

NON-ORBITAL SPACEFLIGHT ACTIVITIES

The Space Law Committee is active already for quite some time. Important accomplishments under its former chairman Prof. Karl-Heinz Böckstiegel included the preparation of principles on space debris.¹ The adoption of a Model Law on National Space Legislation in 2012 in Sofia, Bulgaria, under the chair of Prof. Maureen Williams, also belongs to its achievements.²

After this successful work, the Committee started, under the chair of Prof. Maureen Williams of HQ branch with Prof. Hobe from the German branch as Rapporteur, to work on four new subjects: dispute settlement, satellite data in international litigation, space debris, and non-orbital spaceflights. On the topic of non-orbital spaceflight, Prof. Hobe tabled a first report in 2014 (Washington) and a second report at the Johannesburg 2016 conference.

After the ILA Conference in Japan in 2020 which – due to the COVID-19 pandemic – was no real working session for the Space Law Committee, the third report on non-orbital spaceflight was submitted by the Space Law Committee under the chair of Prof. Hobe with the Rapporteurs Dr De Man and Dr Popova in 2022 in Lisbon. After intensive discussions, the Austrian branch invited the Committee to Vienna, in 2023, to discuss open questions in order to get a ready draft to be adopted at the 2024 ILA conference in Athens.

Moreover, in 2021, the first crewed non-orbital flight was launched, followed by three others during the same year. The emerging practice made additional consideration and legal analysis possible and necessary.

As noted also below in the explanatory remarks for the definition of ‘non-orbital spaceflight activity’, these Rules use the term ‘non-orbital’ instead of the more commonly used notion ‘suborbital’. This choice has been made after a thorough consideration of the most relevant technical and physical characteristics both of the environments in which such activities take place, and of the technical concepts applied. It is the velocity reached by the vehicles used for parabolic (spaceflight) activities that does not and/or is not intended to allow them to complete a full orbit around Earth. The maximum altitude reached can vary. Thus, ‘non-orbital’ refers more appropriately to the main distinguishing criterion characterizing such activities – velocity – which is crucial to distinguish parabolic (space)flight not intended to complete an orbit around the Earth, from space activities carried out via spacecraft that operates in orbit and performs orbital rotation.

Building on the extensive work that has already been done, the ILA Space Law Committee has used the intersessional period between the ILA Biennial Conference in Lisbon (2022) and the

¹ “International Instrument on the Protection of the Environment from Damage Caused by Space Debris”, adopted at the ILA Conference in Buenos Aires 1994, see International Law Association, Report of the 66th Biannual Conference in Buenos Aires (1994) 317-321.

² “Sofia Guidelines for a Model Law on National Space Legislation”, adopted at the ILA Conference in Sofia 2012; see International Law Association, Report of the 75th Biannual Conference in Sofia (2012) 307-313. The Model Law has served several governments in their development of national space legislation.

following one in Delphi in 2024 to discuss and agree on pertinent issues of the Rules, in particular as concerns the commonalities and differences between international space law and air law. This is done in order to identify the relevant rules that can be applied to non-orbital spaceflight, considering that, for example, while international space law does not primarily regulate commercial activities (leaving this via Art. VI Outer Space Treaty to national space legislation), air law offers very detailed rules not only in the Chicago Convention but also in the Standards and Recommended Practices contained in the Annexes to the Convention e.g. on personnel licensing, aircraft operation and airworthiness of aircraft (complemented by Procedures for Air Navigation Services containing detailed technical instructions as well as by manuals and circulars published by ICAO to assist states in implementing general standards).

The present Rules on non-orbital spaceflight activities have been drafted by the ILA Space Law Committee to serve as a reference³ for national legislators. They provide the main elements that should be considered when regulating civil/commercial non-orbital spaceflight activities at the national level, and can be flexibly adapted. At the same time, they can serve as a guidance for international organisations deliberating on the regulation of such activities, and potentially contribute to less fragmented standards and better harmonised requirements for such activities.

I. General overview of the legal problems related to non-orbital (spaceflight) activities

1. Scope of application

The present Rules drafted by the ILA Space Law Committee shall be applicable to civilian, non-orbital spaceflight activities. Such activities are characterized by the fact that, while the vehicle enabling the activity is intended to leave airspace and result in activities related to the exploration and use of outer space, it does not aim to go into or complete a full orbit around the Earth, or go beyond Earth orbit. Its flightpath follows a parabolic trajectory and is completed when the vehicle returns to Earth. Because the non-orbital activity is aimed to at least “reach” outer space and in some cases to have a direct effect in outer space, it is categorized as an activity in the exploration and use of outer space, and hence as a type of space activities.

The most common examples for non-orbital spaceflight vehicles are the concepts designed for commercial non-orbital spaceflight developed by Virgin Galactic and Blue Origin. These activities should be distinguished from other activities that bring vehicles to fly in a parabolic trajectory, such as, for example, high-altitude platforms; sounding rockets or balloons that reach higher atmospheric regions without getting even close to achieving one orbit around the Earth; spacecraft designed to carry out deep space missions that can leave near-Earth space before completing one full rotation around the Earth. It is important to note that even though intercontinental ballistic missiles (ICBMs) may reach space at a velocity close to the orbital

³ An example of an ILA model national law are the Sofia Guidelines for a Model Law on National Space Legislation, adopted at the 75th Conference in 2012.

velocity, they are not to be considered non-orbital spaceflight vehicles within the scope of these Rules, as their activity is generally not considered a space activity.

2. The current status of relevant regulation

The regulation of non-orbital spaceflight activities poses a long list of unresolved issues that require legal consideration. Some of them have been discussed in organisations and fora such as ICAO, UNCOPUOS and UNOOSA at the international level, and have been also tackled by national authorities, e.g. the U.S. Federal Aviation Administration. These unresolved issues concern both general as well as specific questions stemming from the fact that non-orbital spaceflight activities are a new concept that does not completely fall within the scope of established fields of law, such as air law and space law. They include, *inter alia*, the following aspects:

1. the lack of clarity regarding the applicable (international) law;
2. the relevance of air law and space law;
3. the relationship between national legislation and the applicable international law to non-orbital (spaceflight) activities;
4. the lack of legally binding definitions clarifying relevant terms such as, ‘non-orbital vehicle’, ‘non-orbital spaceflight’ and ‘non-orbital activity’;
5. the scope and possible elements of a potential *sui generis* legal order;
6. the question of a competent regulatory authority;
7. the scope of a comprehensive liability and insurance regime for non-orbital (spaceflight) activities;
8. the need for a registration regime for non-orbital (spaceflight) activities;
9. the need for an extensive authorization regime guaranteeing the “air/space- worthiness” of non-orbital vehicles as well as the coordination between air traffic and space traffic, including objects using the so-called meso-space (e.g. HAPS and high- altitude balloons);
10. the status of different categories of persons participating in non-orbital (spaceflight) activities (e.g. pilots/commanders, trained crew, passengers/spaceflight participants) and the provisions/policies applicable to them;
11. various aspects of space transportation (i.e. transportation between two points on Earth, through space) as an application of non-orbital (spaceflight) activities.
12. the regulation of facilities used for carrying out non-orbital spaceflight activities.

These issues are dealt with in these Rules and the accompanying explanatory remarks.

II. Rules and explanatory remarks on Non-Orbital Spaceflight Activities

1. Definitions

Article 1

Definitions

- a) A non-orbital spaceflight activity is any activity at least partly in outer space that does not reach orbital velocity and is not intended to complete an orbit around the Earth.
- b) A non-orbital spaceflight vehicle is any object performing a non-orbital spaceflight activity.
- c) A non-orbital spaceflight operator is the entity, governmental or non-governmental, carrying out a non-orbital spaceflight activity.

a) ‘non-orbital spaceflight activity’

With reference and building upon the (non-legally binding) working definition of ‘non-orbital flight’ suggested by ICAO (“A sub-orbital flight is a flight up to a very high altitude which does not involve sending the vehicle into orbit”)⁴, a non-orbital spaceflight activity can be defined as follows:

Article 1 para. a)

Definition of ‘Non-orbital Spaceflight Activity’

A non-orbital spaceflight activity is any activity [at least partly in outer space] [] that [does not reach orbital velocity and] is not intended to complete an orbit around the Earth.

Explanatory remarks:

- i) *Velocity rather than altitude is the defining criterion for non-orbital spaceflight activities*

⁴ ICAO Council – 175th Session, Concept of Sub-Orbital Flights, Working Paper C-WP/12436, May 5, 2005, p. 2 and Concept of Suborbital Flights: Information from the International Civil Aviation Organization (ICAO), paper A/AC.105/C.2/2010/CRP.9, presented at the 49th session of the Legal Subcommittee of UNCOPUOS, 19 March 2010.

Despite extensive discussions in various international forums, there is no commonly fixed altitude above the surface of the Earth which can be reliably considered to constitute a boundary between airspace and outer space. Moreover, altitude is not the best-suited criterion to define a non-orbital spaceflight activity considering that non-orbital concepts will develop, and in the future higher vehicles may reach higher altitudes in the course of their non-orbital spaceflight trajectory. The highest altitude that a non-orbital vehicle may reach during its flight should hence not be a determining criterion to define a non-orbital spaceflight activity.⁵

Some regulatory proposals and national laws do refer to altitude as a criterion of differentiation between space activities and non-orbital spaceflight activities. For example, the New Zealand Outer Space and High Altitude Activities Act from 2017, without a direct reference to non-orbital spaceflight or non-orbital/suborbital activities, regulates the licensing of activities reaching altitudes above flight level 600⁹ or above the highest upper limit of controlled airspace.⁶ The Act defines ‘high-altitude vehicle’ as “*an aircraft or any other vehicle that travels, is intended to travel, or is capable of travelling to high altitude*”.⁷ Moreover, the 2018 UK Space Industry Act⁸ applies to a “*rocket or other craft that is capable of operating above the stratosphere*”,⁹ thus referring to the upper strata of Earth’s atmosphere as a distinctive physical criterion.

Likewise, the 2010 ICAO proposal on the concept of ‘suborbital flights’¹⁰ also includes a reference to altitude as a relevant criterion for defining this notion in its relationship to aircraft activities, yet clarifies that such criterion is not sufficient to distinguish it from activities performed by registered space objects. As a result, the proposal defines a suborbital flight as “*a flight up to a very high altitude which does not involve sending the vehicle into orbit*”.¹¹

The 2019 UAE Federal Act on the Regulation of the Space Sector follows a similar approach and provides separate definitions for ‘orbital spaceflight’ (“*A Spaceflight with the intention of completing an orbit around the Earth*”) and ‘sub-orbital flight’ (“*A Spaceflight with the intent*

⁵ The lowest point in a viable orbit completed by a satellite lies at 84 km, and some suborbital vehicles have crossed the “von Kármán line”, generally accepted to refer to an altitude of approximately 100 km. For example, Virgin Galactic’s SpaceShipOne reached 100, 102, and 112 km during three test flights in 2004, see <https://airandspace.si.edu/collection-objects/spaceshipone>. Blue Origin’s New Shepard reached 105 km during its 12th test flight in December 2019, see <https://www.blueorigin.com/new-shepard/>. Although Theodore van Kármán originally had introduced 50 miles (approx. 80 km) as the altitude at which the atmosphere is so thin that aircraft cannot be sustained by aerodynamic forces and thus separates aeronautics from astronautics, through the modified reference of the Fédération Aéronautique Internationale (FAI), the altitude of 100 km became widely known as the “von Kármán line”. The FAA, for example, sets the von Kármán line lower – at 50 miles. More recently, arguments have been made to re-establish von Kármán’s original definition. See, Jonathan McDowell, “The Edge of Space: Revisiting the Karman Line”, *Acta Astronautica* 151 (2018), pp. 668-677; Thomas Gangale, *How High The Sky? The Definition and Delimitation of Outer Space and Territorial Airspace in International Law* (Brill/Nijhoff 2018).

⁶ *Ibid.*, Section 4, ‘high-altitude’, alt. (b.)

⁷ Outer Space and High-altitude Activities Act 2017, Section 4, ‘high-altitude vehicle’ and Section 88 (1) (13).

⁸ UK Space Industry Act, Chapter 5, Section 1 “Introduction”, Subsections (4) and (6).

⁹ UK Space Industry Act, Chapter 5, Section 1 “Introduction”, Subsection (5).

¹⁰ See the Concept of Suborbital Flights: Information from the International Civil Aviation Organization (ICAO), paper A/AC.105/C.2/2010/CRP.9, presented at the 49th session of the Legal Subcommittee of UNCOPUOS, 19 March 2010.

¹¹ Information from the International Civil Aviation Organization (ICAO), paper A/AC.105/C.2/2010/CRP.9, presented at the 49th session of the Legal Subcommittee of UNCOPUOS, 19 March 2010.

to enter the Specified Area without the intention of completing an orbit around the Earth”). Thereby, the UAE law relies not only on the altitude of 80 km at which the specified area starts, but specifically refers to the aim of completing an orbit as the decisive criterion.¹²

From these examples, it becomes evident that while some proposals (of New Zealand and the UK) suggest that suborbital activities are characterized by the altitude the vehicle reaches, other regulatory approaches (of ICAO and the UAE) refer also to the lack of intention to complete an orbit around the Earth during the activity. The critical importance of the orbital velocity as opposed to the altitude of the suborbital vehicle is reflected in the definition offered by the US legislator, which defines ‘suborbital trajectory’ as “[t]he intentional flight path of a launch vehicle, re-entry vehicle, or any portion thereof, whose vacuum instantaneous impact point does not leave the surface of the Earth”.¹³

With a view to offering a flexible and comprehensive regulatory approach in creating these rules for non-orbital spaceflight activities, it is essential to take into account the fact that the exact altitude reached by a non-orbital spaceflight vehicle may vary depending on different non-orbital (vehicle) concepts¹⁴ and that it may change as technology advances. Furthermore, irrespective of whether it is a scientifically viable approach or not, the international progress of negotiations on the topic of delimitation between airspace and outer space has shown that a consensus on setting the ‘boundary’ of outer space or defining an area based on altitude will probably not be reached in the near future.¹⁵

Thus, while altitude is a relevant criterion to circumscribe non-orbital spaceflight activities, in particular in their relationship to other activities typically performed by aircraft, it is neither the only, nor the most relevant criterion for *defining* these activities. Indeed, it should be recognized that, for defining non-orbital spaceflight activities, more important than altitude considerations is the fact that the spaceflight vehicle is not intended to reach a velocity sufficient to complete a full orbit around the Earth. Further, differently from aircraft, such vehicles are also not sustained through aerodynamic drag during the (whole) duration of their parabolic flight.¹⁶

¹² United Arab Emirates, Federal Law No. (12) of 2019 on the Regulation of the Space Sector, issued on 19 December 2019.

¹³ U.S.C., Title 51, §50902(23). The vacuum instantaneous impact point should be understood as the impact point, following thrust termination of a launch vehicle, calculated in the absence of atmospheric drag effects. A 2014 Spanish draft Bill on Outer Space Activities that was not made into law defines suborbital flights as “flights that do not enter into Earth’s orbit but have their primary goal to perform an activity in an area which is bordering what can be considered as outer space”. Rafael Moro-Aguilar, National Regulation of Private Suborbital Flights: A Fresh View. FIU Law Review, Vol. 10, No. 2, Art. 18, 2015, p. 707.

¹⁴ See, *supra* 1.

¹⁵ UNCOPUOS, Historical Summary on the consideration of the question on the definition and delimitation of outer space, UN Doc. A/AC.105/769 (2002).

¹⁶ Whether aerodynamic drag plays a role at least for one part of the activity, depends on the concept applied. Vertical take-off/vertical landing (VTVL) suborbital vehicles are launched and landed like rockets. Horizontal take-off/horizontal landing (HTHL) suborbital vehicles rely heavily on aerodynamic drag as they use a runway for take-off and landing, similarly to airplanes. The combined vertical take-off/horizontal landing (VTHL) concept is used for vehicles using thrust for launch which can land on a runway and thus use aerodynamic drag during the landing phase. For the definition used in the US legislation, see 51USC § 50902(25): “suborbital trajectory” means

ii) *‘Non-orbital spaceflight activity’ vs. ‘non-orbital flight’*

Non-orbital spaceflight activities are approached in these rules as a subset of space activities, as they refer to activities that have as their objective a form of exploration or use of outer space, as understood by the UN treaties on outer space. They can be distinguished from other types of activities in that they use vehicles (or composite vehicle concepts) that are capable of operating in outer space, yet without the aim of completing a full orbit around Earth, or going beyond Earth orbit.

For the purpose of these rules, the notion ‘non-orbital spaceflight activity’ is therefore used instead of the narrower term ‘suborbital flight’ included in some of the legislative proposals quoted in the previous section.

The 2018 UK Space Industry Act refers to suborbital activities¹⁷ as different from space activities, but establishes common rules and procedures for their licensing. Furthermore, as the key distinctive feature for non-orbital spaceflight activities is velocity (higher *vis-à-vis* flight of aircraft, but lower than needed for the orbital motion of space objects),¹⁸ no specific differentiation shall be made with regard to the purpose of the non-orbital spaceflight activity as scientific (e.g. for tests, scientific microgravity experiments, in-flight test purposes, astronauts training), touristic, commercial or military, to name but a few. On the applicability of international law, see below under Article 2.

iii) *Not every parabolic flight is a non-orbital spaceflight activity*

The wording used in Article 1 para. a) – “A *non-orbital spaceflight activity* (...) *not intended to complete an orbit around Earth*” underlines the relevant link between non-orbital spaceflight activities and outer space. This link is confirmed, for example, by the US law which links (manned) suborbital spaceflight to space launches by defining ‘launch’ as placing or the attempt to place “*a launch vehicle or a re-entry vehicle and any payload or human being from Earth in a suborbital trajectory, in Earth orbit in outer space; or otherwise on outer space*”.¹⁹

There are other types of non-orbital flights which are sent into parabolic trajectory, such as experimental rockets or fireworks that may reach only low altitudes of a few dozen meters or kilometers. Such cases are not to be regulated herein.²⁰ These rules refer specifically to non-

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

¹⁷ Suborbital activity is defined as the “launching, procuring the launch of, operating or procuring the return to Earth of a [...] rocket or other craft that is capable of operating above the stratosphere, a balloon that is capable of reaching the stratosphere carrying crew or passengers, or an aircraft carrying such a craft, but does not include space activity”, UK Space Industry Act, I (4).

¹⁸ As pointed out by the IAASS, suborbital flights are flights “up to an altitude at which the vehicle does not reach orbital velocity”, IAASS, Safety Design and Operation of Suborbital Vehicles guidelines, October 7, 2015.

¹⁹ United States Code, Title 51, §50902 (7).

²⁰ See, in particular Section II.1. above.

orbital spaceflight activities carried out by vehicles that can employ a velocity high enough to “reach” or come close to outer space, but which is nevertheless lower than the velocity needed to complete a full orbit around the Earth, including the possibility to reach a different point on Earth than the initial starting point of the flight for transportation purposes.²¹

The phrase ‘not intended to complete an orbit around Earth’ should be read in conjunction with the parabolic nature of the intended flight, so that the definition clearly does not include such space activities that, while not completing an orbit around Earth, have as their intended flightpath a trajectory beyond Earth orbit through outer space (e.g. robotic interstellar probes such as the ones launched in the Voyager program).

b) *‘non-orbital spaceflight vehicle’*

For the purposes of these rules, a non-orbital spaceflight vehicle could be defined as:

Article 1 para. b)

Definition of ‘Non-orbital Spaceflight Vehicle’

A non-orbital spaceflight vehicle is any object performing a non-orbital spaceflight activity.

Explanatory remarks: The notion ‘non-orbital spaceflight vehicle’ is used in order to differentiate vehicles used for non-orbital spaceflight activities from aircraft and from space objects, without linking such vehicles to either air law or space law.

Non-orbital spaceflight vehicles may be constructed and function according to various technological concepts (e.g. VTVL, HTHL or VTHL).²² This may include vehicles operating as aircraft for a part of their operation (i.e. horizontal take-off and/or horizontal landing), vehicles that do not classify as aircraft for any portion of the operation (i.e. vertical take-off and/or vertical landing of suborbital rockets), and also composite vehicles consisting of a carrier craft (airplane) and a rocket-engine vehicle used for the parabolic part of the flight.²³

As the existing concepts are non-exclusive, the proposed definition is kept general and with a focus on the purpose of use, in order to encompass all possible technological varieties for

²¹ Plans for such forms of point-to-point transportation between two points on Earth, through space, have been announced by companies such as SpaceX, Blue Origin and Virgin Galactic (together with NASA and The Spaceship Company, see the Space Agreement (SAA), with more concepts by other actors expected to follow.

²² See, *supra* 1.

²³ The most famous example for a composite suborbital vehicle is the concept that won the X Prize in 2004, SpaceShipOne/White Knight, and its successor SpaceShipTwo/White Knight Two (in test flight since 2013, but not yet operating).

vehicles which can be used for non-orbital spaceflight activities - without aiming at defining the vehicle either as an aircraft or as a space object.

c) *Non-orbital operator*

Article 1 para. c)

Definition of 'Non-orbital Spaceflight Operator'

A non-orbital spaceflight operator is the entity, governmental or non-governmental, carrying out a non-orbital spaceflight activity.

Explanatory remarks: As non-orbital spaceflight activities take place at least partly outside national territory and airspace, it is necessary to associate the entity undertaking the activity (irrespective of the fact whether it is governmental or non-governmental) with a State. This 'attribution', resp. 'allocation', of the non-orbital operator to a given State can be established on the basis of registration of the entity. The State in which the entity is registered is not necessarily the same as a State(s) that authorizes the non-orbital spaceflight activity according to Articles 3 and 4, and/or which registers the non-orbital spaceflight vehicle under Article 5 (as there may be more than one authorizing State).

2. **Applicability of international law to non-orbital spaceflight activities**

Article 2

Applicability of International Law

To the extent that non-orbital spaceflight activities are not confined to national territory, including national airspace, the relevant rules of international law [and the rules implementing them at national levels] must be respected.

Explanatory remarks: To the extent that activities performed by non-orbital spaceflight vehicles (1) are not confined to national territory, including national airspace; (2) may reach and pass through international airspace; (3) reach higher altitudes in which no aircraft can fly, but also where no orbital motion is possible, so that it is questionable whether space law would apply; and with this, arguably, possibly neither air law, nor space law apply directly; and (4) are primarily aimed to "reach" outer space, they do have many commonalities with space activities, and the relevant rules of international space law will be applicable to these activities.

Accordingly, unless specific provisions of international law exist, general international law will be applicable to non-orbital spaceflight activities to the extent that they transcend areas regulated by other specific legal regimes. For those phases of non-orbital spaceflight activities that take place in the airspace or otherwise on the territory of (a) State(s), and further considering that international law can (with a few exceptions) not create direct rights and obligations for private entities, the domestic legal system of such States must be respected as well.

The transboundary character of non-orbital spaceflight activities does require the development of specific, tailored legal rules that may incorporate concepts contained in air law and space law, also in an analogous form, where suitable and necessary, but which cannot be taken solely from only one of those fields.

3. Authorization of non-orbital spaceflight activities

a) Authorizing State(s)

Article 3

Authorizing State

Every non-governmental non-orbital spaceflight activity must be authorized by an appropriate State, being

- (i) (primarily) the State on whose territory or from whose facility the activity, or part(s) of it, is carried out; or
- (ii) the State(s) whose nationals, including natural and legal persons, carry out the activity, or part(s) of it; or
- (iii) the State(s) from whose vessels or aircraft (registered in the state's national registry) the activity, or part(s) of it, is carried out.

Explanatory remarks: As non-orbital spaceflight activities involve various significant risks which may materialize on Earth, in airspace or at a higher altitude, an extensive regime for governmental authorization for non-governmental operators has to be established. Such a regime will allow national authorities to apply strict criteria to private non-orbital operators, the non-orbital spaceflight vehicles and to the parameters of the intended activity.

In these draft rules, the use of the verb 'perform' or 'conduct' are preferred to 'launch' or 'take off' in order to encompass the different concepts for suborbital non-orbital spaceflight vehicles, including those that do not necessarily involve a launch and may instead use an aircraft as part

of a composite vehicle.²⁴ Unlike one-time vehicle registration of ships and aircraft, due to the complex potential hazards that may result from non-orbital spaceflight activities, Article 3 requires that every aspect of a non-orbital spaceflight activity is authorized, subject to the specific regulations of national authorization regimes (see Article 4). In addition, Article 5 of these rules provides for the national registration of suborbital non-orbital spaceflight vehicles for purposes of enhancing transparency and enabling international coordination.

Due to the close link between the activity in its first phase (launch/take-off), on the one hand, and the territory (or facility, or from whose vessels or aircraft registered in the State's national registry) of a State where the vehicle is taking off/is being launched/is landing, on the other hand, it is presumed that the identification of an appropriate State to authorize the activity, and, respectively, to impose requirements for the technical "air/space worthiness" as well as the vehicle and the competence of the crew, as is well established in air law, will be based primarily on the territorial jurisdiction of the State over the territory (or facility), from which the activity is performed.

In addition, in case the non-orbital spaceflight vehicle is not intended to land at the same location/on the same territory that it was launched/took off from, or in case the initial phase of the non-orbital spaceflight activity is conducted from a multinational facility located beyond national jurisdiction (e.g. on the High Seas), the competence for authorization can be derived in reference to space law²⁵, which requires space activities to be authorized by the 'appropriate State' – a concept which not only entails a positive obligation of the State to authorize and to subsequently continuously supervise the activity, even though not always straightforward in its application, but which can be useful for cases in which it is not possible or not sufficient to resort to territorial jurisdiction for determining the authorizing State.

In case there is no single State considered to be exercising territorial jurisdiction (for example, because a given non-orbital spaceflight activity is conducted from an area beyond national jurisdiction such as the High Seas, and there is no clearly defined territorial link to the facility used), and therefore, no State can authorize the activity in question, personal jurisdiction can be applied as a subsidiary link, thus ensuring that there will always be at least one State responsible for authorizing said activity.

In sum, it is recommended that – depending on the individual technical concept applied, and the location(s) and facility used, every (non-governmental) non-orbital spaceflight activity must be authorized by the State from whose territory or facility the activity, or part(s) of it, is performed; or whose nationals, including natural and legal persons, carry out the activity, or part(s) of it; or from whose vessels or aircraft (registered in the state's national registry) the activity, or part(s) of it, is conducted.

²⁴ As is the case with Virgin Galactic's SpaceShip/WhiteKnight composite suborbital vehicle series

²⁵ Art. VI Outer Space Treaty.

Even though currently, non-orbital spaceflight activities usually take off and land within the same territory, it is possible that in the future certain non-orbital spaceflight activities also use the territories of more than one State.

b) Requirements for authorization

Article 4

Elements of Authorization

(1) The information required for deciding on the authorization of non-orbital spaceflight activities shall cover the activity, the vehicle, and the operator.

(2) The activity-related information shall include:

- (a) Main purpose of the activity;
- (b) Route description: altitude/trajectory/time of non-orbital spaceflight and landing location;
- (c) Coordination with air traffic control;
- (d) Type of cargo/number of crew members and spaceflight participants;
- (e) Qualification of commanders, crew members and spaceflight participants;
- (f) Compliance with Annex 6 of the Chicago Convention on Operation of Aircraft, as far as applicable,
- (g) Insurance for third-party liability of the non-orbital space vehicle and of any person participating in the activity through the operator.

(3) Information with regard to the non-orbital spaceflight vehicle shall include:

- (a) Initial air/space worthiness in compliance with Annex 8 of the Chicago Convention on Airworthiness of Aircraft, as far as applicable,
- (b) Main design features;
- (c) Safety features;
- (d) Continuing air/space worthiness, including maintenance organization and maintenance personnel, in accordance with Annex 8 on Airworthiness of Aircraft, as far as applicable.

(4) Information relating to the operator shall include:

- (a) Operator name and trading name;
- (b) Operator's principal place of business address;
- (c) Names and contact details of operational management;
- (d) Documentation on technical expertise, including certificates as applicable.

(5) States may impose conditions relating to public interests, public safety, public health, environmental protection, national foreign policy or security interests, or any other matter deemed relevant by them at their own discretion and with respect for their international obligations.

Explanatory remarks: A minimum of requirements to non-orbital operators with regard both to the planned activities and to the vehicles should be established on the international level to enhance a generally valid standard for States authorizing non-orbital spaceflight activities. The implementing method could be similar to the one used in the Chicago Convention with its Annexes, according to Art. 38, 39 and 90 of the Convention, in particular in Annex 6 on Operation of Aircraft and Annex 8 on Airworthiness of Aircraft. This may enable a quick adaptation to the most current safety standards. At the same time, as foreseen in Article 4 para. 5, States should have margin to consider additional conditions, in order to take responsibility for the respective activity. This has been done, for example, in the US legislation which leaves it to the discretion of the Government to issue additional regulations “*governing the design [...] of a launch vehicle to protect the health and safety of crew, government astronauts, and spaceflight participants*”. Also, the 2018 UK Space Industry Act²⁶ puts an emphasis on public safety and the safety of third-parties.²⁷

It is recommended that States, when regulating non-orbital spaceflight activities, include more detail regarding the qualification of non-orbital flight crew and participants, the vehicle, and also impose additional conditions regarding safety and environmental protection, including rules for the avoidance of space debris creation and of environmental pollution. In this regard, air law contains very detailed regulations on environmental protection, personnel licensing, aircraft production and operation and airworthiness of aircraft in order to ensure high safety levels which can serve as a well-established source of reference – see for example the criteria for personnel competency and responsibilities, safe operating practices (including flight planning and in-flight procedures, aircraft operating procedures, performance, instruments, equipment, maintenance, operating limitations etc.), the protection of the environment from the effect of aircraft noise and emissions, and the security of aircraft (including design, construction and functioning) could perhaps be a guidance in this regard (e.g. Articles 29-42 Chicago Convention and Annexes 1, 6, 8 and 16). Moreover, due to the potentially hazardous nature of non-orbital spaceflight activities, it is highly preferable that sufficient insurance requirements, *inter alia* for third-party liability, passenger/cargo liability, and environmental liability are included in any national legislation for non-orbital spaceflight activities. Thus, specific provisions on the obligation to conclude an insurance policy are a *conditio sine qua non* for any future regulation and must be considered by national legislators.

²⁶ Space Industry Act, Section 2(1).

²⁷ Space Industry Act, Section 9(4)(a) and (b)

4. Registration of non-orbital spaceflight vehicles

Article 5

Registration of Vehicle(s) involved in a Non-orbital Spaceflight Activity

- (1) A national register shall be established (by the appropriate /authorizing State) containing at least the following details relating to non-orbital spaceflight vehicles:
 - (a) Name and business name;
 - (b) Manufacturer;
 - (c) Type and registration number;
 - (d) Name and address of owner;
 - (e) Name and address of operator;
 - (f) General function of the non-orbital spaceflight vehicle;
 - (g) Technical information on type of power, maximum velocity and altitude;
 - (h) Location and date of first launch/take-off.
- (2) Certificates of Registration and Deregistration in accordance with Annex 7 of the Chicago Convention on Aircraft Nationality and Registration Marks need to be obtained, if applicable.

Explanatory remarks: In order to allow for a minimum international standard as to the key registration data and to enhance transparency on the type and general function of the non-orbital spaceflight vehicle as well as on the envisaged location(s), launch/take-off and landing time(s), it is required that the State(s) authorizing such activities establish and maintain national registries, or use space or aircraft registries that are already established for the purpose of registering non-orbital spaceflight vehicles to avoid additional administrative costs and burdens. It is recommended that such national registries are made publicly accessible as a measure of transparency and confidence-building. The registry should contain information required both under international space law (Article IV of the Registration Convention) and international air law (Annex 7 of the Chicago Convention on Aircraft Nationality and Registration Marks), as it is recommended in paragraph 1 (a) to (h).

It is recommended that, if there is more than one authorizing State, a non-orbital vehicle is not registered in more than one State at the same time and that, with reference to air law, information sharing concerning the registration and ownership of non-orbital vehicles, among

others is provided for (see e.g. Articles 18-21 Chicago Convention and Annex 7). As to the character of authorization, it can be considered that only one licence/authorization is issued for the first launch/take-off of the non-orbital spaceflight vehicle, and that consequent single launches/take-offs are notified as additional information to the national authorities. An example of state practice in this direction was the US Space Frontier Act submitted to Congress in 2019²⁸ proposing that for multiple launches by the same operator “at multiple sites” only one licence or permit shall be issued.²⁹ Reference can be made also to the regime in international air law, where the registration of aircraft is separate from and complemented by less rigid rules on flight plans and other documents relating to a specific flight.

While international coordination is needed, the setting-up of a new international registry specifically for non-orbital spaceflight vehicles needs further discussion. Such an international register could be maintained by the UN (UNOOSA) or ICAO in the future. It should be noted in this regard that space law does not formally require the registration of space objects that are not launched into Earth orbit or beyond (Art. II Registration Convention).³⁰

The existing publicly available UN Register of Objects Launched into Outer Space³⁴ contains information on space objects that is provided by the States (Parties) of registry on the basis of the entries in the respective national registries³¹ or on the basis of UNGA Resolution 1721. Thus, it can be considered whether and how the UNCOPUOS Member States can, in the future, extend the scope of the UN register to reflect not only information on space objects, but also on non-orbital spaceflight vehicles that they carry on their national registry.

²⁸ Bill S. 919, Introduced in Senate in March 27, 2019. 116th US Congress (2019-2020) and reported to the Committee on Commerce, Science, and Transportation on 12 November 2019, see report No. 116- 172 of 11 December 2019.

²⁹ Bill S. 919, Section 102, Use of Existing Authorities.

³⁰ Convention on Registration of Objects Launched into Outer Space, 1023 UNTS 15, adopted on 14 January 1975, entered into force on 15 September 1976.

³¹ Convention on Registration of Objects Launched into Outer Space, 1023 UNTS 15, adopted on 14 January 1975, entered into force on 15 September 1976, Arts. II and III.

5. Liability and insurance

Article 6

Liability and Insurance

1. Without prejudice to any liability arising under other obligations of international or national law as concerns, inter alia, operator and carrier liability, the authorizing State is liable for any damage caused by the non-orbital spaceflight vehicle to persons or property not directly participating in the non-orbital spaceflight activity.
2. The term “damage” means loss of life, personal injury or the impairment of health, or loss of or damage to property of States or of persons, natural or juridical, or damage to property of international intergovernmental organisations.
3. The authorizing State can have recourse against the non-orbital spaceflight operator under the conditions and within the limits specified by applicable national legislation.
4. The liability of the operator for any personal injury or death of the crew or participants in the non-orbital spaceflight activity is regulated with reference to Articles 17 and 20 of the 1999 Montreal Convention on International Civil Aviation and can thus be capped. For any sum above this cap, the authorizing State will be liable.

Explanatory remarks:

a) The authorizing State as the liable State

The present article deals with third-party liability for damage caused by non-orbital spaceflight vehicles. Non-orbital spaceflight activities, arguably more than aviation and rather more similarly to human spaceflight, are ultrahazardous and, despite the benefits, also carry a significant risk of damage both for property and for humans - especially during launch/take-off and re-entry/landing. The compensation for such damages might be disproportional to the financial possibilities and scope of insurance policies taken out by a non-governmental entity, so that the interest of the damaged persons would only be safeguarded if a claim for compensation can be addressed against a State. Thus, the victims suffering damage to their property, health or life caused by non-orbital spaceflight activities should be able to claim compensation directly from the State that has authorized the non-orbital spaceflight activity (see Articles 3 and 4) and not from the (private) non-orbital spaceflight operator. This applies

without prejudice to any liability arising under other obligations of international or national law.

Due to the commercial character of such activities and the fact that they will eventually most likely predominantly carry humans on board, it is recommended that operator liability is established to allow for the protection of passengers and third parties. As the scope of damage (and the necessary insurance) may render high risks for the economic viability of the industry, States, in the process of authorization, should oblige the operator to take out appropriate levels of insurance, in accordance with its national policy, to cover liability.

Article 6 (4) introduces a contractual liability of the operator for any damage (which must be foreseen in the contract between the operator and the participant in the activity). It is based on the concept applied in the 1999 Montreal Convention that sets a two tier system of liability, with strict liability up to approximately 130.000 SDR in the first tier, and a second tier where the operator must prove that it did not act negligently in order to get out of any liability.

b) Liability regardless of the location where the damage occurs

For the types of damage, as defined in para. 2, liability can be invoked irrespective of the location where the damage has occurred. Therefore, this article applies regardless of whether the damage occurred on the surface of the Earth, in airspace or in outer space.

c) Insurance

In the internal relationship between the authorizing State and the non-orbital operator, national legislation should require insurance as a requirement for authorization and enable the State to take regress against private entities as considered appropriate in the circumstances (see Article 4 (f)).

The specific conditions and requirements for insurance will be decided at the national level. In terms of the scope of compensation to be carried, States could consider whether a liability cap should be incorporated into the relevant national legislative framework.

For the consideration of specific aspects of liability, be it for third-party liability, and/or for contractual liability for non-orbital spaceflight activities, the experience of the air and space industry could be relevant.

6. Crew and spaceflight participants

Article 7

Crew of Non-orbital Spaceflight Vehicles and Participants in Non-orbital Spaceflight Activities

The rights and responsibilities of persons directly participating in a non-orbital spaceflight activity shall be differentiated based on the following roles:

- a) Commander: the person directing the non-orbital spaceflight activity on board the non-orbital spaceflight vehicle;
- b) Crew members: persons essential to the operation of the non-orbital spaceflight vehicle or responsible for the safety on board under the command of the Commander;
- c) Spaceflight participants: persons participating in a non-orbital spaceflight activity with the consent of the operator, who are not members of the crew.

Explanatory remarks: As far as persons on board non-orbital spaceflight vehicles are concerned, the differentiation between trained crew and non-trained persons on board may be important in terms of the applicable requirements for their qualification (see Article 4), in order to distinguish them from ‘astronauts’ as per Article V of the Outer Space Treaty³² and ‘personnel of a spacecraft’ referred to in the Rescue Agreement³³, to whom specific rules apply, as well as with regard to insurance requirements under national legislation.³⁴

According to Annex 1 of the Chicago Convention on Personnel Licensing, a pilot-in-command is designated “*as being in command and charged with the safe conduct of a flight*”. With respect to crew members, Annex 6-Part I to the Chicago Convention defines flight crew as a “*licensed crew member charged with duties essential to the operation of an aircraft during a flight duty period*”, and a cabin crew member “*performs, in the interest of the safety of passengers, duties assigned by the operator or the pilot-in-command of the aircraft, but who shall not act as a flight crew member*”. A passenger, under the General Conditions of Carriage of the International Air Transport Association (IATA), is “*any person, except for members of the crew, carried or to be carried in an aircraft with the consent of the carrier*”.

US national legislation³⁵ differentiates between a crew member and a ‘spaceflight participant’. Thereby, a member of the ‘crew’ is “*any employee of a licensee or transferee, or of a contractor or subcontractor of a licensee or transferee, who performs activities in the course*

³² Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, 610 UNTS 205, adopted on 27 January 1967, entered into force on 10 October 1967.

³³ Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, 672 UNTS 119, adopted on 22 April 1968, entered into force on 3 December 1968.

³⁴ See, for example, Federal Aviation Administration, Guidance in Informing Crew and Space Flight Participants of Risk, Version 1.1., 4 April 2017.

³⁵ 51 US Code, Chapter 509, Commercial Space Launch Activities.

*of that employment directly relating to the launch, re-entry, or other operation of or in a launch vehicle or re-entry vehicle that carries human beings”.*³⁶ Spaceflight participants are defined as individuals who are “*not crew, carried aboard a launch vehicle or re-entry vehicle*”.³⁷

In practice, any private operator would require persons involved in non-orbital spaceflight activities to sign a waiver on liability under national laws before they undertake the activities. The extent to which operators can exclude their liability could be specifically regulated on a national level as this is not a matter of international regulation.

For crew members onboard a non-orbital vehicle, a “Code of Conduct” can be elaborated, similarly to the rules governing activities of astronauts, which may distinguish between the role of commander and other crew members, to allow for a clear division of tasks, rights and responsibilities in the interest of safety. The experience with the International Space Station Crew Code of Conduct may be of interest here, in particular since the document also distinguishes between astronauts and spaceflight participants.

7. Legal regulation of non-orbital launch facilities

Article 8

Non-orbital Spaceflight Launch Facilities

Details concerning ground facilities used for the launch of non-orbital spaceflight activities (e.g. airports and spaceports) shall be regulated in specific laws and regulations to ensure safety of operations and minimize the risk of accidents considering the standards and recommended practices contained in the respective Annexes of the Chicago Convention.

Explanatory remarks: The purpose of regulating the facilities used for the performance of non-orbital spaceflight activities to ensure, in the first place, the safety of such facilities,³⁸ but also sufficient protection of public safety, the environment as well as a broad range of other public interests.

According to Annex 14 of the Chicago Convention on Aerodromes, States shall ensure that an aerodrome manual including all pertinent information on the aerodrome’s site, facilities, services, equipment, operating procedures, organization and management including a safety management system is submitted. This shall contribute to ensuring safety and to the avoidance of accidents. Chapter 9 of Annex 14 provides details on the operation of aerodromes with respect to rescue and firefighting and contains a large number of recommendations in this regard. Annex 19 of the Chicago Convention on Safety Management provides that States shall

³⁶ 51 US Code, Chapter 509, §50902(2).

³⁷ 51 US Code, Chapter 509, §50902(20).

³⁸ See, for example, as a reference Annex 14 of the 1944 Chicago Convention.

establish and maintain a State safety programme (SSP) that is commensurate with the size and complexity of the State's respective activities.

It is important to note that, pursuant to Article 38 Chicago Convention, States may deviate from recommendations contained in its Annexes, if they find it impracticable to comply with the international standards or procedures contained therein, or if they deem it necessary to adopt a different regulation. However, they must give immediate notification to ICAO to enable the Council to notify all other states of the difference between the international standard and the corresponding national practice.

An example of a more recent draft for national legislation concerning non-orbital facilities is the 2019 Regulation on Construction and Operation of Spaceports of the Italian Civil Aviation Authority (ENAC).³⁹ It was proposed identifying the need for “*a strategic infrastructure essential to implement suborbital transportation operations and access to space, in order to ensure a sustainable development of the sector of commercial suborbital flights*”. It considers currently only “horizontal spaceports”, i.e. certified aerodromes that “include(s) infrastructures, buildings, equipment, plants and systems which are used to execute the launch, the landing and the related ground and flight operations of a non-orbital HOTOL vehicle (horizontal take-off and horizontal landing), where the launch and landing of which can be, respectively, compared to the horizontal take off and the landing of an aircraft (Horizontal Spaceport)”,⁴⁰ but may, in the future, include also spaceports used for VTVL.

³⁹ Ente Nazionale per L'Aviazione Civile, Regulation on Construction and Operation of Spaceports.

⁴⁰ Ibid., p. 2.