



## Legal conundrums of space tourism

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### ABSTRACT

Private commercial space tourism carrying passengers to outer space is no longer a distant or far-fetched fantasy, rather it is at verge of becoming an affordable reality with exponential development in space technology including development of Reusable Launch Vehicle (RLV), increasing involvement of private companies like Virgin Galactic, SpaceX, Blue Origin etc. into research and funding of space tourism explorations and applications. It is also receiving huge attention from the public. These developments reflect the infinite possibilities and inevitability of space tourism in near future. However, space tourism may also pose many critical legal issues which must be addressed to ensure the consistent and sustainable development of space tourism, and to secure the rights of all stakeholders involved including operators, passengers, launching State etc. The research paper would highlight the crucial legal issues associated with the space tourism. The paper would critically analyze the efficiency of the present international space treaties in dealing with these issues. At the end, the paper would also attempt to provide few suggestions and solutions to these legal conundrums relating to space tourism.

### 1. Introduction

The term ‘space tourism’ refers to any activity of commercial nature which provides the experience of travelling in outer space to the participants [1]. The flight participants who undertake such space tourism activities for recreational purpose are called space tourists [2]. Currently, several governmental agencies like that of Russia, and private companies like Space X, Virgin Galactic etc. are providing space tourism opportunities to the people. It is also receiving huge attention from the public. These developments reflect the infinite possibilities and inevitability of space tourism in near future [3]. These agencies and companies use different models of aerospace vehicles to launch the space tourists. In 2001, American businessman Dennis Tito, who undertook the space travel in the Russian Soyuz, became the first space tourist in the world, by travelling to the International Space Station (ISS) [4]. He was followed by the Mark Shuttleworth, Gregory Olsen, Anousheh Ansari, Richard Garriott and several others [5]. The cost of the space travel was very high in the beginning of 21st Century which limited this ultimate adventure only to few multi-billionaires, the exponential development in the space technology like Reusable Launch Vehicles (RLVs), and the growing participation of the private space companies in

the space tourism sector has brought down the space travel to below \$200,000, and there is high possibility that it would get down to \$35,000 in the next decade. Thus, space tourism is no longer a far-fetched science fiction, rather it has at the verge of becoming day-to-day reality for the people [6].

Space tourism is of various types including sub-orbital space tourism, orbital space tourism, inter-continental point-to-point rocket transportation through space, orbital space travel with accommodation in space hotel or ISS.

While the space technology, private space companies and market demand have evolved substantially in the last two decades, the legal framework to regulate the space tourism activities have lagged behind [1]. The contemporary space tourism activities are governed primarily by the four space treaties i.e. Outer Space Treaty, Rescue Agreement, Liability Convention and Registration Convention. Since Moon Agreement has very low number of State Parties, and considering the fact that majority of major space faring nations have not ratified the Moon Agreement, many space law jurists have vehemently argued that it cannot be considered as international legal norm regulating space tourism activities. The space treaties were drafted during the cold war era when both the space powers, United States and USSR (now Russia),

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were speculative and apprehensive of each other's action and were engaged in fierce space race. As a result, they agreed upon only minimal regulatory framework. As a result, the space treaties are very broadly and loosely worded creating several interpretational ambiguities. Also, the space treaties have been designed with only the exploratory space activities of governmental space agencies in mind, and they are ill-equipped to deal with modern day legal issues of space adventures by private companies including space tourism activities [7]. The absence of comprehensive regulatory framework to govern space tourism is detrimental to the growth of the space tourism activities in the long run because it is leading to divergent state practices and consequently, the space passengers, private space companies, insurance underwriters and the States are doubtful as to their precise rights and liabilities in case of any mishap like Columbia disaster. Presently, only the domestic law of United States provides elaborate norms supporting commercial space tourism activities, and is a good attempt to fill the void left by space treaties. The research paper hereinafter discusses the critical legal issues pertinent to the space tourism activities.

## 2. Air law versus space law debate

The modern aerospace vehicles vary significantly in their functioning model. For example, Spaceship 2 of Virgin Galactic uses hybrid model which comprises of both aircraft and spacecraft. Initially, the aircraft part is ignited which takes the aerospace vehicle to a stipulated height in airspace. The spacecraft part (Spaceship 2) attached to it is ignited thereupon, and the spacecraft is launched into outer space. Such hybrid aerospace vehicle poses complicated issue of determining applicable legal regime i.e. air law versus space law [8]. The two legal regimes are mutually exclusive and squarely different from each other [9]. While air law regime stands on the principle of sovereignty of the underlying State, the space law regime is based on the 'freedom of use' principle, and prohibits any claim of sovereignty or national appropriation. This has led to the 'boundary dispute' between airspace and outer space [10]. It is quite settled that outer space begins where airspace ends. However, the international air law treaties like Chicago Convention fail to provide any clarity on the maximum geographical limit of airspace [11]. Another debatable issue is whether there should be any explicit demarcation between air space and outer space.

### 2.1. Spatialist approach

Some jurists have advocated that there is an imminent need of international agreement to crystallize delimitation of air space and outer space to demystify the long standing debate [12]. They argue for a strict demarcation between air space and outer space with an imaginary line. The aerospace vehicle should be treated as a spacecraft beyond the said line and would be governed by space law. When the aerospace vehicle is below the said line, it can be deemed to be an 'aircraft', regulated by air law [11]. This viewpoint is known as 'spatialist approach' and the supporters of this approach are called spatialists [13]. Presently, it is agreed that the region below 80 km comes under airspace. However, the region between 80 and 110 km remains controversial [14,15]. The Australian space legislation supports the spatialist approach and fixes the boundary at the 100 km.

The spatialist approach has been criticized on the ground that delimitation of boundary argue that the settlement of boundary can lead to few States denying outer space activities including space tourism in the garb of airspace restrictions. Further, it has been argued that the space technology is still naïve and it is too early to reach an agreement on the outer boundary of air space, as the altitudinal reach of the future aeroplanes can increase with development of aviation technology, and once settled, it would be very difficult to change the limits. Also, it would be difficult to settle on a demarcation line without amicably resolving the claims of equatorial States made through Bogota Declaration.

### 2.2. Functionalist approach

Other jurists have contended that there is no need of establishing such a boundary. The nature of the activity, rather than the location of the vehicle, should be the determining factor. This perspective is known as 'functionalist approach' [16]. United States strongly supports the functionalist approach. They argue that since no problem has come up yet, the boundary issue should be left unsettled.

### 2.3. Exclusive utilization space or near space approach

Considering the denial of major space faring nations, especially United States, to accept the spatialist approach and the need to bring certainty in legal norms governing space tourism activities, eminent space law jurists like Dr. Paul Stephen Dempsey [13], Dr. Fabio Tronchetti and Dr. Hao Liu have propounded a harmonious and effective middle way in the form of a buffer zone between 18 and 100 km above sea level called Exclusive Utilization Space or Near Space, drawing analogy from Exclusive Economic Zone under the United Nations Convention on Law of the Sea, 1982 [17]. This approach argues that no State would have sovereignty over the Exclusive Utilization Space [18]. The underlying State would retain priority rights and right to regulate matters relating national safety and security in the Exclusive Utilization Space above its territory [19]. Private aerospace tourism activities can be carried out in the Exclusive Utilization Space after operating license from the underlying State [20]. The approach seems to be the most practical way ahead as it provides a delicate balance between the underlying State's interests and interests of the private companies willing to provide near space travel services.

## 3. Registration and jurisdiction

Jurisdiction under international law refers to the power of a State to deal with legal matters with its territory. States have an authority to apply its laws and authorize activities (including air and space endeavours) within its jurisdiction. Registration is the key prerequisite for a State to claim jurisdiction and control over an aerospace vehicle.

### 3.1. Jurisdiction issues

It must be noted that the international space treaties were formulated with state to state outer space engagements in mind. However, the growth of commercial space tourism would lead to substantial increase in private individual to individual engagements. Numerous legal issues with respect to such private individual interactions have been left unaddressed in the international space treaties. Jurisdiction for national space activities (including those of private companies registered in a State, and carrying out operation through license) is currently governed by the various principles of jurisdiction under international law [21]. However, extending these principles as it is to outer space can lead to complex legal conundrums including the problem of multiple claims of jurisdiction. Also, if a private individual launches a space object in outer space from a stateless territory, such space object might not have a specific launching state. The determination of State having jurisdiction in such a case remains ambiguous.

The contemporary international space treaties do not specify the jurisdiction in which legal action vis-à-vis commercial space tourism activities could be initiated. This could lead to conflicting claims of jurisdiction. Till now, this problem has not been practically confronted because usually the space tourists have been the nationals of the launching state. However, in future, space tourists of multiple States would be on board in a single spacecraft, hence such jurisdictional problem is quite foreseeable.

### 3.2. Registration issues

Currently, the uncertainty over legal regime applicable to aerospace vehicles create consequent dilemma regarding the law under which such vehicles should be registered. It remains debatable that an aerospace vehicle should be registered as an aircraft or space object. While in aviation law, the aircraft must be registered and carries the nationality of the State of Registry under Article 17 of the Chicago Convention, in Space law, the launching State of the space object has been obligated to register the space object in its domestic registry, and with the United Nations under Article II of the Registration Convention.

The literal interpretation of Article II of the Registration Convention shows that the article should be applied only when the flight is “to earth’s orbit or beyond”. However, that not the case in sub-orbital tourism in which flights only go till sub-orbit. Thus, Article II of Registration Convention would not govern sub-orbital tourism activities [22]. Registration of aerospace vehicles for the sub-tourism activities should be made under the air law regime. Even in respect of orbital space tourism flights, application of Article II of the Registration Convention in the existing form is not conducive because it would require registration of the same vehicle by the operator for every subsequent launch. Also, the obligation of the launching State to notify the Secretary-General of United Nations for frequent launches for space tourism activities is not conducive. Further, for a hybrid vehicle like Spaceship 2, it remains ambiguous that the registration should be made when the vehicle is launched from the ground, or when the spacecraft separates from the launching aircraft. The most feasible solution to the resolve the registration conundrum is the amendment of the said convention and require registration of the spacecraft only for the first launch, and merely notifying the appropriate State of registry for the subsequent times.

### 4. Authorization issues

It is a general norm of customary international law that States are responsible for any loss or damage caused by activities of individuals and companies within its territory. The private companies are thereby require the consent of States to run their business activities.

This customary norm of international law has been reiterated in the Outer Space Treaty. Article VI of the Outer Space Treaty obliges the States to authorize and continuously supervise national activities within its jurisdiction. The obligation extends to activities of both public and commercial nature. Usually, the States comply with this obligation by enacting domestic legislation providing for a licensing mechanism for private players. Several nations including United States, France, Germany, United Kingdom, Russia. Australia have introduced such legislations providing for authorization by State of private activities through licenses.

In 2004, United States enacted a comprehensive national law (CSLAA) to regulate the private space activities by granting licenses. The Act governs a very wide range of commercial space activities including space tourism and spaceports. The companies involved in space tourism endeavours can get the licenses on satisfying the elaborate norms of the said statute. The Act also requires the private players to obtain the ‘informed consent’ of the space tourists, whereby the tourists willing to undertake space tourism acknowledge the fact that space tourism is a risky adventure and waive any claim of liability against the State [23]. Similar provision of informed consent can also be found in the United Kingdom’s Space Industry Act, 2018.

### 5. Legal status of space tourists

In contrast with the international air law, the international space law is silent with respect to the legal status of the passengers. It has been almost half a century since first human landed in moon, but still it is debatable whether space tourists would fall under the category of ‘astronauts’ or ‘personnel of a spacecraft’. It is important to determine this

issue as the former and the latter category of flight participants to outer space enjoy distinct special rights under the international space treaties, while any other flight participants other than the aforesaid two categories would not be entitled to enjoy those special rights [24].

Article V of the Outer Space Treaty obligates States to consider astronauts as ‘envoys of mankind’ and requires States to provide all feasible aid to them at times of any distress, accident or emergency landing on other State’s territory. The provision carries some legal value or is a mere symbolic declaration remains debatable. Further the Outer Space Treaty does not provide any definition of the term ‘astronaut’. The ordinary definition of term is “A person trained to make rocket flights into outer space”. According to the plain interpretation of the term, it can be inferred that to qualify as an astronaut, the person must be professionally trained, and engaged in the operation of the spacecraft. Astronauts have been bestowed this special status in order to recognize their contribution towards the betterment and development of mankind [25]. However, the legal status of space tourists who undertake space travel only for their own pleasure and recreation remains contentious. Further, the applicability of duty to rescue and assistance under Article V of the Outer Space Treaty to space tourists remains doubtful. Also, assuming the duty to rescue is applicable to space tourists, it is also unsettled that in case of such commercial space flights facing any accident, distress or emergency situation, the responsibility to rescue lies with the States or with such commercial private entities providing space tourism services.

Article VIII of the Outer Space Treaty uses the term ‘personnel’. The general meaning of the term ‘personnel’ is “the body of persons engaged in any service or employment”. While the literal interpretation of the term would exclude the space tourists from the scope of ‘personnel’, liberal interpretation providing a broader meaning to the term could encompass the whole crew of the spacecraft including passengers under its ambit. However, the precise meaning of the term is yet not settled. Thus, legal status of the space tourists that is, whether they fall under the category of ‘astronaut’ or ‘personnel of a spacecraft’, and legal protections extended to such space tourists under the contemporary international space treaties is unclear and needs clarification [26].

Another bone of contention regarding the legal status of the space tourists arises with respect to the Liability Convention. Article VII of the Liability Convention states that Liability Convention would not be applicable in case of damage caused by launching State’s space object to national of foreign States “during such time as they are participating in the operation of that space object from the time of its launching or at any stage thereafter until its descent”. Since space tourists would generally not be participating in the technical function of operating spacecraft, their legal status under the Liability Convention remains ambiguous.

In case of any damage to the space tourists, the Liability Convention only allows the State parties to claim any compensation. The injured space passengers cannot directly bring legal action against the operator, manufacturer or the Launching State. Further, any attempt by the space passenger to institute legal action against its own State might be restricted by sovereign immunity. These limitations might prove to be detrimental to the growth of the space tourism and requires modification.

### 6. Liability issues in space tourism activities

The first and foremost concern with respect to liability of space tourism activities is the unsettled applicable standard of liability for the space tourism operations. Such space tourism activities could be governed by absolute liability principle as stipulated under Article II of the Liability Convention or else, they may also be regulated by negligence-based fault liability as delineated under Article III of the Liability Convention. Further, it is unclear that the amount of compensation for any damage by such space tourism activities should be limited by some upper threshold or should be left unlimited [27]. These issues might be very vital from the perspective of the insurers [28]. It would be difficult

for insurers to determine the quantum of feasible insurance coverage which could be provided for such space tourism activities without clarity on the aforesaid issues, as it could potentially subject them to expensive unquantifiable risks [29]. Also, from the passengers' point of view, it is pertinent to have settled jurisprudential principles on the basis of which they could claim relevant damages caused in such activities. It is important to have well defined principles and provisions dealing with the liability of such activities to ensure a good balance between the industry and the need to secure justice for the space tourists [30].

Another important issue is the lack of uniform norms of insurance and indemnification may lead to problems of forum shopping and flags of convenience in space tourism activities, similar to that in maritime law. Considering the absence of specific uniform international legal provisions regulating insurance and indemnification norms for the private players engaged in space tourism industry, many States may loosen their registration, insurance and regulatory norms to attract private space companies, and also since the enforcement mechanism is very weak, with lack of international body like ICAO, and in absence of any tribunal at international level to specifically deal with the violations of space law by States in an expedite manner, the States might feel that the financial benefits derived from loosening registration, insurance and regulatory norms are far greater than the risk of enforcement [31]. Also, diluting the regulatory norms can lead to grave disasters causing environmental pollution in space, and threat to life of the space passengers.

## 7. Environmental issues

The increase in the number of space tourists could also enhance the environmental pollution in outer space. However, due to lack of regular sub-orbital and orbital human spaceflights, it is difficult to ascertain their precise environmental consequences. Sub-orbital and orbital space tourism flights would pass through different layers of atmosphere and can have degrading effects on earth's atmosphere, especially the upper layers of the atmosphere. The potential negative anthropogenic impacts include ozone depletion, climate change, alteration of radiative properties of the atmosphere, and modifying the radio-wave reflecting properties of ionosphere resulting in distortion of radio communications [32].

The Lower Earth Orbit (LEO) is used for placing various kinds of satellites which help to ease the life of humans. LEO has already got overcrowded because of huge number of satellites and other human space activities like Anti-Satellite missile (ASAT) testing. The debris produced by break up or collisions of sub-orbital vehicles can further increase density of debris in LEO. Sub-orbital or orbital space tourism flights might also collide with space objects launched into space or deorbiting objects.

The international regulatory framework with respect to sub-orbital flights is not clear. The question of applicable legal regime (air law or space law) remains unsettled. For space flights, Outer Space Treaty has only a brief environmental protection provision in the form of Article IX. While Article IX of the Outer Space Treaty deals with environmental protection of outer space, it only provides basic restrictions on the States. It does not specifically deal with space debris. Further, the international space treaties do not any procedure to reduce or clean space junk. Thus, the minimal environmental protection norms provided by space treaties are grossly insufficient to deal with modern day environmental concerns of outer space.

The other option is to extend the earthly principles of international law like polluter pays, precautionary principle etc. to outer space environment via channel of Article III of the Outer Space Treaty, 1967. Considering the existing stalemate over drafting and adoption of new space treaties after 1979 Moon Agreement and exponential spur in commercial uses of outer space, the extension of the aforesaid principles of international environmental law to outer space is the most feasible solution for now [33]. However, it can only be a temporary solution because the international environmental law principles are very broad

and vague in nature. Also, these principles were designed especially with earth's atmosphere in mind, and their suitability in dealing with complicated and technical legal issues arising out of high risk activity like space tourism in an entirely different arena i.e. outer space remains untested. Thus, they are not permanent solution of the environmental threats posed by such human space tourism activities. There is a need for international legal framework governing space tourism activities.

Without a strong environmental protection legal regime, space tourism could lead to permanent irreversible damage to the outer space environment, making it unsuitable for the free exploration and use by all States [34]. Also, there is an imminent need of space traffic management mechanism to ensure smooth flow of traffic generated by future increase in commercial space tourism explorations [35,36].

## 8. Property rights

Protection of intellectual property rights could prove to be another critical concern in relation to space tourism. Outer Space Treaty broadly attempts to protect space objects, and the people of the State Parties in outer space. It also lays down principles of jurisdiction and control with respect to space objects. However, Outer Space Treaty does not expressly provide any protection to intellectual property rights of State Parties. In addition, it also fails to provide elaborate enforcement mechanism in case of any intellectual property rights (IPR) violations in outer space. Further, the Treaty is silent on any violations of IPR in outer space by non-signatory nations. Similarly, the Registration Convention is primarily concerned with respect to ownership and registration of space objects, and not IPR claims. Also, the Registration Convention does not specifically deal with private third-parties and provides that States have international responsibility for their national activities in outer space. It remains contentious whether the definition of damage provided in Liability Convention may be extended to violation of IPR rights, especially private non-State third-party party IPR rights [37].

Thus, it can be safely concluded that the present international space treaties fail to precisely deal with potential violations of intellectual property rights during space tourism activities. There is an urgent need for an international agreement clarifying and crystallizing the IPR protections in outer space. The ISS Agreement can serve as a template for any future treaty on IPR protection in outer space. Alternative solution could be extension of the existing IPR regime with minor modifications to suit the special environment of outer space [38].

The growth of space tourism in future could also necessitate the creation of hotels in outer space for the accommodation of the space tourists, and consequently, would require some legal protection of such property. However, it is not clear whether the principle of non-appropriation under Article II of the Outer Space Treaty, and declaration of the outer space as "province of all mankind" allow granting of any such property rights.

## 9. Conclusion

While the space technology has evolved exponentially in the last few decades and participation of private space companies has substantially increased in the space sector including space tourism, the international legal framework dealing with the concerned issues have remain stagnant since the Moon Agreement. Existence of strong international legal regime is an elementary requirement for the sustainable development of space tourism activities. The lack of clarity and certainty of legal rights, duties, liabilities and enforcement mechanism can hamper the growth of the private commercial space tourism industry. The crystallization of international legal norms can instil confidence and would act as a catalyst for the growth of private space tourism activities. International regulatory body like International Civil Aviation Organization to regulate space tourism activities, settlement of delimitation debate, better environmental protection norms, providing certain property rights, harmonising liability and licensing provisions, appropriate enforcement



and dispute resolution mechanism are few suggestions which can prove effective in resolving the current legal conundrums of space tourism.

### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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