommendations

It would be ideal to have a harmonized (or integrated) approach where both ICAO and UNOOSA/COPUOS share the duties of regulating suborbital flights. However, given the disposition of States towards national interests and given the lethargy of the United Nations to get new regulations passed -- no less agreed upon -- by the many number of members residing in COPUOS, it is more realistic and feasible to assume that this task would be better suited to a dedicated team of experts and scholars from both fields of interest.

Therefore the most feasible solution, and the primary recommendation from this analysis, would be to have an expert group approach gathering experts and scholars from engineering, science, business, economics, law, policy, politics, et cetera from both the aviation and space fields to consider how to create and implement international regulations for suborbital flights. The most logical home for this group would be under the auspices of ICAO, as they already have experience working with commercial issues that arise in aviation. However, there is a strong need for this to be carried out in co-operation with UNOOSA/COPUOS, ideally by including representatives of those bodies within the group of experts. It is also important to note that these members should reflect not only States and space agencies but also organizations, companies, universities, and other various relevant actors at large.

Eventually this could lead to an international organization for aerospace

activity similar to, for example, the International Telecommunications Union (ITU) or the International Association for the Advancement of Space Safety (IAASS) or, ideally, a UN specialized agency for aerospace commercial activities.

For this to be feasible, this option should appeal to pertinent actors from both air and space. In order for this to happen, we must assume that it is the common interest of all actors that commercial aerospace -- including suborbital flights -- is an issue that requires attention and more in-depth active discussion and action. We believe that the actors involved would be open to such an option, as is the one presented in this paper, because:

- This option works with existing international organizational structures and mandates thus making its implementation easier, following along the lines of what has been set up previously for air and space.
- From the commercial actors' point of view, this would allow them to have a voice on the issues whereas in COPUOS they do not have that ability.
- This option allows for the issues to stay within the UN system so that UN members that are parties to either the Chicago Convention, the Outer Space Treaty, or both will have the ability of inclusiveness. All members of the United Nations would be able to participate, or at least observe, the discussions brought forth through this entity.
- For States this allows them to maintain the power that they have analogous to their power in other UN committees and UN specialized agencies.

In terms of what would be discussed and created by this group would be the goals that were outlined in an above section, such as:

Goal A - Safety Standards for Suborbital Flights
Goal B - Safety Standards for Crew and Passengers
Goal C - Aerospace Traffic Management Plan
Goal D - Registration
Goal E - Liability
Goal F - Launching

Regarding these goals would be the creation of various documents based on experiences and lessons learned, such as, SARPS, guidelines, recommendations, protocols, and eventually treaty law.

VII. Conclusion

The existing legal regime is inadequate, ill-prepared, and ill-equipped to deal with suborbital flights, particularly those of the commercial variety. There are numerous issues that need to be addressed. These range from issues that date from the dawn of the space age, such as the need to define and delaminate airspace and outer space, to issues which have only cropped up with the dawn of the 'new' commercial space age, such as a need to define the difference between astronaut, space tourist, spaceflight participant, et al. This causes, at best confusion and at worst an actual barrier to further progress and development of the sector and industry.

There are several potential avenues out of the current mess that confronts suborbital flight regulation. These range from treating suborbital flights entirely as atmospheric flights thus subjecting them to the existing aviation legal and regulatory regime; to treating them entirely as space flight; to removing it from international consideration altogether and allowing a patchwork of solutions to be developed by individual States; to an integrated and harmonized international approach seeking to bring together the best of both systems and finally to an expert, evidence led approach designed to develop a system that best meets the needs of all concerned.

It is this final approach that we recommend. This approach will allow the combination of over a century of aviation experience to be combined with the many decades of experience accrued in spaceflight. It will also allow for the needs of industry to be heard and addressed in the process of developing a regime that is specifically tailored to the unique needs of suborbital flight.

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