Suborbital Flights: Applicable Law

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Abstract

Following the US Space Shuttle retirement and the cancellation of the NASA Constellation program, new space transportation vehicles have been developed, especially by the Russians and private companies.
These types of spacecraft are hybrid objects capable of flying like a spacecraft and an aircraft and of performing "suborbital flights", i.e. of climbing to altitudes higher than 100 km. The hybrid nature of these objects poses many problems in terms of the applicable law: in fact, sometimes such vehicles fall within the scope of air law and other times within that of space law.
In this paper, these vehicles have been divided by type: spaceplanes performing intercontinental flights, hybrid aerospace systems – including multistage rockets – and spacecraft, traditionally intended as those transportation vehicles carrying materials and people to and from the ISS as well as in a modern definition of the term, i.e. those craft performing commercial suborbital flights at an altitude known as the Karman line.
This paper aims to identify the applicable law for each of these categories of vehicles performing suborbital flights. The functional criteria was adopted to identify those international air law provisions that are best suited to regulate the first type of spaceplaces. As regards the second type of vehicles, instead, due to their hybrid nature and to the fact that a part of the rocket is released in outer space (i.e. the second stage) and another part flies into suborbital space (i.e. the first stage), air law should apply before such release and space law after. The third type of craft, instead are considered spacecraft if they carry out their mission principally in outer space, while those vehicles developed by the private industry for commercial exploitation purposes are considered aircraft. Therefore, this paper aims to identify the applicable national and international law for each of these categories of vehicles, at times suggesting changes in the regulations to better regulate these new means of transport.

1. Suborbital Flights

Following the US Space Shuttle retirement in 2011 and the ongoing initiatives carried out by NASA and private commercial companies to develop new space transportation vehicles, manned spaceflight has now entered a transitional phase. Increasing attention has been paid to more flexible and less expensive space transportation vehicles, especially following the first successful launches. The so-called "**suborbital flights**" are also attracting a great deal of interest. They are flights in which a spacecraft climbs to

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altitudes higher than 100 km but its trajectory intersects the atmosphere or surface of the gravitating body from which it was launched so that it does not complete an orbital revolution. Its speed and altitude are insufficient to go into orbit and it falls back to Earth. Many private companies – as well as governments, particularly the US Department of Defense – are showing increased interest in manned suborbital flights, as they offer great commercial opportunities in terms of space tourism[1].

Suborbital flights are flights in which a spacecraft climbs to altitudes higher than 100 km but below where satellites orbit, in line with the definition of spaceflight provided by the US legislation. As mentioned above, the spacecraft does not complete an orbital revolution, as its speed and altitude are insufficient to go into orbit and it falls back to Earth.

The term **aerospace plane** has not been accepted univocally, so that the German government, in its answer to the first question contained in the COPUOS Legal Subcommittee's unfruitful Questionnaire on Possible Legal Issues With Regard To Aerospace Objects of March 1996, opted for the more generic term "space transportation system"[2].

In order to cut costs of access to outer space, many space players are planning different types of **reusable means of transport** having different technological features, as well as traditional non-reusable launchers. These spaceplanes have different functions and must therefore be treated differently from a legal standpoint.

To better analyze these vehicles, they are divided into three groups having different technological features and functions as well as legal treatments: spaceplanes, hybrid objects and spacecraft.

2. Spaceplanes

Suborbital space travel, also called intercontinental flight, is a very promising market. Research, such as that done for the X-20 Dyna-Soar project suggests

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1 Italian company ALTEC was commissioned by the NATO Supply Agency to conduct a study on the possibility of carrying out a "Spacegate" initiative in Italy that, rather than focusing on space tourism opportunities, is designed to develop a so-called next-generation air transportation system. See www.altecspace.it.

2 Doc. ESA/IRC (96) 15.P.J. Annexes, *Document de Travail*, Paris, April 24,1996. Only ten replies were received from member States, of which only two were ESA members (i.e. Italy and Germany).
The questionnaire was proposed again and replies from member States were analyzed at the 50th Session of COPUOS Legal Subcommittee, which was held in Vienna, from March 28 to April 8, 2011.
Questionnaire on Possible Legal Issues: Analytical summary of the replies to the questionnaire on possible legal issues with regard to aerospace objects: preferences of member States, A/AC.105/849.
See: http://www.oosa.unvienna.org/oosa/SpaceLaw/aero/index.html

that a semi-ballistic suborbital flight could travel from Europe to North America in less than an hour and to Australia in only three hours.
Spaceplanes include projects for supersonic planes, such as "**Super Concorde**", which will take-off like a plane without using a rocket launcher, as it is not designed to be placed in orbit, even if it might reach suborbital altitude for a few seconds. Its mission will basically be to transport passengers from one place to the other in the world. The future European supersonic plane is still in an early planning stage[3].
Oxfordshire-based Reaction Engines company is designing orbital plane **Skylon** on behalf of the UK Space Agency. If the project is completed, the UK, in 10 years' time, could use a commercial single-stage-to-orbit spaceplane, the first of its kind[4].
Skylon will be able to carry 12 tons of payload or 30-40 passengers, double the payload of a conventional rocket.
The Italian Space Agency (ASI) is currently working with the Italian Aerospace Research Center (CIRA) and the Japanese Space Agency (JAXA) to develop an Unmanned Space Vehicle (USV), by using new technologies and materials that can withstand extremely high temperatures and speed.
As regards the first type of spaceplanes, experts are divided over the criteria to be adopted to identify the applicable regime. The **spatial** theory – according to which air or space law shall apply to spaceplanes depending on where they are located – does not seem to be the right way to proceed. The **functional** theory – which is, instead, based on the nature of the activity carried out, i.e. the craft's purpose – seems the most convincing[5].
These supersonic aircraft serve the function of connecting two points on the Earth and transporting passengers, in the shortest time possible, from one place to another. These craft pass through outer space, at a low altitude, only for technological needs. They have the same function as an aircraft, so they shall be subject to the national regulations of the State over whose territory they fly as well as the international law provisions contained in the **Chicago Convention on International Civil Aviation** of December 7, 1944 as regards registration and authorization. Registration is a key issue in the Chicago Convention: the State in which an aircraft is registered shall have jurisdiction over such craft and shall be held liable for damage. In air law there is a

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3 See: www.repubblica.it/.../super-concorde/super-concorde/super-concorde.html-

4 Skylon will be 269 feet (82 meters) long and will have a wingspan of 82 feet (25 meters). The vehicle will take off and land horizontally on a conventional runway like a commercial plane. Its features are impressive: it can reach a top speed of Mach 25 and travel at an altitude of approximately 460 km, thus performing a true orbital flight. Skylon will be able to carry 12 tons of payload or 30-40 passengers, double the payload of a conventional rocket, with a cost that is 10 times lower than that of an orbital launch with a multistage rocket.

5 See CATALANO SGROSSO, International Space Law, Florence, 2011, LoGisma ed., p. 285 ff.

customary right of "innocent passage" for aircraft, but there is no such thing for commercial suborbital flights. The ICAO Council adopted the Standards and Recommended Practices for Aerodromes, better known as Annex 14, setting out the key rules and specifications regarding facilities and technical services normally provided at an aerodrome that States must comply with when drafting their domestic regulations.

As regards liability of the carrier, the following conventions shall apply: the **Warsaw Convention** of October 12, 1929 regarding international carriage by air, as amended by the Hague Protocol of 1955, the Guadalajara Convention of 1961 (Convention Supplementary to the Warsaw Convention for the Unification of Certain Rules Relating to International Carriage by Air Performed by a Person Other Than the Contracting Carrier) and the Guatemala Protocol of 1971 (which sets out certain limits to the liability of the carrier). The Convention regulates liability for international carriage of persons, luggage or goods performed by aircraft, imposing a limited liability regime upon airline companies (with respect to passengers and cargo in case of personal injuries, delays etc.).

The **Montreal Convention** (i.e. the Convention for the Unification of Certain Rules For International Carriage by Air) of May 28, 1999, which entered into force on November 4, 2003, was drawn up to make certain rules relating to international carriage by air and related instruments uniform[6].

The Montreal Convention was ratified by Italy on April 29, 2004 and entered into force in Italy on June 28, 2004 (as of 2009, 94 countries had ratified it). Regulation (EC) no. 889/ 2002 of May 13, 2002, amending Regulation (EC) no. 2027/97 of October 9, 1997, was also implemented. This Regulation implements the relevant provisions of the Montreal Convention in respect of the carriage of passengers and their baggage by air

[6] For the text of the older Aviation Conventions, see BALLARINO BUSTI, *Diritto aeronautico e spaziale*, Milan 1988, pp. 769, 608, 833, 314; for the text of the other Conventions, see the following website: http://www.fog.it/convenzioni/aer.htm
For the Montreal Convention, see: ANTONINI, *Il danno risarcibile nel trasporto di persone*, in *La nuova disciplina del trasporto aereo* – Commento alla Convenzione di Montreal del 28 maggio 1999, cit., 81, 88; FIELD, *Air Travel, Accidents and Injuries: Why the New Montreal Convention is Already Outdated*, in *Dalhousie L.J.* 28/2005, 69, 84; HERMIDA, *The New Montreal Convention: The International Passenger's Perspective - One airline's merit is another passenger's shortcoming*, in «Air & Sp. Law» 2001, 150, 153; MENDES DE LEON - EYSKENS, *The Montreal Convention: Analysis of Some Aspects of the Attempted Modernization and Consolidation of the Warsaw System*, in *J. Air L. & Com.* 66/ 2001, 1155, 1167; SARMIENTO GARCIA, *Estructura de la responsabilidad del transportador aéreo en el Convenio de Montreal de 1999*, in *Dir. trasp.* 2004, 687, 702 ff. Instead, for an overview of the Montreal Convention in the sense that it would not preclude the possibility to ask compensation for such category of damage, see: WEBER-JACOB, *The Modernization of the Warsaw System: The Montreal Convention of 1999*, in *A.A.S.L.* 1999, pp. 333, 340.

and extends their application to carriage by air within a single Member State. Another key instrument is Regulation (EU) no. 285/2010 amending Regulation (EC) no. 785/2004 of the European Parliament and of the Council on insurance requirements for air carriers and aircraft operators.
The abovementioned conventions wish to ensure the orderly development of international carriage operations and regular traffic of passengers, baggage and cargo.
A key bilateral **Air Transport Agreement** was signed between the **United States of America and the European Community** on March 2, 2007. In a nutshell, under this agreement, any European airline may fly between any point in the EU and any point in the United States, without restrictions with respect to fares and ability. The same right is also granted to US airlines with respect to the European Union[7].
The **Convention on Damage Caused by Foreign Aircraft to Third Parties on the Surface**, of October 7, 1952 – commonly called the **Rome Convention** – establishing the carrier's objective liability, entered into force in 1958 and has only been ratified by less than 50 countries, none of which is a major space-faring nation.
The subject matter of the Convention is emblematic for the peculiarity of the provisions contained in it: it concerns, in fact, lawful but hazardous activities which may cause damage to third parties and establishes a special regime derogating from 'common law'. The Convention envisages objective, unlimited liability, to meet the need to protect third parties who are subject to the risks of air navigation.
The requirement to mandatorily take out insurance is usually imposed and a compensation limit established when an objective liability regime is adopted. However, this limit should be equal to the maximum extent of damage and, therefore, it should be adequate and fair. As the 1952 Convention, instead, establishes a very low limit, very few States have ratified it[8].
This has spurred ICAO to formulate **a new liability regime for damage** caused by aviation activities; as a result, two Conventions on risks «of a general nature» and those «resulting from acts of unlawful interference» were adopted at the ICAO Diplomatic Conference held in Montreal from April 20 to May 2, 2009. In reality, as it should be for a non-contractual liability regime, there still is a tendency – which, since post-World War II, has characterized international aviation regulations – to extend, to the maximum extent possible, the scope of application of uniform law instruments. These

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7 This agreement was approved by the EU Transport Council on March 22, 2007 in Brussels and became effective on March 30, 2008. See article by QUARANTA in: http://www.fog.it/tamj/tamj-07-01.pdf

8 Proceedings of the Conference on "Aircraft carrier liability for damage to third parties on the surface" of February 5, 2007.
See: http://www.giureta.unipa.it/VolumeV2007/articoli/convegno%20roma.htm

two Conventions are uniform law instruments; it is worth briefly mentioning them, as they are also reference regulations for future space activities.

- The **Convention on Compensation for Damage Caused by Aircraft to Third Parties** (General Risks Convention) should replace the Rome Convention. The Convention sets out that the liability of the operator shall not exceed certain limits[9]. Moreover, if the operator proves that the damage was caused, or contributed to, by the negligence or other wrongful act or omission of a claimant, or the person from whom he or she derives his or her rights, the operator shall be wholly or partly exonerated from its liability (art. 10 of the Gen. Risks Convention and art. 20 of the Unlawful Int. Convention). One of the merits of the Convention is that it centralizes actions for compensation: actions for compensation may be brought only before the courts of the State Party in whose territory the damage occurred and judgments shall, when they are enforceable in the State Party of the competent court, be automatically enforceable in any other State Party[10].
- The **Convention on Compensation for Damage to Third Parties Resulting from Acts of Unlawful Interference Involving Aircraft** (The Unlawful Interference Convention) establishes a supplementary compensation mechanism for any damage exceeding the liability limits set forth by the Convention.

  After the 9/11 tragedy, where terrorists used an aircraft as a weapon of mass destruction, causing immeasurable damage to third parties on the surface of the Earth, **the International Civil Aviation Compensation Fund** (ICACF) was set up. The Fund shall, at its own discretion, cover the liability of the operator, in case of damage caused by an act of unlawful interference, to the extent that the total amount of damage exceeds the limits of its liability covered by insurance. The maximum amount of compensation available from the International Fund shall be 3 000 000 000 (approximately USD 4.5 billion) Special Drawing Rights for each event[11].

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9 These limits are the following: 750 000 Special Drawing Rights (SDRs) for aircraft having a maximum mass of 500 kilograms or less; 700 000 000 (approximately USD 10 million) Special Drawing Rights for aircraft having a maximum mass of more than 500 000 kilograms (art.4(1) of the General Risks Convention and art. 4(1) of the Unlawful Interference Convention).

10 See: http://www.dirittoestoria.it/7/Contributi/Comenale-Responsabilit-danni-urtoaeromobili.htm
And on extending the Convention to damage caused by aircraft collisions, see ZAMPONE, *Le nuove norme sulla responsabilità del vettore nel trasporto aereo internazionale dei passeggeri*, http://www.fog.it/articoli/00-0007.htm

11 See: ABEYRATNE, *The Unlawful Interference Compensation Convention of 2009 and Principles of State Responsibility* in:
http://www.aviationdevelopment.org/eng/2010090702_publication

However, air law conventions do not take into consideration liability for damage caused to space objects during the period of time, albeit short, in which a supersonic aircraft flies through outer space. On the contrary, the opposite situation, that is to say liability for damage caused by a space object to aircraft in flight while passing through airspace is regulated by the 1972 UN Convention on International Liability for Damage Caused by Space Objects (Liability Convention), establishing absolute objective liability. This is certainly a problem that must be resolved, at least by those countries deploying these aircraft.

3. Hybrid Spaceplanes

This group of vehicles includes multistage hybrid aerospace systems: some of their components have the characteristics of an aircraft and carry out their mission in airspace while others have the characteristics of a space object and carry out their mission in orbit.

The German project **SANGER** envisaged building a liquid hydrogen-powered **hypersonic aircraft** which would carry a second stage on its back that would be left behind at approximately 40 km, at Mach 7; its mission would be to carry payloads to space stations. The first stage lands and the second returns to Europe by gliding flight.

Russian-conceived transport aircraft **An-225** (Mriya, i.e. "dream" in Russian) is the world's largest aircraft: it carries a second stage, which is released at an altitude of approximately 9 km.

On May 26, 2001, the An-225 received its type certificate from international aviation authorities enabling it to perform commercial flights. The fact that the United States used this Russian-built aircraft proves how advanced Russian heavy-cargo aircraft engineering is.

In 2010, Antonov announced that it was working on developing a passenger version of the An-225 Mriya, which will be called Antonov An-248. An-248 could carry up to 715 passengers in a single-class layout and up to 605 in a double-class layout. Many experts believe that if it is built, the An-248 will be a direct competitor to Airbus A380. The cost of this future passenger version is estimated at approximately USD 280 million[12].

A joint Russia-UK program plans to carry a **HOTOL** spacecraft on the An-225. This single-stage-to-orbit reusable automatic winged launch vehicle is designed to carry small payloads in Low-Earth Orbit at lower cost. However, this project is currently on hold[13].

As this group includes multistage aerospace planes, it is worth mentioning that a complex space system will entail greater problems in determining the applicable law and suitable solutions will have to be found to regulate those

[12] See: http://it.wikipedia.org/wiki/Antonov_An-225_Mriya
[13] See: http://en.wikipedia.org/wiki/HOTOL

special situations which might occur during the life of the aerospace plane. Some authors claim that even the first stage, which is used in airspace to carry and launch a space object, or from whose back a space object takes off, must be considered as a "component part", and precisely as the launch vehicle, and should therefore have the status of space object. However it is clear that the first stage, which serves its function in airspace, infringes the sovereignty of the State over whose territory it flies and that all the authorization, security and information disclosure rules of the States over whose territory an aircraft flies should be complied with.

It therefore seems more appropriate, in this complex system, to consider the first stage, which serves as a transportation means in airspace, flies over the airspace of other countries and lands, especially in Europe, in States other than the launching State, as an "aircraft" and therefore subject to all the national and international rules of air law. The second stage, instead, which serves its function in orbit, may be considered a "space object".

The difference between the rules of air and space law on matters such as registration, certification, status of the crew and liability will make it necessary to adapt them, to a certain extent, to those conflict situations the aerospace plane could find itself in.

Most authors tend to consider such vehicles subject to national and international air law before the **separation** occurs, while space law shall apply once the second stage is released in orbit[14]. The moment the second stage is released in outer space is considered the launching of a space object. The launching State, which also registered the space object, shall be held liable for any damage caused by such object (art. II of the 1972 Liability Convention – the term "launching State" meaning a State which launches or procures the launching of a space object or a State from whose territory or facility a space object is launched).

4. Spacecraft

This group of aerospace planes includes those craft having features more similar to space objects: vertical take-off, launch from ground-based launchers, placement in orbit – where their mission is carried out – and return to Earth performing a horizontal landing, sometimes in another State (it takes off like a rocket, orbits the Earth like a satellite and lands like an airplane). The US Space Shuttle is the first spacecraft of this kind. It is used to carry space labs and other payloads into outer space and, in its re-entry

[14] See: HOBE, MEISHAN GOH, NEUMANN, *Space Tourism Activities – Emerging Challenges to Air and Space Law*, in *Journal of Space Law* 2007, vol.33, n.2, p.359; ibidem WALKER, *Suborbital Space Tourism Flights: An Overview of Some Regulatory Issues at the Interface if Air and Space Law*, p.375 ff.; CHENG, *International Responsibility and Liability for Launch Activities in the Use of Air and Outer Space Cooperation and Competition*, 182 (Chia-jin Cheng 1998 ed.), p.180.

phase, it lands like a glider in a designated landing site in the US. The United States has defined its Shuttle as a space object; therefore, it is governed by space law. There is a functional reason behind this: due to the fact that its mission is mostly carried out in outer space and due to its limited maneuverability during the re-entry phase, the Shuttle is considered like a typical spacecraft. The first Space Shuttle to be successfully launched was **Columbia**, on April 12, 1981. Due to the wave of enthusiasm that swept over the space sector in 1983, the joint NASA-ESA Spacelab program was launched. European-built Spacelab was designed to be carried in the Shuttle cargo bay. Moreover, the deployment of reusable launchers has become necessary with the advent of large manned space stations. Unfortunately, a series of accidents started on January 28, 1986, when Space Shuttle Challenger exploded during takeoff, only 73 seconds after launch and seven crew members died. The Space Shuttle Columbia disaster, instead, occurred on February 1, 2003, when, during mission STS-107, which had begun on January 16 that same year, the Shuttle disintegrated over Texas during re-entry into the Earth's atmosphere. The loss of Columbia resulted in the death of all seven crew members. These two accidents seriously compromised the development of the program.

NASA's Space Shuttle Atlantis' last flight was launched on May 14, 2010. Atlantis successfully docked to the ISS, carrying its primary payload, i.e. the Russian Mini-Research Module (MRM-1, named Rassvet), which was subsequently docked to Zarya.

The United States' new space program, called "Constellation", envisages building new space shuttles to replace the retiring shuttle fleet. The entire space program, though, has been cancelled by President Obama's administration, also in light of the recent global financial crisis. Flying shuttle fleet past its scheduled 2010 retirement date would cost 3 billion dollars per year and would increase the risk of potential accidents[15].

NASA now has to pay to use Russian spacecraft or rely on private space providers, such as Space X, which successfully launched its privately-built Falcon 9 rocket designed to transport astronauts and cargo to and from the ISS. Moreover, a new reusable launch vehicle called ORION is currently being designed: it is an Apollo-like capsule that will carry cargo and crew to and from the ISS. However, its purpose is still a secret – it is not yet known whether it's a military or dual use program[16]. The X-37B, instead, is another ongoing project for a new reusable launch vehicle, but, for the time being, its mission is still classified. X-37B is launched using an Atlas V rocket and is equipped with advanced state-of-the-art technology. Its main goal is to demonstrate reusable space technologies and test new devices in orbit[17].

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15 See: http://www.mystars.it/EraSpaziale/Era_Spaziale_Navette_Spaziali_Shuttle_Buran.aspx

16 See: http://it.wikipedia.org/wiki/Orion_(veicolo_spaziale)

17 See: http://www.lastampa.it/_web/cmstp/tmplrubriche/giornalisti/ grubrica.asp?

In 1992, due to the collapse of the Soviet Union, the **Buran** program was canceled and the Russian spacecraft, some of which had already been built and other were still under construction, were dismantled or simply abandoned. Since then Russia has worked on developing its Soyuz ('Union' in Russian) spacecraft, which have been used to carry astronauts to and from space stations Salyut, Mir and now ISS[18].

The Progress freighter spacecraft was derived from Soyuz and is used for servicing the ISS. Due to the US shuttle fleet retirement, Russian spacecraft have become increasingly important and Russia is increasingly carrying out research in the field. In 2004, the Russian Space Agency announced that it intended to replace Soyuz with the new **Kliper** spacecraft.

Kliper is a partly reusable manned spacecraft proposed by RSC Energia, which has been designed to carry up to six people. Another viable option currently under discussion is the possibility of launching Soyuz from other pads, such as the ESA pad in Kourou, French Guiana, so as to fill the middle ground between heavy-class Ariane 5 and future small Vega launchers[19].

The Japanese HOPE project (H-II Orbiting Plane) can also fall within this group: it's an unmanned, single-stage reusable vehicle, which will take off vertically and land horizontally and automatically, once it reaches an altitude of 80 Km, in a designated landing site. It could serve the Space Station, carry payloads and also be used as an unmanned space lab. However, the project has been suspended.

The Space Shuttle and the other vehicles included in this group, which carry out their function in outer space, must be considered space objects and shall therefore be subject to the rules of international space law governing registration, liability for damage, rescue and return of astronauts and space objects.

The most delicate point is the passage through airspace, especially during the re-entry phase, as, if the object performs a horizontal landing, it could land in a State other than the launching State. Today, most agencies tend to rely on private agreements signed between government agencies or between States and private companies to regulate such cases, i.e. that of a spacecraft performing suborbital flights and then landing in another State's spaceport. As regards space objects, it has so far been agreed that they shall land in the territory of the launching State or in any other place subject to its jurisdiction, while the problem concerning the passage through the airspace of another State has only been considered for takeoff. This could be defined as a right of "**innocent passage**" which, however, is not mentioned in either air or space law. As States have never protested at such passage, it could be

ID_blog=69&ID_articolo=3667&ID_sezione=138&sezione= http://www.corriere.it › Scienze

[18] See: http://it.wikipedia.org/wiki/Veicolo_spaziale_Soyuz

[19] See: http://newton.corriere.it/PrimoPiano/News/2004/05_maggio/17/Navetta.shtml

considered a customary rule. With the advent of spaceplanes, though, there is a general opposite tendency, as the passage through the airspace of a foreign country risks becoming more frequent and lasting longer.
The US Space Shuttle and other future craft start their re-entry phase at approximately 8,000 Km from the landing site, passing through the atmosphere for 14-15 minutes and flying at an altitude that is less than 60 km. Therefore, measures must be taken to avoid collisions with other aircraft.
Germany's reply to question 2 of the COPUOS questionnaire states that the security and traffic organization rules of the State over whose territory an aircraft flies must be mandatorily complied with; an agreement among the States involved in a certain spaceplane mission seems to be the most feasible option[20].
Space tourism is a relatively new and extremely profitable phenomenon: American businessman Dennis Tito obtained authorization to fly in space and became the world's first "space tourist". Thanks to a 20-million dollar contract with the Russian Space Agency, Mr. Tito flew to the ISS as a member of the Soyuz "taxi crew" on April 28, 2001 and spent seven days in space. Following NASA's opposition to the Russian Space Agency's request to allow Mr. Tito to fly to the Station, the Russian Space Agency and the American businessman agreed to specific behavior regulations, some of which were already contained in the flight rules, the ISS Crew Code of Conduct and liability regulations, requiring increased onboard safety training and granting the tourist only limited access to non-Russian elements of the Station.
NASA demanded that the Russian Space Agency be liable for any damage that might have been caused to ISS elements and to the crew members of other Partner States due to the presence onboard of the visitor. The Russian Space Agency took out a 100 thousand dollar policy, with the Aviakos insurance company, covering any damage caused by Mr. Tito's flight[21]. A few months after the first tourist flight in space, the Multilateral Coordination Board (MCB) agreed to some common rules applicable to the commercial

[20] An example of such case is the MOU signed between Sweden and Virgin Galactic concerning suborbital flights landing in Kiruna, Sweden, requesting the adoption of a regulatory regime modeled on what the U.S. Federal Aviation Administration (FAA) did in the United States. See: NILSDOTTER, *Spaceport Sweden – Your next Adventure: International Perspective*, paper at FAA Commercial Spacecraft Transportation Conference, 7 Feb., 2013; JAKU &NYAMPONG, *International Regulatory Standards for Spaceports*, paper at Proc. 3Nd IAASS Conference, Rome Oct. 2008; the author insists on compliance with Annex 14 of the Chicago Convention.

[21] See: Official Document on space tourism of the United States Subcommittee on Space and Aeronautics. Meeting of June 26, 2001

branch of space tourism: "The Rules of Road for Travelers to the International Space Station" [22].

There are two categories of visitors: "short-term visitors", who are nominated by the space agency providing the ride to the space station and shall carry out activities on the station, e.g. scientific experiments; and "visiting crew members", such as journalists, tourists, etc. Visiting crew members should train with the expedition crew members who will be their hosts on the space station. Additionally, minimum training for short-term visitors riding a shuttle would include a week at NASA's Johnson Space Center, while those riding a Soyuz would have to train for at least a week at RKA's Star City facility.

Some other issues, such as liability for damage during a tourist's space flight, as well as the detailed requirements for medical fitness and training, are being handled by other panels. Commercial exploitation of the Station is now taken into consideration by all the Partner States and is included in their space policy; many of them think that space tourism will probably be a key area for space development[23]. It is worth mentioning that with the advent of space tourism new needs have arisen: therefore, a regulatory framework should be created based on negotiations between parties.

So far, all the space tourists flew to and from the International Space Station on Soyuz spacecraft. After the Columbia disaster, NASA started developing its COTS (Commercial Orbital Transportation Systems) program to coordinate the delivery of crew and cargo, which should soon offer space tourists the opportunity to fly in space. The US is still assessing this commercial branch's growth potential. The 1996 National Space Policy contains various provisions aimed at encouraging and promoting commercial space activity[24].

The Space Shuttle and the other space transportation vehicles that fall within this group are considered space objects and shall therefore be subject to the rules of international space law governing registration, liability for damage, etc. However, there are lacunae in the existing legislation: among the existing gaps in space law, the fact that there is still no clear distinction between "**crew members**" and "**passengers**" and that there is no definition or status of "**space tourist**" are particularly important. As regards the first issue, a distinction could be made following the example of air law and the 1944 Chicago Convention (Convention on International Civil Aviation of

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[22] *"Rules of road for travelers to the International Space Station"*: it is a document adopted by the MCB to support the development of this new branch, i.e. space tourism. See the article published on the MSNBC website: http://www.msnbc.com/news/694231.asp?cp1=1#BODY, 31 Jan 2002.

[23] DISCOVERY ON LINE, *Space Entrepreneurs, Space Tourist*: See: http://www.discovery.com/stories/science/entrepreneurs/tourist.html

[24] For a detailed overview of space tourism and the commercial exploitation of space tourism, see CATALANO SGROSSO, International Space Law, cit. in note 5, p.264 ff.

December 7, 1944), requiring crew members to hold a license enabling them to carry out the profession, while it doesn't impose any requirement upon passengers, who are under the responsibility of the carrier. As regards liability for damage suffered by passengers, article III of the 1972 Liability Convention does not consider civil liability issues for damage caused to passengers within a craft, it only deals with States' liability. Therefore, it only applies to damage caused to cargo and passengers aboard a vehicle by a vehicle belonging to another State.

Hence, some authors suggest to regulate the issue following the example of air law and the 1929 Warsaw Convention establishing carrier liability, thus overcoming the lack of regulations on passenger liability[25].

Nonetheless, a legal problem arises with respect to the determination of the State holding jurisdiction over tourists (which shall also be held liable for them). The latter, not being crew members, do not fall within the "personnel" category, which is mentioned in article VIII of the Outer Space Treaty (OST) and article II of the Registration Convention, establishing that the State of Registry of a space object shall retain jurisdiction and control over such object and any "personnel thereof". The status of the space tourist is undoubtedly a civil status, which may be equated to that of astronauts; specifically, some authors suggest that space tourists be considered "pseudo-astronauts". Nonetheless, under existing space law, space tourists shall be subject to the jurisdiction and control of the State of registry of the spacecraft aboard which they are traveling (article VIII of the OST). This State shall also be responsible for their conduct.

In conclusion, we can say that the Intergovernmental Agreement and the Memoranda of Understanding have been established during a phase of the ISS program where Partner States mainly focused on the various aspects to be included within the development of the Station itself. The provisions on the various stages of development are detailed and clear, whereas those directly linked to its use are vague and incomplete and therefore require a greater interpretation effort when applying to real life situations. Establishing a common legal framework on specific matters, similarly to the ISS Crew Code of Conduct (CCOC), seems to be the direction suggested by doctrine and practice of Partner States for the future developments of the ISS legal framework and cooperation program. Any astronaut working on the Station shall agree to comply with the standards of conduct prescribed in the CCOC, which sets out common rules, defines the ISS Commander's authority and responsibility, establishes a clear chain of command on-orbit, a management hierarchy and a clear relationship between ground and on-orbit management. Furthermore, it must be noted that

[25] Convention for the Unification of Certain Rules relating to International Carriage by Air, Warsaw, October 12, 1929. A new committee, the "Commercial Space Transportation Legislation Research Committee", which examines links between air and space law, was set up in Japan in 1998.

these common standards have so far been complied with. However, some jurisdiction and control problems have arisen when astronauts aboard the ISS or transportation vehicles have been faced with unusual situations, e.g. when new roles have been introduced, such as that of visiting astronauts, or with the advent of space tourism. The innovation introduced by the IGA with respect to jurisdiction over crew members, i.e. the adoption of an approach based on nationality criteria – which stand alongside territoriality criteria – appears to be somewhat outdated and no longer justified in light of these new situations. The 1967 Outer Space Treaty could not but only envisage the existence of simple space objects, built and registered by a single country. The construction of an International Space Station, however, in which many countries cooperate and provide personnel, required that State jurisdiction be extended, in order to also include jurisdiction over personnel on or in a module provided by another Partner. Hence jurisdiction over crew members is linked to the nationality of each individual and not only to his/her presence on or in a space object.

However, the advent of new categories of space travelers calls for specific rules to be set forth by "implementing arrangements" and "flight rules", as prescribed in the CCOC, defining roles, responsibilities and the chain of command and establishing the relationship between ground and on-orbit management. As the degree of commercial exploitation of the Station increases, and space tourism becomes a reality, a new situation is created, paving the way for the presence of visiting-astronauts. For the latter, who are not necessarily nationals of any Partner State, it wouldn't make sense to adopt nationality-based criteria for jurisdiction. To resolve the issue, specific "rules of road" have been established.

Lastly, the Intergovernmental Agreement is a legal instrument whose purpose is basically that of a framework law, since it refers to subsequent *ad hoc* agreements regulating specific ISS matters, such as crew management, more in detail.

5. Reusable Means of Commercial Transport

Commercial suborbital flights fly at an altitude known as the Karman line (70/100 km): scientists half-jokingly call it the "ignorosphere" - a region about 50-100 kilometers above the Earth that's too high for airplanes, but too low for satellites. The commercial suborbital flight sector - which poses various problems in determining the applicable law, i.e. whether air or space law should apply - has not yet grown to the same extent as air transportation, but it is growing fast.

Presently, space tourism is viewed as a money-making proposition by several companies. Apart from Space Adventures, other companies are engaged in the sector, including the following: Virgin Galactic, Starchaser, Blue Origin, Armadillo Aerospace, XCOR Aerospace, Rocketplane Limited, the European "Project Enterprise", and others.

Most are proposing vehicles that make suborbital flights peaking at an altitude of 100-160 kilometers. Passengers would experience three to six minutes of weightlessness, a view of a twinkle-free starfield, and a vista of the curved Earth below. Costs are expected to be about $200,000 per passenger.
Several companies are already planning the first commercial spaceflights. Currently, Virgin Galactic is designing the VSS Enterprise (**SpaceShipTwo**), a new type of commercial spacecraft. A citizen astronaut will only require three days of training before spaceflight, and the spacecraft will peak at an altitude of 130,000 meters. SpaceShipTwo flights will last two and a half hours, carry six passengers and reach a speed of Mach 3.
The third test flight of SpaceShipTwo was performed in January 2014 from the Mojave Air and Space Port. After SS2 was released from its carrier aircraft (WhiteKnightTwo) at an altitude of 12 km, the spaceship ignited its rocket motor, which burned for 20 seconds as planned, propelling it to an altitude of 18 km above Earth's surface before reentering the atmosphere and gliding back onto the runway. Over 600 customers from all over the globe have already signed up for a flight, at a ticket price of $250,000 per person, "all inclusive" (i.e. an all-accommodations three-day package: hotel, training and transport to and from the spaceport site).
Another company, EADS Astrium (a subsidiary of EADS), announced its intention to compete against US companies in the race to commercial spaceflights. Space Adventures Ltd. also declared that they are working on circumlunar missions to the Moon, and are currently developing a spaceport at Ras al-Khaimah.
In the US, such flights fall within the scope of US air transportation law and specific regulations were implemented by the Federal Aviation Administration (FAA). Such regulations include the following acts:

- the 1986 Commercial Space Launch Act (Title 49 of the US Code, chapter 701);
- the Commercial Space Transportation Reusable Launch Vehicle and Reentry Licensing Regulations, Final Rule;
- the **2004 Commercial Space Launch Amendments Act** (amending Chapter 701 of Title 49 U.S.C.): the US Government released a set of proposed rules to promote commercial spaceflights[26].

Under current US law, any company proposing to launch paying passengers from American soil on a suborbital rocket must receive a license from the Federal Aviation Administration's Office of Commercial Space Transportation (FAA/AST). The licensing process imposes safety requirements, and the details can be found in the Code of Federal

[26] See: Commercial Space Launch Amendments Act
http://www.space.com/news/congress_spacetourism_041209.htm

Regulations, Title 14, Chapter III. As always, the US tends to make regulations uniform.
As regards spaceflights carrying paying passengers, further requirements are necessary to ensure safety of the crew and of **space flight participants**.
For each mission, operators must inform space flight participants, in writing, of the known hazards and risks that they are taking and obtain full written and "informed consent" from them. The issue sparked widespread debate among the legal community over the meaning and value of "informed consent". Informed consent cannot be considered a waiver of the right to claim compensation for any damage that may be caused by an accident. It only serves to enhance transparency: operators have a duty to inform SFPs of the risks that they are taking in participating in such activity[27].
However, to streamline the commercial suborbital flight sector, the licensee could make a reciprocal waiver of claims with its contractors and subcontractors.
Commercial suborbital flights include two phases: the pre-launch and launch phases. There are two types of launch vehicles performing such flights:

- A single-stage-to-orbit (SSTO) vehicle reaches orbit from the surface of a body without jettisoning hardware, expending only propellants and fluids and using a rocket propulsion system. Once in orbit it releases its payload, then returns to Earth. In this case, the payload is an integral part of the launch vehicle, which carries out its mission in outer space and is to be considered a space object. Therefore, it shall be subject to the rules of international space law, including those governing registration, jurisdiction and liability for damage.
- A multistage rocket (e.g. SpaceShipOne) carries a second stage on its back that is left behind in orbit. The first stage then returns to Earth, landing back at the launch base, or, in the future, also at other launch bases. In this case, a distinction must be made: before the second stage is released from its carrier craft, the vehicle shall be considered an aircraft and shall therefore be subject to air law (even in the re-entry phase). The second stage, instead, that after the release carries out its mission in orbit, shall fall within the scope of space law[28]. As previously mentioned, however, air and space law differ greatly.

The 1999 Montreal Convention regulating air carrier **liability** for damage caused to passengers in flight applies to the vehicle before such release. The Convention establishes unlimited liability in the event of death or injury of passengers and limited liability for damage to passengers caused by delay in

[27] See: KNUTSON, *What Is "Informed consent" For Space Flight Participants in The Soon-to-Launch Space Tourism Industry,* 2007, 33 *Journal of Space Law*, 105
[28] See HOBE, MEISHAN GOH, NEUMANN, *Space Tourism Activities*, cited, note 14, p. 364 ff

transportation. However, the carrier shall not be liable for damage occasioned by delay if it proves that it took all measures that could reasonably be required to avoid the damage. Moreover, the Convention sets liability limits in Special Drawing Rights.

The liability regime applicable to space objects is quite different from that established for aircraft. Space law sets out that States shall also be held liable for damage caused by the activities of non-governmental entities in outer space (Article VI of the OST) but it fails to consider liability for passengers – an issue that not even the 1972 Liability Convention takes into account. The latter establishes that a launching State shall be held liable for damage caused to people aboard another space object in outer space, only if such damage is due to its fault or the fault of persons for whom it is responsible.

Air law, instead, imposes a limited liability regime and requires carriers to mandatorily take out insurance. Moreover, the carrier shall prove that it took all measures that could reasonably be required to ensure crew and passenger safety. Although space law fails to address such issues, certain agreements between private parties or between States and private parties, as well as some countries' recent domestic space regulations take them into account.

As mentioned above, space law applies to the vehicle after the second stage is released: article III of the 1972 Liability Convention states that a launching State shall be held liable for damage caused to a space object or to persons or property on board such space object provided that the launching State's fault or that of persons for whom it is responsible is proven. Moreover, according to art. VI of the OST, the launching State shall also bear international responsibility for those activities carried out by "non-governmental entities" in outer space.

To date, the US is the only country to have implemented a specific regulatory framework for commercial suborbital flights. Other countries have issued domestic space regulations, such as Australia's Space Activities Regulations 2001, no. 186 – which requires launch and re-entry permits and authorizations but does not take the human element into account, i.e. the presence of passengers aboard an RLV. Other examples include the 2007 Dutch Space Activities Act, the United Kingdom's Outer Space Act 1986 and the Swedish Act on Space Activities 1982. All these regulations, however, fail to specifically address commercial suborbital flights. This seems to indicate that such flights should fall within the scope of domestic air law[29].

In Europe, Regulation (EC) no. 216/2008 of February 20, 2008 established the European Aviation Safety Agency (EASA), which is in charge of civil aviation safety in the EU. EASA is an independent EU agency engaged in

[29] For a detailed analysis of national and international law, see: LANGSTON, *Suborbital Flights: A Comparative Analysis of National and International Law*, in *Journal of Space Law* 2011, no. 2, vol.37, p. 299; FANEMA, *Suborbital Flights and ICAO,* (2005) 36 *Air and Space Law*, issue 1, p.87 ff.

implementing and monitoring safety rules, giving type-certification of aircraft and components, authorizing foreign operators and giving advice for the drafting of EU legislation[30].

Although the EU Regulation does not expressly state that EASA shall also regulate commercial suborbital flights – unlike the US law – if vehicles performing commercial suborbital flights are considered aircraft, such flights shall also fall within the scope of EASA. While in the US FAA grants a **license**, in the EU EASA grants an **authorization**. Some authors claim that while under a license an operator is to be held fully liable for operations, a certification entails that the certifying authority shall also be held partly liable[31]. If an operator fails to obtain a commercial space transportation license, it may be entitled to a "FAA type certification in the restricted category" or an "experimental permit" for special purpose operations, provided that certain requirements are met.

The abovementioned suborbital flights are subject to EU regulations (Treaty on European Union) and international transportation law and fall within the scope of ICAO.

6. Conclusions

Among the spatial, functional and the specific regime approach, the functional approach seems to be preferable, although it needs to be adjusted in order to meet the specific needs of a different type of aircraft, i.e. aerospace planes. The key differences between air and space law regard registration, which has consequences on the certificate of airworthiness and the identification of the launching State, the statute of the crew and liability, in its threefold meaning as liability for damage caused to third parties, liability for damage caused during carriage and liability for product defects. Although we endorse the functional theory according to which the applicable legal regime will be determined based upon the function of the aircraft and the place where it mainly operates, some measures must be taken, as

[30] The issue regarding certification for operations, crew and passengers was also addressed at the European level. See: ESA General Studies Programme: http://www.esa.int/out_Activities/Preparing_for_the_Future/GSP/ESA_to_help_Europe_prepare_for_space_tourism
For an overview of the situation in Europe, see: MASSON ZWAAN, *Regulation of Suborbital Space Tourism in Europe -A role for EU/EASA*, 2010/35 *Air and Space Law* issue 3, p. 263 ff.

[31] See: HOWARD, *Points of connection: relating ICAO Annex 14 to Spaceport*, in *Annals of Air and Space Law* 2013, vol. 38, p.281. The author also addresses the issue of aerodrome certification, which may differ from airport certification, and suggests that regulations should be made uniform. For the application of national and international law, also see: UPASANA DASGUPTA, *Legal Issues on Sub-orbital Space Tourism: International and National Law Perspectives*, in *Annals of Air and Space Law* 2013, vol.38, p. 237

previously mentioned, in order to resolve any conflict situations the aerospace plane could find itself in. However, it does not seem feasible to suggest neither a revision of existing space law conventions, nor the drafting of an *ad hoc* multilateral agreement with respect to aerospace planes[32].
Moreover, it would take too much time to draft new legal instruments or amend existing ones. Therefore, signing specific cooperation agreements among the parties and applying private law, which is increasingly regulating the transportation and insurance sectors, seems to be the solution to this problem. Specific situations regarding aerospace planes, such as flying through the airspace of another country or landing in areas subject to the sovereignty of a State other than the launching State, will likely be regulated by special agreements between the States involved. An example of an agreement of this kind could be the United States and Spain Space Cooperation Agreement, signed on July 11, 1991, which establishes that in case of need the American Space Shuttle may fly over Spain's airspace and land in a Spanish base[33].
Certain national regulations, including German law, extend the scope and application of the rules established for aircraft also to space objects. Within a regional framework, such as the European one, it could be possible to entrust the European Organization for the Safety of Air Navigation (EUROCONTROL) with the promotion of cooperation on air safety among the European countries involved in a spaceplane mission. The 2002 Protocol Consolidating and Revising the EUROCONTROL International Convention of 1960 confirmed that the policy of the Organization includes, among its aims, «... those of standardization, planning, performance and safety regulations; the technical and financial selection of major framework programs for cooperation; external relations with States and organizations and applications for accession to this Convention». Furthermore, among the tasks of the Council, there is the duty to «determine the rules and procedures

[32] Germany's answer to the UNCOPUOS Questionnaire (question 3) seems to go in this direction, as it states that Germany is, at the moment, against the creation of a special regime for space transportation systems.

[33] The authorized Spanish bases are specified in the agreement, as are the procedures for landing, in case of a more severe emergency, in another landing site on the Spanish territory; moreover, NOTAMs and the Spanish Air Force regulations shall be complied with. The United States' liability for damage caused in Spanish territory is also regulated.
See: BOE n. 124, p. 16104, May 25, 1994, as amended in BOE n. 269. p. 34672, November 10, 1994 (R. 1994/3138); see the International Conference "The Legal Regulation of aerospace Transportation Vehicles", Rome, February 28 - March 1, 1997

applicable to standards, specifications and practices for air traffic management systems and services»[34].

Finally, as previously mentioned, with the advent of private operators also in the field of space transportation, the matter is likely to be regulated by private law; clauses will be contained in transportation and insurance contracts to cover the different cases of liability for damage, without prejudice to the *ad hoc* internal provisions issued by the States responsible for space activities carried out by private parties

[34] Protocol consolidating the Eurocontrol International Convention relating to Cooperation for the Safety of Air Navigation of 13 December 1960, as variously amended, Brussels, 27 June 1997 [The Protocol has not been ratified by the United Kingdom], Art. 1.2, III, IV, V and art. 7.2, m; http://www.pca-cpa.org/upload/files/03%20Eurocontrol.PDFProtocol