

SPACE TOURISM AND LIABILITY: NAVIGATING LEGAL CHALLENGES IN THE ERA OF COMMERCIAL SPACE TRAVEL

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Abstract

The commercial space industry is growing at a breakneck speed, and with it comes a slew of new legal issues. The expanding commercial space industry raises a wide range of legal concerns, which are explored in this abstract. Questions of liability and passenger safety have arisen with the emergence of space tourism, calling for thorough regulatory systems. Space traffic management, spectrum allotment, and orbital slot allocation are all issues that arise when deploying satellites for communication and observation. In addition, as space junk continues to pile up, comprehensive mechanisms to mitigate harm and assign responsibility for accidents involving debris from outer space are urgently required. This article highlights the pressing legal challenges inherent in the commercial space industry, emphasizing the need for comprehensive and forward-thinking legal frameworks to facilitate the sustainable and responsible exploration of space.

Introduction –

1. Rise of Space Tourism: From Science Fiction to Commercial Reality –

The idea of people travelling into space for leisure or business purposes has moved out of the realm of science fiction and into the actual world in recent years. A new front line of legal problems has appeared as a direct result of the proliferation of private space enterprises and their aspirational intentions to provide commercial space travel experiences. At a time when people are getting excited about the prospect of travelling beyond the atmosphere of Earth, concerns regarding responsibility, safety standards, and legal frameworks have taken centre stage.

The practice of travelling to space, which was long thought of as a privilege only available to trained astronauts, is now being promoted to a wider public with the promise of awe-inspiring travels and experiences that only come around

once in a person's lifetime. Space tourism is considered to be another niche segment of the aviation industry that seeks to give tourists the ability to become astronauts and experience space travel for recreational, leisure, or business purposes.⁸

Advancements in technology and the emergence of private space companies have paved the way for everyday individuals to experience the wonders of space travel. The rate of progress in the space tourism business has sped up since government-funded space projects gave way to privately-funded ones. Companies like SpaceX, Blue Origin, and Virgin Galactic are leading the way by investing in cutting-edge spaceships and new launch methods that aim to change the way we think about and experience space.

II. Legal Frameworks for Space Tourism: Liability and Safety of Passengers –

⁸ Space Tourism, <https://www.sciencedirect.com/topics/social-sciences/space-tourism>

As space travel becomes more accessible, it is crucial to ensure the safety of tourists and lessen the hazards inherent to the unknown. Because of the distinct dangers and inherent uncertainties associated with space travel, a thorough legal framework is required. A well-defined legal framework that takes into account international agreements, national laws, and the unique conditions of space missions in order to adequately address the complications of culpability assessment and compensation in the case of accidents or events involving space tourists is what is required.

Virtually every major disaster, from Mount St. Helens to Bhopal to the Air Florida plane crash, whether man-made or natural, eventually finds its way into the federal courts. For the sake of passenger safety, it is imperative that private space businesses follow strict safety measures. This entails meticulous planning of the spacecraft's construction, testing, and crew preparation. There should be strict rules and regulations in place to enforce these safety measures and guarantee compliance throughout the sector.⁹

When it comes to the law, space tourism is heavily influenced by international treaties and accords.¹⁰ Harmonized regulations and cross-border uniformity require international cooperation to develop. The Outer Space Treaty and other related accords lay the groundwork for resolving legal concerns raised by space operations. However, these agreements will need to be reviewed and updated as space tourism develops to account for the unique difficulties and complexities of this new field.

The implementation of risk reduction strategies and emergency procedures is required in order to successfully navigate the unpredictability of space flight. In operational standards, contingency planning, emergency response protocols, and efficient communication lines

between the spaceship and ground control should all be included. It is vital for space tourism operators, regulatory organizations, and emergency response agencies to maintain close coordination and collaboration in order to guarantee that prompt and effective action can be taken in the event that anything unexpected occurs.

Major Space Travel Mishaps and their Legal Implications –

a) **Challenger Space Shuttle Disaster (1983)** – Shortly (73 seconds) after liftoff, the US Space Shuttle Challenger had an explosion that killed all seven of its crew members. The tragedy prompted other authorities, including the Rogers Commission, to investigate the safety of space travel. NASA has revised its policies and safety measures as a result of the study, which uncovered faults in both design and administration. Settlements were reached in lawsuits made by crew members' families against NASA and contractors.¹¹

b) **SpaceShipTwo VSS Enterprise Crash (2014)** – During a test flight, Virgin Galactic's SpaceShipTwo, named VSS Enterprise, suffered a catastrophic in-flight breakup, leading to the death of one pilot and serious injuries to another. This incident prompted investigations by the National Transportation Safety Board (NTSB) and the Federal Aviation Administration (FAA). The legal implications focused on determining the cause of the accident and potential liability for the company involved.

The legal ramifications of each of these incidents often included inquiries by the appropriate government authorities, potential liabilities for the parties involved (such as space agencies or private corporations), and the requirement for further safety measures.

A. Navigating the uncertainties of Space travel

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I. Risk Mitigation and Emergency Protocols –

⁹ Space Law, <https://www.unoosa.org/oosa/en/ourwork/spacelaw/index.html>

¹⁰ International Space Law https://www.spacefoundation.org/space_brief/international-space-law/

¹¹ <https://www.washingtonpost.com/archive/politics/1986/02/21/shuttle-disaster-poses-liability-questions/e04e6e87-72ad-456d-afe1-e98d18132bfe/>

The process of mitigating risks begins a very long time before a spacecraft is ever launched. Vulnerabilities may be found and fixed with the aid of exhaustive testing and simulations, as well as a careful examination of all possible failure scenarios. In order to guarantee the spacecraft's resiliency, redundancy, and tolerance for malfunctions, robust design concepts are put into practice. These precautions are being taken in the hopes of lowering the risk of catastrophic failures and improving the overarching security of space travel.

During space missions, emergency protocols provide a critical foundation for addressing unanticipated events as they arise. They detail, in sequential order, the procedures that members of the crew and ground control are expected to follow in the case of an emergency. These protocols cover a wide range of potential events, some of which might be fatal to passengers, such as a loss of cabin pressure, a fire, or a breakdown of a crucial system component. Training programs for crews are intended to acquaint astronauts with standard operating procedures for emergencies and to guarantee that they are able to respond successfully even in the most trying of circumstances.

For instance, *the Hubble Space Telescope Servicing Mission*¹² has required several servicing missions over its operational lifespan. These missions involved sending astronauts to the telescope in space shuttles to repair and upgrade their systems. The teams meticulously planned these missions, accounting for potential risks and developing contingency plans to address unforeseen challenges that may arise during the complex repair operations.

In addition, continual monitoring and communication systems play an essential part in both the prevention of potential dangers and the handling of emergencies. Advanced sensors and diagnostic tools are installed on board

spacecraft so that operators can keep track of how well vital systems are functioning and monitor their health at all times. The transfer of data in real-time to ground control allows for the rapid discovery of abnormalities, which in turn permits timely action and decision-making. In addition, effective communication links between crew members, mission control, and other space organizations make it easier to share important information and coordinate operations to provide help or rescue people.

One example that illustrates the importance of continuous monitoring and communication systems in space travel is the *Soyuz MS-10 Mission*¹³, which took place on October 11, 2018. It was carrying NASA astronaut Nick Hague and Russian cosmonaut Alexey Ovchinin and experienced a booster rocket failure during its ascent to the International Space Station (ISS). A severe issue occurred with the Soyuz rocket, prompting a safety abort procedure. With so much at risk, the Soyuz spacecraft's *constant monitoring systems picked up on the anomaly and set off the emergency procedures*. Sensors and diagnostic equipment on board the spaceship made a speedy assessment and transmitted the results in real-time to ground control and the crew. The robust communication channels between the astronauts and mission control played a crucial role in the subsequent response. The crew was able to successfully abort the mission and perform a ballistic re-entry, experiencing high gravitational forces during descent, thanks to the monitoring systems and effective communication.

II. Operational Standards and Crew Training

Space operations involve many moving parts, from spacecraft design and launch to emergency procedures and mission control. Technical requirements, risk management, and emergency preparedness are all areas that regulatory agencies and industry players work

¹² <https://hubblesite.org/home>

¹³ Statement on Soyuz MS10 Spacecraft, NASA
<https://blogs.nasa.gov/spacestation/2018/10/11/statement-on-soyuz-ms-10-launch-abort/>

together to set rules for. Spacecraft designed to these specifications assure the greatest levels of safety, and the whole space tourism infrastructure follows strict operational rules.

The preparation of the crew members working on space tourism missions is also vital. Training programs for astronauts and ground crew members are intense and include a wide range of topics. Exercise, spaceship operation, emergency drills, and mental preparation are all included in these courses. Members of the crew are also prepared for medical crises, fires, and communication breakdowns through specialized training. Regular assessments and refresher courses help crew members keep their skills sharp and up to speed with the latest technical developments, guaranteeing the greatest possible degree of safety. Mission experience and fresh knowledge inform the ongoing process of training.

For instance, The Human Space Flight Centre (HSFC) in Bengaluru was built as part of the *Indian Space Research Organisation's (ISRO) Human Spaceflight Program* (also known as "Gaganyaan") with the express purpose of planning and carrying out the launch of Indian astronauts into space. Crew training is only one of the many objectives of the HSFC, which included various aspects of physical fitness, survival training, spacecraft systems, spacewalk simulations, emergency response procedures, and psychological preparedness.¹⁴ This exemplifies how the Indian space industry is investing in the cultivation of highly competent and capable astronauts who will be indispensable to India's future aspirations in human spaceflight through partnerships and specialized training institutions.

An indispensable part of this training also includes imparting the know-how of **Emergency and Evacuation** processes that are critical aspects of travel, ensuring the safety and well-being of astronauts and space tourists

in potentially hazardous situations. Spacecraft malfunctions, medical emergencies, and other unanticipated events all have clearly defined emergency reaction plans that are put into action when the time comes

As soon as a problem is detected, the crew contacts mission control and any applicable ground-based support teams for an assessment and further instructions. Crew members undergo extensive training to handle various emergency scenarios, including fire, loss of pressure, loss of power, or critical system failures. They are trained to remain calm, think critically, and execute predefined procedures to ensure their safety. Simulations and drills play a vital role in preparing astronauts for emergencies.

Similarly, members are trained to quickly don their spacesuits, secure necessary equipment, and move to designated evacuation points. These points may involve transferring to escape pods, using emergency hatches, or performing spacewalks to reach a rescue vehicle or return to Earth, when their safety is comprised thus initiating an evac.

III. Communication and Coordination with Ground Control

In order to transmit critical data in real-time, such as mission status updates, trajectory modifications, and emergency notifications, it is necessary to create communication protocols and systems. Clear and consistent communication between spacecraft and ground control centres relies on robust voice and data communication systems.

Together, ground control and the space tourists will keep tabs on and manage the mission's many moving parts. Mission success depends on the ground control team's ability to monitor the mission in real-time, provide advice, and make important choices based on the analysis of collected data. They keep an eye on the spacecraft's path, performance, and systems to check for any problems or abnormalities and make sure all safety measures are taken.

¹⁴ Crew Training, ISRO, https://www.isro.gov.in/CrewRecoveryTrainingPlan_Gaganyaan.html

Continuous learning requires post-flight debriefings, data analysis, and mission performance review. Post-flight reports and space vehicle and crew feedback help improve future space tourism operations.¹⁵

B. Space Tourism Insurance: Coverage and Challenges –

I. Insurance Options for Space Tourists and Space Companies

Insurers are working hard to suit the demands of the growing space tourism sector by offering new niche insurance policies. To ensure the financial feasibility and sustainability of space tourism operations, it is crucial that insurers, space tourism operators, and regulatory organizations work together to provide enough coverage and set clear insurance criteria. Ideally, insurance coverage should cover these issues considering the factor that spacecraft and passengers are subjected to microgravity, high radiation levels, and vacuum conditions –

- Medical Emergencies, including the provision of medical care during the flight and potential evacuation or medical assistance upon return.
- Coverage for evacuation, rescue operations, and compensation for bodily injury or loss of life.
- Risks associated with re-entry, including the possibility of a hard landing, parachute failures, or other landing-related incidents.
- Coverage for the space vehicle itself, including hull insurance and coverage for the equipment and technology onboard, is necessary to protect against physical damage or loss.
- Payload insurance addresses the risks associated with valuable cargo or experiments carried on board the spacecraft.¹⁶
- Liability coverage should account for potential third-party claims, including those

arising from interactions with other spacecraft, satellites, or ground-based infrastructure.

II. Insurance Options for Space Tourists and Space Companies¹⁷

a) Liability Insurance: This covers space tourism-related accidents, mishaps, and damages. It covers property, bodily injuries, and other damages. Space tourism firms need liability insurance to defend against passenger or third-party lawsuits.

b) Accident Insurance. This insurance covers space tourism injuries and deaths. It compensates people or their families for accidents, disability, or death. Accident insurance may be included in space travel packages.

c) Property Insurance: Property insurance protects spacecraft, launch vehicles, and other space tourism assets. It prevents launch failures, cargo failures, and re-entry damage. Space vehicle and infrastructure owners may need property insurance.

d) Launch and In-Orbit Insurance: These plans protect satellites and other payloads against space launch risks. These plans cover launch failures, pre-flight damages, in-orbit malfunctions, and other hazards. They may apply to space tourism activities that deliver payloads or research experiments.

C. Lawsuits, Settlements, and Impact on the Industry

Lawsuits and settlements have significant impacts on the space industry, affecting various aspects such as companies, government agencies, and space exploration missions. A few examples of how lawsuits and settlements have impacted the space industry –

a) Commercial Space Companies – Lawsuits involving corporations like SpaceX, Blue Origin, and Boeing centre on issues of contract breach, intellectual property infringement, and product

¹⁵ <https://www.nasa.gov/feature/goddard/2020/space-communications-7-things-you-need-to-know>

¹⁶ Space Insurance Landscape, <https://payloadspace.com/the-space-insurance-landscape/>

¹⁷ Commercial Space Launch Insurance

https://www.faa.gov/about/office_org/headquarters_offices/ast/media/q4_2002.pdf

liability. Financial stability, corporate credibility, and access to government contracts and mission launches are all at risk in the face of such litigation.

b) Intellectual Property - Patents and copyrights for ground-breaking technology and designs are two common areas where conflicts over intellectual property emerge in the space sector. Legal fights and settlements resulting from these disputes can have an impact on a company's ability to market its goods and innovations.¹⁸

c) Safety and Accidents - Accidents, such as launch failures or in-orbit mishaps, can lead to lawsuits. Families of astronauts or space mission participants who have suffered injuries or fatalities may file lawsuits against the responsible entities, seeking compensation and changes to safety protocols.

d) Environmental Concerns - Rocket launches and satellite installations can harm the environment. Contamination, debris, and rocket emissions may lead to lawsuits and settlements. These lawsuits can affect environmental rules and industrial practices.

e) Privacy Concerns - Satellite images and data collecting have raised privacy issues. Commercial space enterprises and government satellite operators may face privacy or data breach lawsuits.

f) International disagreements - International collaboration in the space sector can lead to disagreements. These disputes might include satellite orbital slots, intellectual property, or contractual duties. Diplomatic disagreements can affect collaborative space initiatives.

These settlements may include cash compensation, contract revisions, safety protocols, or industry rules. They can create legal precedents and affect space sector corporations and governments.

D. Future Prospects and Challenges for Space Tourism Liability

A need for the development and refinement of legal frameworks requiring new laws or modifications to establish space tourism accident duties, liabilities, and compensation will be witnessed. Governments and international organizations can work together to unify legislative frameworks to safeguard passengers and reduce hazards. Coordination and cooperation among different countries and regulatory bodies will be crucial for addressing liability challenges, given the international nature of space tourism.¹⁹

Space tourism operators will need to ensure that passengers are fully aware of the risks involved and provide clear information about the nature of the journey, potential hazards, and safety measures. Developing comprehensive and transparent consent processes will be crucial to addressing liability concerns and minimizing legal disputes.²⁰

Clear guidelines and mechanisms for determining compensation amounts, insurance coverage, and financial responsibility need to be established to address the challenge of accidents or fatalities.

Conclusion –

In a world not too far away, where space travel is a thing, liability floats in space with no gravity like a rock. As tourists go on experiences in space, the legal problems they face look like a celestial dance. From informed consent forms shaped like nebulae to liability insurance plans as rare as moon rocks, the relationship between law and space travel has a strange charm. Just as the bizarre crew in "Interstellar" went into the unknown, the brave pioneers of space tourists must deal with comical accidents, cosmic disasters, and intergalactic lawsuits. In this cosmic dancing, finding a balance between risk

¹⁸ Air and Space Law, <https://airandspaceclaw.olemiss.edu/pdfs/jsl-34-2.pdf>

¹⁹ Space Agencies of the World, <https://goingtospace.com/space-programs/space-agencies-around-the-world>

²⁰ <https://apuedge.com/space-law-current-agreements-and-the-future-possibilities/>



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and responsibility becomes a dance of the stars. This ensures that the legal framework of space tourism is as wacky and wonderful as the universe itself.

