



Universiteit
Leiden
The Netherlands

Practical solutions for the regulation of private human sub-orbital flight: a critical analysis

Masson-Zwaan, T.L.; Moro Aguilar, R.

Citation

Masson-Zwaan, T. L., & Moro Aguilar, R. (2011). Practical solutions for the regulation of private human sub-orbital flight: a critical analysis. In *2nd IAA Symposium on Private Human Spaceflight [Proceedings on USB]* (pp. 1-16). Paris: IAA. Retrieved from <https://hdl.handle.net/1887/18520>

Version: Not Applicable (or Unknown)

License: [Leiden University Non-exclusive license](#)

Downloaded from: <https://hdl.handle.net/1887/18520>

Note: To cite this publication please use the final published version (if applicable).

AA-2-2011-47

PRACTICAL SOLUTIONS FOR THE REGULATION OF PRIVATE HUMAN SUB-ORBITAL FLIGHT: A CRITICAL ANALYSIS

Tanja Masson-Zwaan, IIASL-Leiden
Rafael Moro-Aguilar, Orbspace-Austria

ABSTRACT

In the context of the FAST20XX project that started in 2009 under the 7th Framework Programme of the European Union, the authors have carried out a new examination of the legal status of private human sub-orbital flight, and whether it will be regulated as aviation or as spaceflight.

International space law is ambiguous as to accommodating sub-orbital activities. While some provisions of the UN outer space treaties would seem to exclude them, generally there is not any explicit condition in terms of reaching orbit as a requirement for application. International air law presents equal difficulties in dealing with this activity. The classic definition of “aircraft” as contained in the Annexes to the Chicago Convention does not really encompass the kind of rocket-powered vehicles that are envisaged here. As a result, it is unclear whether COPUOS, or ICAO, or both could be involved in an eventual international regulation of sub-orbital flight.

In the absence of a uniform international regime, each country has the sovereign right to regulate human sub-orbital flights operating within its airspace. So far, there are two practical solutions that can be identified and subjected to analysis.

On the one hand, the US has granted power for regulation and licensing over private human sub-orbital flight to the FAA’s Office of Space Transportation. Subsequent regulations by the FAA have set out a series of requirements for companies who want to operate these flights, enabling a market to develop. On the other side of the Atlantic, both ESA and a group of representatives of EASA would rather regard this activity as aviation, and potentially subject it to the certification competences of EASA.

Due to these differences, exactly when this activity will be considered aviation, and when it will be considered a type of spaceflight, is uncertain. However, such a characterisation will have important consequences for the industry, and for chances of having a stable regulatory landscape.

1. INTRODUCTION

1.1. The FAST20XX Project and sub-orbital flights

As of 2011, a number of companies had announced their intention to start operating sub-orbital vehicles intended to carry passengers to the fringes of outer space¹. Although most of these ventures

¹ A sub-orbital flight is a flight in which the vehicle reaches outer space, but its trajectory intersects the atmosphere or the surface of the Earth, so that it does not complete one orbital revolution; it falls back to Earth instead. Potential uses for manned sub-orbital vehicles are: private human spaceflight (“space tourism”); human-tended microgravity experiments, astronomical observations, and sub-orbital science in general; astronaut training; ultra-fast point-to-point transportation of passengers; ultra-fast cargo delivery; reconnaissance and other military applications. <http://en.wikipedia.org/wiki/Sub->

will take place in the United States, some have also expressed their intention to fly from Europe and elsewhere.

The EU Project FAST20XX aims at exploring precisely this borderline between aviation and space.² The Project is investigating two novel concepts of sub-orbital manned vehicles, which are envisaged as taking place on two separate time-lines. Also, depending on the amount of energy required for different trajectories and mission profiles, one distinguishes between low- and high-energy transportation:

- *Alpha*: a small space vehicle launched from an airplane would provide a low-energy ballistic flight experience, like those currently intended for commercial touristic flights. This concept is envisaged in the medium term of five to ten years.
- *SpaceLiner*: a much larger, vertically starting two-stage rocket vehicle concept is also investigated, in order to identify the conditions experienced during high-energy, hypersonic flights intended for commercial, point-to-point, long-range transportation of passengers. This concept is seen as taking place in a longer term, i.e. the second part of the 21st century.

The main focus of FAST20XX is the identification and mastering of critical technologies for such vehicles, rather than the vehicle development itself. Besides the technical aspects, the most important pre-requisites for commercial operation are also being examined, such as safety of human spaceflight, business cases, environmental issues, and legal issues.

In the context of the legal analysis of the FAST20XX Project, the authors have carried out a new examination of the legal status of private human sub-orbital flight, and whether it will be regulated as aviation or as spaceflight. The present paper will focus on the analysis concerning the *Alpha* type of vehicle, as in reality it is the more pressing issue. However, some comments have been included on the *SpaceLiner* concept as well.

1.2. The uncertain legal nature of sub-orbital flights

Sub-orbital flight is by no means a technical novelty, and this kind of trajectory has been used for many decades now. Examples of already existing sub-orbital devices are:

- 1) Sounding rockets, or small rockets used by scientists to conduct experiments in microgravity and make astronomical observations above the atmosphere;
- 2) Ballistic missiles (particularly ICBMs), used by the military to convey warheads onto the battlefield; and
- 3) Certain objects designed for in-flight experimentation of space technologies, such as systems for atmospheric reentry –for instance, ESA's *Intermediate eXperimental Vehicle (IXV)*, to be launched from the European spaceport at Kourou, French Guiana, by a *Vega* rocket in 2013³.

All these devices are unmanned, have usually not crossed any international frontiers, and have posed no significant legal problem so far.

However, sub-orbital flight takes place at the border between air and outer space. This border is difficult to define, both from a physical as well as a legal point of view. At the present time, no official delimitation exists in international law between the two spaces. For this reason, both aviation and space

[orbital_spaceflight](http://www.orb.space.com/es/Background-Information/Sub-orbital-vs-Orbital.html). See also for further explanation: <http://www.orb.space.com/es/Background-Information/Sub-orbital-vs-Orbital.html> (this site, and all other sites mentioned in this paper, was last accessed and verified on 22 May 2011).

² The work presented on this paper was performed within the "Future High-Altitude High-Speed Transport 20XX" Project investigating high-speed transport. FAST20XX, coordinated by ESA-ESTEC, is supported by the EU within the 7th Framework Programme, Theme 7 "Transport", Contract no.: ACP8-GA-2009-233816. Further info on FAST20XX can be found on <http://www.esa.int/fast20xx>.

³ http://www.esa.int/SPECIALS/Launchers_Home/SEMQDO4N0MF_0.html.

law and treaties have to be analysed for their applicability with respect to the intended sub-orbital human flight activities.

International space law is ambiguous as to accommodating sub-orbital activities. While some provisions of the UN outer space treaties would seem to exclude them, generally there is not any explicit condition in terms of reaching orbit as a requirement for application. In addition, existing space law has important shortcomings as to regulating the legal status and liability of the sub-orbital operator, crew, and participants.

International air law presents equal difficulties in dealing with this activity. The classic definition of “aircraft” as contained in the Annexes to the Chicago Convention do not really encompass the kind of rocket-powered vehicles that are envisaged here. Moreover, insofar as these ventures are promoting purely vertical trajectories, and they do not intend to cross any international frontiers, the activity hardly qualifies as “international aviation”.

2. LEGAL ANALYSIS OF MANNED SUB-ORBITAL FLIGHTS

2.1. The legal concepts of “spaceflight” and “space activity”

“Spaceflight” is a legal term which has significant legal implications. If sub-orbital trips are considered spaceflights, then the UN outer space treaties will apply to them. In such case, manned sub-orbital flights will be subject to the requirements of Art. VI (authorisation and supervision by the responsible state), Art. VII (international liability of the launching state), and Art. VIII (duty of registration; state of registry retains jurisdiction and control) of the Outer Space Treaty⁴ (OST). Most notably, the nation from which the sub-orbital vehicle is launched or takes off will become a launching state, and will be internationally liable for any damages that might be caused by the vehicle to other nations. But if sub-orbital flight is not a true space activity, and just a flight into the last fringes of the atmosphere -without ever truly leaving the airspace of the original country- then mainly national regulations would apply, and international liability of the launching state may be excluded, whereas the liability of the operator under air law may be invoked.

The concept of space activity is not defined in international law. The OST does not specify which activities are to be considered space activities. Since, as already mentioned, there is no international delimitation between airspace and outer space, there is no way to know for certain in which space sub-orbital flights are taking place, and to which legal regime they are subject.

The key question is: what would be a correct definition for the activity of carrying several passengers in a vehicle to an altitude of e.g. 110 kilometers and returning them safely back to the Earth? Colloquially and in terms of its commercialisation, this activity is invariably sold as “space tourism”⁵. But of course, the important matter of whether international space law applies to this activity or not should not depend on the marketing choices of a handful of companies. There must be a better way to ascertain whether sub-orbital flights really qualify as space flights, or are merely an extension of aviation activities.

⁴ “Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies”, adopted by the UNGA on 19 December 1966 (Resolution 2222(XXI)), opened for signature on 27 January 1967, entered into force on 10 October 1967. Available at: http://www.unoosa.org/pdf/publications/ST_SPACE_51E.pdf.

⁵ This would not have to be necessarily this way, even in terms of pure marketing. Sub-orbital companies could call this activity “microgravity experience”, “extreme-altitude flight”, or “space-proximity flight”, for instance, should they feel that such names are more advantageous for its commercialisation. But how relevant is the declaration of the operator in the sense that they are conducting “spaceflights” and carrying “astronaut passengers” on-board? Probably not much, since in the end, it will be the regulator (FAA, EASA, ICAO...) who decides which rules (air or space) will be applicable to this activity.

2.2. First possibility: sub-orbital flight is aviation

For the time being, manned sub-orbital flights are sold as “space tourism flights”; and since they aim to touch the edge of space, they are usually considered to be a space activity. Actually, however, there is no technical or legal ground that imposes that qualification. On the contrary, the fact that sub-orbital vehicles do not orbit, and they seem to be flying in the atmosphere rather than space-travelling, are reasons that have been alleged against their consideration as space activities⁶.

The main technical reason not to consider sub-orbital flights as subject to international space law is that the trajectory of the vehicle is essentially vertical, and thus the crossing of any international borders or the overflight of any foreign territories can usually be avoided. As the ICAO Council stated in 2005, “...current commercial activities envisage sub-orbital flights departing from and landing at the same place, which may not entail the crossing of foreign airspaces”⁷.

If we follow this line of argument, it is questionable whether sub-orbital spaceflight is really a space activity. It will basically take place in the airspace of one given country, therefore without any international implications. The fact that the flight may ascend for a few minutes above the 100-kilometres altitude, and thus transit briefly through the lowest part of outer space, would be incidental to a larger part of the activity taking place in airspace. That phase is too short when compared to the major part of the flight taking place in airspace. Therefore, sub-orbital human flights would not justify the application of space law, at least as we know them today. The concerned state is perfectly capable to regulate the whole activity in the framework of its national law.⁸

In addition, several legal arguments exist in favour of excluding sub-orbital trajectories from the current international space law regime.

First, the OST forbids in Art. IV.1 the placing of mass destruction weapons “in orbit around the Earth”. This means that the sub-orbital trajectories of ICBMs and similar weapons are not covered by the prohibition (and therefore, are not covered by the OST).

Second, the Registration Convention⁹ expressly restricts its scope of application to “objects launched into Earth orbit and beyond”. Probably for the latter reason, the US Government did not include *SpaceShipOne* in its national registry of space objects, and did not provide the UN Register with the corresponding information about the SS1 flights. However, such exclusion of sub-orbital vehicles from the international register of space objects may be significant and have legal implications for sub-orbital activities.

Third, the legal status of sounding rockets provides an interesting analogy. In their trajectory, these objects usually do not cross any borders beyond the launching state, so international space law is not involved in their regulation. And at least one country, Sweden, has expressly taken the position of excluding the applicability of its national space law to sounding rockets.¹⁰

To sum up, there are a number of arguments in favour of accommodating manned sub-orbital flights within the ambit of the current air law regime.

⁶ Armel Kerrest & Lesley Jane Smith, “Article VII”, in Stephan Hobe, Bernhard Schmidt-Tedd & Kai-Uwe Schrögl (eds): *Cologne Commentary on Space Law – Volume 1: Outer Space Treaty* (2010), p. 140.

⁷ ICAO Council, “The Concept of Sub-orbital Flights”, 30 May 2005, Part 6, “Conclusions”.

⁸ André Farand, “Tourisme spatial: considération juridique sur les vols suborbitaux”, in Philippe Achilleas (ed.), *Droit de l'espace* (2009), pp. 362-3.

⁹ “Convention on Registration of Objects Launched into Outer Space”, adopted by the UNGA on 12 November 1974 (resolution 3235 (XXIX)), opened for signature on 14 January 1975, entered into force on 15 September 1976. Available at: http://www.unoosa.org/pdf/publications/ST_SPACE_51E.pdf.

¹⁰ Section 1.4 of the Swedish Act on Space Activities (1982). Available at: <http://www.oosa.unvienna.org/oosadb/showDocument.do?documentUId=318&country=SWE>.

- 1) The function or purpose of the vehicle seems to be earth-to-earth transportation (definitely so in the *SpaceLiner* mission scenario).
- 2) They spend most of the time in airspace, crossing only very briefly through outer space.
- 3) Similar unmanned sub-orbital devices are usually not subject to space law.
- 4) Registration of sub-orbital vehicles as space objects is precluded by the space law provisions in force, while they could still be registered as aircraft.

In addition, the inclusion of sub-orbital flights under the current air traffic regime would have a practical advantage: it would avoid the need to modify the UN space law treaties, which currently have no specific rules for such activities.¹¹

2.3. Second possibility: sub-orbital flight is spaceflight

Let us examine now the arguments supporting the opposite view. First, according to the so-called functional approach, there is no doubt that low-energy sub-orbital human spaceflight derives all its interest from that brief phase when the vehicle is actually “in” outer space. These vehicles are designed with the purpose to reach outer space, or at least touch briefly the edge of space (this is definitely so in the case of “space tourism” flights). Therefore, the destination of the flights would favour the application of outer space rules to them, instead of aeronautical rules. And this “functional approach” may gain strength in the future, insofar as sub-orbital flights spend longer periods of time in outer space, by increasing the initial energy of the rocket engines or by modifying their trajectories.¹²

Taking into consideration the mission profile, there is no doubt that (1) sub-orbital vehicles are destined to reach outer space, just like any other space launch, except with lesser thrust; and (2) depending on the maximum altitude reached, at least one part of the normal trajectory of the vehicle does go through outer space. As a result, for some authors, from a functional point of view, these launches have all the characteristics of a proper space flight.¹³

Also, from a technical point of view, it is obvious that rocket planes such as *SS1* or *Alpha* do not work on the same aerodynamic principles as airplanes; hence it is doubtful that they could be covered by current international air law conventions.

Even from a historical perspective, there are arguments to consider sub-orbital flights, at least when they are manned, as space flights. Exactly 50 years ago, in 1961, the first two flights of the American human space program *Mercury* took place: those of Alan Shepard and Virgil Grissom. They, together with several *X-15* pilots, who also flew their rocket planes on sub-orbital trajectories up to the edge of outer space during the 1960s era, are today officially considered “astronauts”, despite the fact that they never reached Earth's orbit. If we choose to consider sub-orbital activities as simply aviation, and leave them altogether out of the scope of the UN space treaties, then some kind of arrangement or exception would have to be made, in order to keep considering these historic flights as true “spaceflights”.

Finally, moving back to a purely legal perspective, the main provisions of the OST refer only to “outer space”, and not to “orbiting”. Indeed, no orbiting seems necessary to establish international responsibility (as per Art. VI OST) and international liability (as per Art. VII OST) for any space activities. The same could be said about maintaining jurisdiction and control on board a space object

¹¹ Sethu Nandakumar, “Legal Impasse – Commercialisation of Space Through Reusable Sub-orbital Launchers”, in *Proceedings of the 47th IISL Colloquium on the Law of Outer Space* (2004), pp. 457-8.

¹² A. Farand, *supra* note 8, at p. 363.

¹³ S. Nandakumar *supra* note 11, at p. 458.

(as per Art. VIII): it does not seem to depend on reaching orbital altitude,¹⁴ since a similar degree of jurisdiction is exercised on an aircraft by the state that registers it.

The Liability Convention¹⁵ in particular does not contain any limitation similar to the one contained in the Registration Convention (i.e. applicable only to “objects launched into Earth orbit or beyond”). Given this fact, the question arises: Does the international absolute liability regime established in the United Nations Treaties (Art. VII OST, Liability Convention) apply to manned sub-orbital flights? In other words, is the launching state internationally liable for any eventual damages caused by these vehicles? This would of course be a very good solution for the damaged third parties. But it could also bring about severe constraints for the company players in the field, as well as for passengers’ liability claims.

If space tourism activities are subject to the liability regime that is in force under space law, then liability would be absolute, instead of being based upon principles of negligence, as is the case in international air law. Also, liability under space law is unlimited (no upper limits, like in international air law). And damaged third parties would not be entitled to institute the procedures of the Liability Convention: only the relevant states could do that.

Moreover, this option could preclude all space participants from claiming damages under Art. VII of the Liability Convention (i.e. the Convention does not apply to nationals of the launching state, neither to foreign nationals participating in the space activity). Some other solution will have to be found to address the issue of liability for damages to passengers; otherwise, this gap could become an obstacle to the development of manned sub-orbital flight.¹⁶

2.4. The case of *Spaceliner*

What about the activity of carrying passengers at hypersonic speeds to a similarly high, sub-orbital altitude, in order to transport them to the other side of the world? Here we find again a total absence of specific regulation. Both the air law and space law treaties were drafted at a time when the technology for such earth-to-earth aerospace transportation was not yet foreseeable.

In the absence of specific rules, almost all legal authors look at the character of the activity of this aerospace object, and thus concede that the point-to-point transportation character of such a project render it analogous to current international transportation aircraft. Since the vehicle carries passengers and intentionally enters foreign air space, one could consider this an international air carriage service. Moreover, *SpaceLiner* uses outer space only while “in transit” from two points on the Earth. The “space” phase of the flight is not the function of the projected spaceplane, but only the medium through which the vehicle moves in order to carry out its function of transporting passengers from one point to another on the Earth. These spaceplanes, even though they cannot be considered “aircraft” proper, would be analogous in many ways to current airliners; and similarities are also very significant between current air transport and future earth-to-earth travel through outer space. Therefore, much of the current air law regime could apply “as is” to these objects, regardless of the fact that they move through outer space for one part of their flights.¹⁷

¹⁴ Michael Gerhard, “Article VI”, in S. Hobe, B. Schmidt-Tedd & K.U. Schrögl (eds): *Cologne Commentary on Space Law – Volume 1: Outer Space Treaty*, pp. 107-8. In the view of this author, it is favourable to apply the OST also to activities that only take place “partly” in outer space, like the flight of sub-orbital rockets, provided that air law applies to them for the “airspace” part of the flight.

¹⁵ “Convention on International Liability for Damage Caused by Space Objects”, adopted by the UNGA on 29 November 1971 (resolution 2777 (XXVI)), opened for signature on 29 March 1972, entered into force on 1 September 1972. Available at: http://www.unoosa.org/pdf/publications/ST_SPACE_51E.pdf.

¹⁶ Ram Jakhu & Raja Bhattacharya, “Legal aspects of space tourism”, Proceedings of the 45th IISL Colloquium on the Law of Outer Space (2002), pp. 128-9.

¹⁷ Tanja Masson-Zwaan, “The Aerospace Plane: An Object at the Crossroads Between Air and Space Law”, in T. Masson-Zwaan & P. Mendes de Leon (eds), *Air and Space Law: de lege ferenda* (1992), pp. 247-261; Claudio Zanghi, “Aerospace

Indeed, according to the ICAO Council, “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, [and] any crossing of outer space [would be] brief and only incidental to the flight (...) Should foreign airspace(s) be traversed, and should it be eventually determined that sub-orbital flights would be subject to international air law, pertinent Annexes to the Chicago Convention would in principle be amenable to their regulation”.¹⁸

There is an additional practical argument in favour of this solution. Aviation has a longer history than space activities and is regulated in much more detail, with a sophisticated legal framework both at the national and the international level. Therefore, it is much more advantageous for *SpaceLiner* to be regulated by aviation law, in view of the legal certainty this brings.

3. PRACTICAL SOLUTIONS FOR INTERNATIONAL REGULATION

3.1. Regulating sub-orbital flights under space law: A role for COPUOS?

In principle, a single, uniform regime is to be preferred for sub-orbital vehicles during the complete flight. The problem with this idea is that neither air nor space law, as they are now, cover many of the necessary issues.

International space law in particular would need a number of amendments or clarifications. A protocol to the existing treaties, or even a whole new multilateral treaty, should be added to the current legal space regime, in order to cover all the topics involved in manned sub-orbital flights.

However, given the long time needed to agree on a new multilateral treaty, this is not a very realistic response for the short term, and will not solve the immediate problems of today's space tourism entrepreneurs. An alternative to elaborating new treaties could be the development of a code of conduct (or a similar kind of “soft law” text), possibly under the auspices of the UN –same as recently happened with the (non-binding) Guidelines on Space Debris Mitigation adopted by the Scientific and Technical Subcommittee of COPUOS in 2007–. Such guidelines could develop and harmonise some rules governing the liability of the operator towards passengers and third parties, and could also include provisions destined to ensure safety of the sub-orbital manned flight. Perhaps some of them could be modeled after international air law.¹⁹

If we accept sub-orbital flight as subject at least in part to international space law, then indeed the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) should play some role in the regulation of sub-orbital human activities.

So far, COPUOS has not made any decision concerning sub-orbital “space tourism”. The reasons may be twofold. First, this is a very recent and small-scale space activity, and so far it has not caused any conflict that might have attracted the attention of the international community. Second, the UN is concerned mainly with fostering international cooperation in space, and with promoting the aid to economic and social development of all countries by means of using space technology. The regulation of private and commercial space activities such as these ones would not be a priority for the UN, unless there were significant security or international implications.

object”, in Gabriel Lafferranderie (ed.), *Outlook on Space Law* (1997), pp. 120-1; Jürgen Cloppenburg, “Legal Aspects of Space Tourism”, in Marietta Benkö & Kai-Uwe Schrögl (eds.), *Space law – Current problems and perspectives for future regulation* (2005), p. 210.p. 208; Peter van Fenema, “Sub-orbital Flights and ICAO”, in *Air and Space Law*, Vol. XXX/6 (2005), p. 401; Stephen Gorove, “Aerospace Object – Legal and Policy Issues for Air and Space Law”, in *Journal of Space Law*, Vol. 25, No. 2 (1997), pp. 101-112.

¹⁸ ICAO Council, “The Concept of Sub-orbital Flights” (see note 7 above), Part 6, “Conclusions”.

¹⁹ See Tanja Masson-Zwaan & Steven Freeland, “Between Heaven and Earth: The Legal Challenges of Human Space Travel”, *Acta Astronautica* 66 (2010), p. 1603.

That said, there have already been some proposals within COPUOS to include this topic in its agenda. In 2007, Mr. Gérard Brachet, then Chairman of COPUOS, drafted a working paper on the “Future role and activities of the Committee on the Peaceful Uses of Outer Space”, after extensive consultations with many experts and delegations.²⁰

The same year, the opposing views were expressed in the Legal Subcommittee of COPUOS that “sub-orbital flights could be covered by air traffic law”²¹, but also that “the tendency of using the lowest satellite orbit as a criterion for the delimitation of air space and outer space was obsolete, in view of the fact that both the X-15 rocket plane and *SpaceShipOne* were regarded as spacecraft and qualified as sub-orbital, which, according to the criterion, meant that the beginning of outer space could be far below the lowest satellite orbit.”²²

In the last few years, there have been several interventions in the Legal Subcommittee of COPUOS about the impact that sub-orbital private flights are going to have on current space law. Most of them took place under the agenda item devoted to the definition and delimitation of outer space. Also, solutions for international problems posed by sub-orbital “space tourism” may inter-relate with some of the problems posed by aerospace objects. The latter have been the subject of analysis by the Legal Subcommittee for almost 20 years now.²³ Finally, during a recent session of the Legal Subcommittee, in March 2010, all COPUOS delegations considered the ICAO Working Paper that we have referred to above. However, no decision on possible further steps was taken.²⁴

In the long run, it could be considered whether a new convention would be required to establish some rules applicable to “space tourism” and other sub-orbital activities. However, since commercial passenger transportation to and through outer space currently does not occur on a large scale, there does not yet seem to be a practical need for new binding rules.

3.2. Regulating sub-orbital flights under air law: a role for ICAO?

As a number of authors have remarked, international aviation rules could serve as a much better model when considering how to regulate this area. Any regulatory system for commercial sub-orbital vehicles must be international in application to ensure global parity of standards, much as it currently happens with international passenger transportation. Therefore, a parallel *modus operandi* to that of ICAO would seem a realistic and optimal goal for commercial “space tourism” operations.²⁵

A strong case could be made in favour of granting ICAO the main role in future international regulation of sub-orbital flight, with only minor additions or assistance from the UN or COPUOS.

ICAO is equipped with an excellent treaty, the 1944 Chicago Convention, which has stood the test of time and has provided proven standards and guidelines for practically every conceivable aspect of international civil aviation through its 18 Annexes.

Already in 2000, the President of the Council stated:

²⁰ See official COPUOS document A/AC.105/L.268, of 10 May 2007. It is available online at: http://www.oosa.unvienna.org/pdf/limited/II/AC105_L268E.pdf. In paragraphs 36-38, we find some proposals for a future role of COPUOS in analysing and regulating sub-orbital flights.

²¹ See para. 9 of the Report of the Chairman of the Working Group on the Definition and Delimitation of Outer Space, Annex II to the Report of the Legal Subcommittee on its 46th session, Vienna, 26 March - 5 April 2007, Doc. A/AC.105/891: http://www.oosa.unvienna.org/pdf/reports/ac105/AC105_891E.pdf.

²² *Ibidem*, under the agenda item on the Definition and Delimitation issue, at para. 84.

²³ Cf. for instance the discussions about the questionnaire on possible legal issues with regard to aerospace objects. Available at <http://www.oosa.unvienna.org/oosa/en/SpaceLaw/aero/index.html>.

²⁴ “Report of the Legal Subcommittee on its forty-ninth session, held in Vienna from 22 March to 1 April 2010”, available at http://www.oosa.unvienna.org/pdf/reports/ac105/AC105_942E.pdf.

²⁵ Lesley Jane Smith & Kay-Uwe Hörl, “Legal Parameters of Space Tourism”, Proceedings of the 46th IISL Colloquium on the Law of Outer Space (2003), p. 41.

“The idea of adopting ICAO as a model, or expanding the mandate of ICAO to encompass outer space, has been raised before. This approach has merit. SARPs have proven effective in adapting to the dramatic transformation of civil aviation during the past 50 years or so. A global forum of nations is essential for achieving consensus on the management of outer space, and there already exists such a respected and time-honoured structure.”²⁶

Again in January 2005, the President of the Council, referring to the *SpaceShipOne* flights, suggested that ICAO would be the most appropriate organisation to regulate the safety of such sub-orbital flights²⁷.

The ICAO Working Paper titled “The Concept of Sub-orbital Flights”²⁸ reminds that the Chicago Convention applies to international air navigation, and states that, should foreign airspace(s) be traversed by sub-orbital vehicles, and should it be eventually determined that such vehicles are subject to international air law, then “pertinent Annexes to the Chicago Convention would in principle be amenable to their regulation”.

Neither the 2000 statement nor the discussion in the Council on the basis of the 2005 Working Paper²⁹ has resulted in any follow-up actions on the part of ICAO. At the 2010 session of the COPUOS Legal Subcommittee, ICAO made a presentation and basically concluded that the 2005 document was still valid.³⁰ However, no further action has been taken by ICAO in this field.

On the one hand, it is unclear on which basis ICAO should undertake the regulation of sub-orbital flights. The term “aircraft” in Annex 8 to the Chicago Convention is clearly defined as “any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth’s surface”. This definition is usually seen as reflecting a common understanding among states. It can therefore be argued that the Convention does not regulate rocket-powered airplanes, as they do not fall under the definition of an aircraft (they do not derive support from the air; at least, they do not for some parts of their flight).

From that perspective, perhaps it must then be concluded that ICAO *de lege lata* is not competent to regulate the activities of *Alpha*-type vehicles. But even then, lessons can be learnt from the experience of ICAO and its institutional arrangements. The technical rules contained in the Annexes should be analysed to determine whether it would be appropriate to adapt them to sub-orbital vehicles.

A different answer may be required for *SpaceLiner*. Clearly, technical differences and a divergent level of commercial development would require dedicated regulations. But sub-orbital earth-to-earth transportation might be considered so close to current international air navigation, that no different legal regime may be acceptable³¹.

On the other hand, it may be argued that the purpose of the Chicago Convention is not to regulate a specific type of vehicle, but rather to ensure that international civil aviation takes place in a safe and orderly manner; the treaty was not meant to be frozen in time.

Some authors³² have noted that the Chicago Convention does not place restrictions on ICAO’s authority to regulate civil aircraft simply because the aircraft traverses the upper reaches of Earth’s

²⁶ ICAO Journal Vol. 55, No.7 (September 2000).

²⁷ Peter van Fenema, *supra* note 17, p. 396.

²⁸ Official document C-WP/12436 (see note 7 above). Reprinted in Peter van Fenema, *ibidem*, at 404.

²⁹ “Concept of Sub-orbital Flights: Information from the International Civil Aviation Organization (ICAO)”, 19 March 2010.

³⁰ Cf. Doc. A/AC.105/C.2/2010/CRP.9, at: http://www.oosa.unvienna.org/pdf/limited/c2/AC105_C2_2010_CRP09E.pdf.

³¹ Jürgen Cloppenburg, *supra* note 17, pp. 197-8 and 208.

³² Paul Dempsey & Michael Mineiro, “ICAO’s Legal Authority To Regulate Aerospace Vehicles”, Proceedings of 3rd IAASS Conference 2008. Available at SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1289547; Paul Dempsey & Michael Mineiro, “Space Traffic Management: A vacuum in Need of Law”, Presented at the 59th IAC, Technical Session E3.2 on Space Policies and Programs of International Organizations, held in Glasgow, Scotland 2008. Available at SSRN: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1285623. The next paragraphs reflect some of the arguments presented in these papers.

atmosphere. These authors believe that the Chicago Convention grants ICAO the legal authority to adopt SARPs governing rules of the air applicable to civilian sub-orbital and even orbital vehicles in flight traversing airspace. Drafters of the Chicago Convention acknowledged that challenges relating to international civil aviation, unforeseen at the time of the Convention drafting, would eventually arise. Therefore, ICAO was granted the authority to adapt to these challenges in order to meet the objectives of Article 44 of the Chicago Convention i.e. “ensuring the safe and orderly growth of international civil aviation”. For instance, Article 37 allows ICAO to adopt and amend SARPS to address “any such matter concerned with the safety, regularity, and efficiency of air navigation”, including those not explicitly referenced in the Chicago Convention when it was drafted in 1944. Also, ICAO possesses genuine rule making powers and authority on matters of navigation over the high seas and other ocean areas where there is freedom of overflight. These areas, which are outside the jurisdiction of all states, are comparable to outer space.³³

Some interesting proposals have been made by Dempsey & Mineiro in their papers to pave the way for ICAO involvement. ICAO could amend its Annexes governing navigation and collision avoidance to include aerospace vehicles. It could redefine the term ‘aircraft’ to clearly include aerospace vehicles. It could also promulgate a new Annex 19 on “Space Standards”, play a role in the coordination of air and space traffic, and define the limits of airspace in the Annexes. As a start, ICAO could establish a permanent working group to examine this issue.

The ideal solution would be an integrated international civil aviation and space regulatory framework. In this respect, an international civil space regulatory branch within ICAO could fulfil at the international level the same role currently performed within the US FAA by its space branch.³⁴

An important contribution to the debate about the possible involvement of ICAO in the regulation of sub-orbital flights is given by the IAASS (the International Association for the Advancement of Space Safety), which produced a document titled “An ICAO for Space?” in 2007.³⁵ Its proposal is to extend the ICAO mandate to near-space (defined as the space region up to and including geostationary orbits), rather than setting up a separate new international spaceflight organisation. We wonder whether one can call the GSO ‘near space’ and whether it is necessary or feasible to extend ICAO’s mandate that far, as it is not envisaged that these flights will reach such heights. However, expanding it just to cover sub-orbital vehicles such as *Alpha* and *SpaceLiner* would be quite useful. Questions of Space Traffic Management (STM) could thus be adequately addressed by ICAO, as it does for aviation (ATM).³⁶

4. PRACTICAL SOLUTIONS FOR NATIONAL REGULATION

4.1. Regulating sub-orbital flights in the US

Another possible model for future regulation in this area, of course, is the pioneering legislation enacted recently by the United States. The US approach to private human sub-orbital flight, as outlined in the 2004 amendments to the Commercial Space Launch Act, has granted power for regulation and licensing over this activity to the Federal Aviation Administration’s Office of Space Transportation. Subsequent regulations by the FAA/AST have set out a series of requirements for companies that want

³³ Peter van Fenema, *supra* note 17, p. 396 ff.

³⁴ Tomasso Sgobba, “An International Civil Aviation Organization for Outer Space?”, in ‘Security in Space: The Next Generation—Conference Report, 31 March–1 April 2008, United Nations Institute for Disarmament Research (UNIDIR)’, 2008, <http://www.unidir.org/pdf/articles/pdf-art2819.pdf>. An updated version of this paper, co-authored with Ram Jakhu and Maite Trujillo, was presented at the 4th IAASS Conference, Huntsville, 2010 (paper on file with the authors).

³⁵ “An ICAO for Space?” The first draft was published in May 2007 by IAASS. A final version, edited by R. Jakhu, T. Sgobba and P. Dempsey and titled ‘ICAO for Space?’ was issued in March 2011 (paper on file with the authors).

³⁶ See also the International Academy of Astronautics “Cosmic Study on Space Traffic Management”, Corinne Contant-Jorgenson, Piotr Lála, Kai-Uwe Schrögl (eds.), 2006, at <http://iaaweb.org/iaa/Studies/spacetraffic.pdf>.

to operate these flights, enabling a market to develop. The licensing process mostly focuses on public safety and safety of property.³⁷

The American law makes the crucial distinction between “orbital” and “sub-orbital”, as well as between “crew” and “spaceflight participants”. The two distinctions, particularly the second one, are likely to be adopted in the future by other countries, and if this turns out to be the case, they may eventually become rules of international customary law.

Prior to employ a new crew member or accept compensation from flight participants, the operator or license holder for a sub-orbital vehicle must notify them that the US Government has not certified the vehicle as safe. Passengers must provide their “informed consent” in writing in order to participate in the flight. Because the latter requirement is such an important element of the regulation, the FAA has issued further guidance about what constitutes informed consent. And several US states have already enacted additional legislation intended to ensure exclusion from liability for sub-orbital operators launching from their respective territories.³⁸

The FAA does not enter into the discussion on whether sub-orbital flights are space flights or not. It regulates according to the type of vehicle involved (rocket plane). Accordingly, the FAA will license the sub-orbital element of Virgin Galactic (i.e. SS2) as a launcher, while its mothership (i.e. WK2) operates under an experimental aircraft certificate.

4.2. Regulating sub-orbital flights in Europe: ESA

The European Space Agency presented in April 2008 an official position paper on privately-funded sub-orbital spaceflight³⁹. The ESA position paper provides the following definition of “space tourism”: “the execution of sub-orbital flights by privately-funded and/or privately operated vehicles and the associated technology development driven by the space tourism market”.

ESA observes that, since sub-orbital space tourism “will be carried out substantially in the airspace of a given country”, the civil aviation authorities concerned and the competent agencies of the EU should be at the forefront for setting up a regulatory framework for space tourism in Europe. It also states that “since in the longer term space tourism will involve travelling to outer space, some rules of space law may find application for space tourism”. This seems to imply that ESA sees the currently foreseen *sub-orbital* flights as an *aviation* activity to which *air* law must be applied and would at a later stage look at the possible application of space law for the regulation of *orbital* space tourism.

The paper suggests that ESA could assist in the setting up of legal frameworks for operation across Europe, involving civil aviation authorities and other relevant bodies in a debate on this matter. ESA is obviously not a regulatory body that has the legislative power to enact new rules or harmonise national legislation for space tourism in Europe..

The position of ESA with respect to private sub-orbital flights is one of “cautious interest and informed support”. Overall, it is not to be expected that ESA will play a pioneering role in this field. Its position may be rather similar to the secondary role assumed by NASA in the development of the sub-orbital commercial market in the US.

³⁷ U.S.C. Title 49, Subtitle IX, Chapter 701, Secs. 70101-71021; C.F.R. Title 14, Chapter III, parts 401, 415, 431, 435, 440, 450 and 460. On the US regulation of private human sub-orbital flight, see e.g. Francis Lyall and Paul B. Larsen, *Space Law – A Treatise* (2009), pp. 131-2, 493-5; Timothy Robert Hughes & Esta Rosenberg, “Space Travel Law (and Politics): The Evolution of the Commercial Space Launch Amendments Act of 2004”, in *Journal of Space Law*, Vol. 31 No. 1 (2005), pp. 1-80; Joanne Irene Gabrynowicz, “One Half Century and Counting: The Evolution of U.S. National Space Law”, in *Harvard Law and Policy Review*, Vol. 4 (2010), pp. 405-426.

³⁸ Virginia (2007), Florida (2008), New Mexico (2010), and Texas (2011).

³⁹ See press release at http://www.esa.int/esaCP/SEM49X0YUFF_index_0.html, and position paper at http://esamultimedia.esa.int/docs/gsp/Sub-orbital_Spaceflight_ESA_Position_Paper_14April08.pdf.

4.3. Regulating sub-orbital flights in Europe: the EU

The European Union has so far not formally expressed its position on the issue of sub-orbital human flights. Interestingly, there was a motion for a resolution in the European Parliament in 2008, which in paragraph 21 *“calls on the Commission to produce a study on the impact of space tourism and its necessary relevant safety, security and regulatory framework”*. The European Parliament subsequently adopted the “Resolution on the European space policy: how to bring space down to earth” on 20 November 2008, and it contains this exact same paragraph.⁴⁰ Noteworthy also is a press release of 18 June 2010, announcing cooperation between the Commission and the US in the field of civil aviation R&D, specifically mentioning “sub-orbital airplanes”.⁴¹

Ideally, for sub-orbital flights taking place in the EU, the regulation should be addressed at the European level, rather than leaving it to the Member States to create their own rules. And if the Member States are to regulate space tourism at the national level, perhaps some efforts to harmonise these national rules could be undertaken by the EU. The question is of course whether it has the competence to do so, or whether, alternatively, this is something that remains within the realm of the Member States’ own legislative powers.⁴²

The recent entry into force of the Treaty on the Functioning of the European Union (TFEU) has codified the competence of the EU in the field of space activities. However, it is questionable whether the EU could undertake specific action to regulate space tourism.

Title 1 of the TFEU addresses EU Competences (“Categories and Areas of Union Competence”). Article 4 concerns so-called “shared” competences (e.g. transport, energy, environment, etc.) which allow for the adoption of (binding) Regulations, Directives and Decisions. Article 4.2 lists the areas of shared competence, which include transport, and, hence, aviation. Interestingly, “Space” is not mentioned in that same paragraph, but in paragraph 3, which states: “In the areas of research, technological development and space, the Union shall have competence to carry out activities, in particular to define and implement programmes; however, the exercise of that competence shall not result in Member States being prevented from exercising theirs.”

The fact that “space” is not mentioned in the (exhaustive) listing of paragraph 2 of Article 4, but in a separate paragraph 3, the “space” competence (as well as R&TD) seems to be different from the competences in the areas mentioned in paragraph 2. For the “normal” shared competences listed in paragraph 2, the Member State’s competence is “subsidiary” to the EU competence: the Member State may only exercise its competence if the EU does not (any longer) make use of its competence; this is also referred to as the “pre-emption principle”.⁴³ For space, the competences of EU and Member States “co-exist”, meaning that the Member State does not have to sit and wait for the EU to decide whether it will undertake action or not. Space is therefore sometimes referred to as a “parallel competence”.

Depending on whether one would consider space tourism as tourism, as aviation, or as a space activity, the EU would have a “support” competence, a “shared” competence or a “parallel”

⁴⁰ Motion for a resolution of 11 Nov. 2008, B6-0582/2008. The resolution was adopted on 20 Nov. 2008 as doc. P6_TA(2008)0564, European Parliament resolution of 20 November 2008 on the European space policy, available at: <http://www.europarl.europa.eu/sides/getDoc.do?type=TA&reference=P6-TA-2008-0564&language=EN&ring=B6-2008-0582>.

⁴¹ <http://europa.eu/rapid/pressReleasesAction.do?reference=IP/10/761&format=HTML&aged=0&language=EN&guiLanguage=en>.

⁴² See on these questions Tanja Masson-Zwaan, “Regulation of Sub-orbital Space Tourism in Europe: A Role for EU/EASA?” Air and Space Law 35, no. 3 (2010): 263-272. See also Tanja Masson-Zwaan and Steven Freeland, *supra* note 19, pp. 1597–1607.

⁴³ Cf. Art. 2.2: “When the Treaties confer on the Union a competence shared with the Member States in a specific area, the Union and the Member States may legislate and adopt legally binding acts in that area. The Member States shall exercise their competence to the extent that the Union has not exercised its competence. The Member States shall again exercise their competence to the extent that the Union has decided to cease exercising its competence.”

competence. If considered as tourism, and hence as a “support” competence for the Union, the EU would *not* have the power to enact EU legislation in the field, and legislation would be left to the Member States. If considered as an aviation or space activity, the Union would have legislative power.

In the case of human sub-orbital flight being considered as aviation, as ESA seems to suggest, Title VI on Transport, and the whole body of EU aviation rules (*acquis communautaire*) would be applicable, with far-reaching powers delegated by the Member States to the EU. This could have dramatic consequences for plans to develop sub-orbital projects in Europe.

If considered a space activity, we have to look at the substantive provisions in Title XIX, dealing with “Research and Technological Development and Space”. The powers of the Union in the field of space are contained specifically in Article 189.

What are however the implications of this provision for the EU’s competence to either enact EU law in the field of space tourism or to harmonize national legislation? First, it seems that the powers of the EU are limited to scientific and technological space activity, and may not cover private commercial space activities such as space tourism. But perhaps even more important is the exclusion of harmonisation of national laws and regulations in paragraph 2.

A study called for by the European Parliament in 2008, as well as the forthcoming cooperation between the Commission and the FAA which will also cover SoAs⁴⁴, may eventually lead to the formulation of a clear position of the EU in this field.

4.4. Regulating sub-orbital flights in Europe: a role for EASA?

Since sub-orbital space tourism will be substantially carried out in airspace, it is possible that the civil aviation authorities concerned, as well as the competent agency of the EU (i.e. the European Aviation Safety Agency, EASA), will be at the forefront of setting up the regulatory framework for sub-orbital flights in Europe.

At present, EASA’s mandate does not cover any kind of space activities. But if the EU should qualify sub-orbital flights at least partially as aviation, EASA could play a role with regard to safety and licensing issues of sub-orbital flights. Of course, if *Alpha* and *SpaceLiner* flights were considered purely as aviation, there would be no question about the competence of EASA, while if they were defined purely as space activity, the probability of EASA competence would be remote and these flights would then rather be regulated under national and international space law. The problem here arises, same as elsewhere, due to the undefined nature of these sub-orbital activities.

Should the EU qualify sub-orbital private human spaceflight wholly or partially as “aviation”, the next step could be to give a formal role to EASA with regard to safety and licensing issues, possibly through an amendment to the Basic Regulation (EC) No. 216/2008, in order to include sub-orbital space tourism in the mandate of EASA.⁴⁵

In this context, it is interesting to note that very recently the EU has recognised EASA’s authority to regulate another kind of vehicle of which it was hard to define whether it is an aircraft or something else, namely Unmanned Aircraft Systems (UAS, sometimes also referred to as UAV). So possibly the EU might do the same in the future for sub-orbital vehicles.

A number of EASA officials presented a paper suggesting a regulatory approach within EASA for sub-orbital flights at the 3rd Conference of the IAASS⁴⁶, held in Rome in October 2008⁴⁷, and in a follow-up

⁴⁴ See reference in note 41 above.

⁴⁵ Tanja Masson-Zwaan, *supra* note 42, p. 271-2.

⁴⁶ International Association for the Advancement of Space Safety. See: <http://www.iaass.org/>.

⁴⁷ The paper, authored by Jean-Bruno Marciacq *et alia*, is titled “Accommodating sub-orbital flights into the EASA regulatory system”: http://www.congrex.nl/08a11/presentations/day1_S09/S09_05_Marciacq.pdf. EASA has in fact been approached

presentation at the 4th IAASS Conference in Huntsville, USA in May 2010. This seminal paper has been further elaborated in a third one, presented at the 61st International Astronautical Congress held in Prague in September 2010⁴⁸. It must be stressed that the views expressed in these papers are not officially those of the agency.

In the 2008 paper, the ESA definition quoted above was accepted, but the authors would see EASA's involvement limited to winged aircraft, including rocket-powered winged airplanes, calling them "Sub-orbital Aeroplanes" (SoA). This excludes pure rockets, and thus "space tourism" ventures using the concept of a vertical take-off. Therefore, the EASA definition is more restrictive than the ESA one. The authors consider that EASA would have regulatory competence over SoA and would treat them as aircraft in a similar way as Unmanned Aircraft Systems (UAS), by complementing existing rules to capture their specific features. They hold that sub-orbital aeroplanes generating aerodynamic lift during the atmospheric part of the flight must be considered to be aircraft. Their airworthiness, crews and operations are under the remit of EASA. The Agency is therefore currently preparing to fulfil its role in relation to civil sub-orbital flights, aircrafts and operations. Finally, the authors claim that EASA would not have competence for "that (very short) outer space part of sub-orbital flight, unless it agrees with the States to enforce this responsibility on their behalf".⁴⁹

The approach taken in the EASA paper would be to require full certification for commercial sub-orbital "space tourism" vehicles. One of the reasons why a more restrictive approach to "space tourism" than the one taken by the FAA seems to be preferred by these authors, is that EASA issues certificates, whereas the FAA issues licenses. Certification entails responsibility, while licensing leaves the responsibility with the operator.⁵⁰

Because of its higher potential exposure to liability, it may be expected that EASA would not be inclined to adopt a transitional regime as has been done by the FAA in the USA. It would however not be desirable for EASA to regulate only that portion of the activity that takes place in the "airspace" – not only because of the absence of an internationally accepted definition or delimitation, but also because this would be highly impractical.

One possible approach for a future European regulation on commercial sub-orbital human activities could be then to create a "Space Transportation Department", with a similar role to the one played by the Office of Space Transportation within the US FAA. It would grant authorisation at the European level, ensure harmonisation of standards and safety of the flights, and serve as the direct European connection for all topics of relevance for the regulation of these activities and their success in practice.⁵¹

4.5. Regulating sub-orbital flights in Europe: national regulation

In the absence of a uniform international or European regime, each European country has sovereignty to regulate human sub-orbital flights launching from and operated within its territory, and decide whether they are to be considered aircraft flights or rocket launches.

by (unnamed) potential applicants, which encouraged it to come forward with a proposed regulatory framework. See also: <http://www.flightglobal.com/articles/2008/10/28/317902/easas-space-tourism-approach-requires-certification.html>.

⁴⁸ The new paper is "Space transportation solutions and innovations (Towards regulating sub-orbital flights – an updated EASA approach)", 61st IAC, Prague, October 2010. See also draft report of EASA Safety Plan 2011-2014, at: [https://easa.europa.eu/sms/docs/European%20Aviation%20Safety%20Plan%20%20\(EASp\)%202011-2014%20v1.2.pdf](https://easa.europa.eu/sms/docs/European%20Aviation%20Safety%20Plan%20%20(EASp)%202011-2014%20v1.2.pdf), which includes regulation of sub-orbital (aero)planes in the list of future tasks for the Agency.

⁴⁹ Jean-Bruno Marciacq *et alia*, *ibidem*.

⁵⁰ Jean-Bruno Marciacq *et alia*, *ibidem*, at heading 2.3.

⁵¹ Julie Abou Yehia & Kai-Uwe Schrögl, "European regulation for private human spaceflight in the context of space traffic management", *Acta Astronautica* 66 (2010), p. 1622.

As a first alternative to the EASA approach, sub-orbital vehicles (all of them, or at least those that use exclusively rocket propulsion during all their journey into space) might be considered more akin to spacecraft. In that case, they most likely will remain under the jurisdiction of each EU member state⁵².

Consequently, and since the EU has no competence for harmonisation of national space laws, a realistic approach for concerted action within the EU might be seen in cooperation and coordination of the legislating states. Ideally this would be done through intergovernmental agreements, or if that is not feasible, at the very least on the basis of frequent consultations (formal and informal) between them⁵³.

National regulations may be enforced in European countries to ensure safety of the vehicles and to protect participants from the possible negative and dangerous effects of human sub-orbital flights: radiation (in the case of crew), accidents, emergencies on board, etc. As for the medical risks to passengers, or spaceflight participants, some pre-flight health and fitness tests, and some previous days of basic training (for instance, basic emergency response training) may become the object of some national regulation, or might become customary practices in the space transportation industry.⁵⁴

Even if we considered sub-orbital flights as aerial rather than space, a solution different than the EASA approach would still be possible. For the reasons that were exposed above, a number of authors have questioned that sub-orbital flight is really a space activity. Sub-orbital “space tourism” will be basically taking place in the airspace of one given country, therefore without any international implications. The concerned state is then perfectly capable to regulate the whole activity in the framework of its national law. In other words, national law applicable to aviation would suffice to regulate these flights.

Under the “Basic Regulation” (BR) establishing EASA, member states have the possibility to exclude certain aircraft from its regulation, by considering them as “aircraft specifically designed or modified for research, experimental or scientific purposes, and likely to be produced in very limited numbers”.⁵⁵ This exclusion applies for instance to historic aircraft, research, experimental or scientific aircraft, and military or police aircraft, which are then regulated under national law instead of by EASA. EU member states might decide to apply this legal exclusion to sub-orbital vehicles as well.

5. CONCLUSIONS

Considering that a sub-orbital vehicle operates both inside and outside the boundaries of the atmosphere, exactly when this activity will be considered aviation, and when it will be considered spaceflight, is uncertain. However, such a characterisation will have important consequences for the industry, and for its chances of having a stable regulatory landscape.

The EASA approach is that “sub-orbital aeroplanes”, defined as all winged vehicles (i.e. vehicles that derive any support from the atmosphere for the largest part of their flight) are considered as “aircraft”, and thus should be regulated as such, with only some minor additional complications if such vehicles fly into space –however that is defined–. This criterion would include some of the proposed sub-orbital vehicles, namely those air-launched (*Alpha*, *SS2*, *Lynx*); but it would exclude others, like those using

⁵² The following EU states have enacted national space legislation: Sweden (Act on Space Activities, 1982), United Kingdom (Outer Space Act 1986), Belgium (Belgian space law of 2005), The Netherlands (Law on Rules Concerning Space Activities and the Establishment of a Registry of Space Objects of 2006), and France (French space law of 2008). In addition, as of 2011 Germany and Austria are in the process of elaborating their own national space laws. Only the Dutch Law makes a brief mention to an eventual inclusion within its scope of commercial human space activities, in its Sec. 2.2.b).

⁵³ Michael Gerhard & Kai-Uwe Schrögl, “A Common Shape for National Space Legislation in Europe”, in Proceedings of the 47th IISL Colloquium on the Law of Outer Space (2004), pp. 81-90.

⁵⁴ A good discussion on the medical risks faced by participants in sub-orbital flights is contained in the International Academy of Astronautics study “Medical safety and liability issues for short-duration commercial orbital space flights”. Available at <http://iaaweb.org/iaa/Studies/sg26finalreport.pdf>.

⁵⁵ See the EASA Basic Regulation (BR), at <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:079:0001:0049:EN:PDF>, Art. 4.4 and Annex II.

expendable or reusable vertical take-off launchers (i.e. those of the American companies Blue Origin and Armadillo, as well as the Copenhagen concept).

Adopting the EASA approach would mean to have two completely different regimes applicable to sub-orbital vehicles, depending on whether the concerned concept involves a horizontal take-off and/or air-launch, or a vertical rocket launch, despite the fact that otherwise they present similar mission characteristics. This may not be desirable: it would not contribute to the legal certainty and to the uniformity that are required to sustain the nascent human sub-orbital industry. It may be preferable to apply a single regime to all sub-orbital “space tourism” concepts, i.e. space law, on the basis of the proposed function of the vehicle, namely that it is destined to reach outer space.⁵⁶

It would also be worthwhile to study in more detail the implications of EASA’s requirement for certification of sub-orbital vehicles in Europe. Certification of aircraft is an extremely lengthy and costly procedure that may not be suitable for the kind of experimental craft that is under discussion here. The adoption of this path for authorisation might increase safety, but at the disproportionate cost of ruining the business case for most if not all of the prospective sub-orbital operators. In this context, we should take into account the fact that human sub-orbital flight will be, at least in the beginning, a rather small market. Also, if the US and Europe adopt very different approaches to regulating the emerging commercial human spaceflight industry, the divergence will force spacecraft operators to operate in very different regulatory environments⁵⁷. It seems clear however that if vehicles such as SS2 or *Alpha* are considered as falling within the realm of aviation, in principle EASA would be the competent authority to regulate them in Europe, including all matters of safety oversight and certification.

Alternatively, the EU Member States may decide to exclude low-energy sub-orbital vehicles from EASA’s mandate. Then, the task of regulating sub-orbital vehicles of the *Alpha* class would be back in the hands of the Member States – which does not mean that they could not undertake some form of harmonisation of national legislation among themselves or in other fora than the EU.

As to the task of regulating high-energy sub-orbital spaceplanes used for international point-to-point transportation (*Spaceliner*), due to the winged character of such vehicles and the international aviation nature of the activity, it is even more likely that they would fall under the competence of EASA in Europe. However, in this case we are considering a much more futuristic concept, which so far has not been discussed by the EASA officials in their papers.

In the longer term, from an international and a European perspective, the ideal solution for regulation may be to create a separate legal regime specifically addressing the particular nature of sub-orbital flight. Sub-orbital transportation is neither aviation nor outer space flight, it is rather something in between. A new legal regime would be able to combine notions of both air and space law, in order to overcome and resolve the current deficiencies of both disciplines.

⁵⁶ Tanja Masson-Zwaan & Steven Freeland, *supra* note 19, p. 1602.

⁵⁷ On this particular issue, see e.g. <http://www.parabolicarc.com/2011/05/13/big-useuro-divide-commercial-spaceflight-regulations/>.