

Chapter 14

Space Tourism



14.1 Introduction

Space is no longer the domain of just professional astronauts or for scientific explorations; it is now accessible to all, even for recreation. The platform is ready for people to explore Space, up to the Karman Line, or the International Space Station (ISS), and efforts have begun to visit even the Moon and Mars. Commercial leisure space transportation has already started, and sub-orbital flights, a segment of space tourism, are consequently poised to grow faster than the rest. Beyond the orbit trip, like up to the Moon or Mars, may take some more time to realize. Terrestrial space tourism activities have continued as many can satisfy their curiosity about Space by watching and learning about space-related events, incidents, and shows. In addition, ZERO-G weightless flights and space flight training are also taking place, which can offer the experience of flying at very high altitudes.

Not only does space tourism extend the freedom to travel into Space for those with a desire to experience space flights, but it is also wide open as a lucrative commercial sector that can directly or indirectly assist in scientific space explorations through innovations and technological advancements as well. It may enable a large number of people to travel to Space in the next few decades. The new millennium's first decade could record several space trips into the International Space Station (ISS), and then there was a slump. Later, the momentum was regained after the pandemic that stalled the human movement on the Earth. A sudden rise in leisure space trips was seen in 2021, started by Virgin Galactic and Blue Origin, two prominent leaders in the space tourism industry. In 10 days in July 2021, the commercial spaceflight sector conducted two giant leaps as Virgin Galactic, and Blue Origin made successful flights with paying customers on board. Soon, more sub-orbital flights took off with tourists to enjoy the space ride. The question now is, when space tourism, both sub-orbital and orbital, becomes affordable for a large section of the society, and when beyond, the orbital space tourism turns out to be a reality. This chapter will discuss various aspects of space tourism and its prospects. An example of space station is shown in Fig. 14.1.

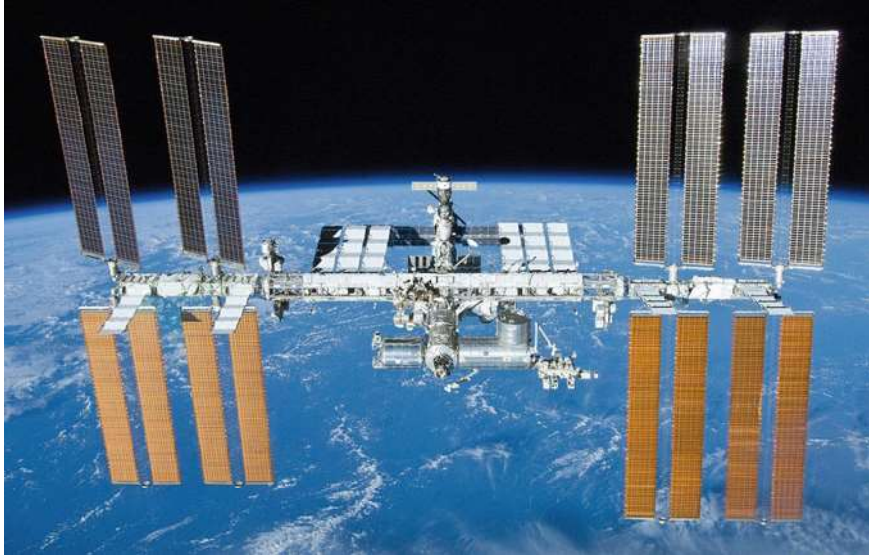


Fig. 14.1 International Space Station. *Courtesy* By NASA/Boeing- https://www.nasa.gov/sites/default/files/thumbnails/image/iss_rosa_correct_channels.jpg (<https://www.nasa.gov/feature/new-solar-arrays-to-power-nasa-s-international-space-station-research>), Public Domain, <https://commons.wikimedia.org/w/index.php?curid=10561008>

14.2 What Is Space Tourism?

Space tourism is considered a futuristic segment of tourism that aims to have voyages into Space for leisure purposes. Wittig et al. (2017) consider Space tourism as the provision of a ‘next generation’ luxury experience, offering affluent travelers unique adventures in Space. Spending leisure in Space has been a dream, and only a few can achieve it as of now. The ongoing efforts can enable space enthusiasts to become astronaut-like for a short period and to experience space journeys as a recreational option. Experience the weightlessness while in Space, feel the infinity while in the dark Space, view the Earth from Space, etc., lure many to venture into space journeys. Space tourism is also defined as space travel for novelty seeking, leisure and recreation, and knowledge pursuit (Chang & Chern, 2013). Diverse motivations can urge people to engage in space tourism. Early space tourists examples are reported in Table 14.1.

Space journeys were primarily limited to scientific explorations, and the scope of having expeditions into Space to satisfy curiosity began just a few decades ago when some started thinking of commercial flight operations into Space. The organized form of space tourism requires regular operations by commercial firms, which, after a few experimental trips, is yet to become a reality. In this regard, Loizou (2006: 289) pointed out that space tourism is “any commercial activity offering customers direct or indirect experience with space travel”. Further, the definition proposed

Table 14.1 Early space tourists

Orbital space tourists	Sub-orbital space tourists
1. Dennis Tito, first space tourist, flew on Russian Soyuz rocket on 28 April 2001, and reached International Space Station. The journey lasted for eight days 2. Mark Shuttleworth reached International Space Station. The trip started on April 25, 2002 3. Greg Olsen (October 1, 2005) 4. First female space tourist, Anousheh Ansari, traveled on 20 September 2006 5. Charles Simonyi (April 7, 2007) (All of them travelled on Russian Soyuz rocket and reached International Space Station (ISS) of NASA)	6. Sir Richard Branson, the owner of Virgin Galactic, along with three of its employees, such as Beth Moses, Sirisha, and Colin Bennett; made a cruise into space on July 11 on Virgin Galactic's First Flight 7. Jeff Bezos, Mark Bezos, Oliver Daemen, and Wally Funk flew on Reusable Space Ship First Step (RSS First Step), a New Shepard space capsule organized by Blue Origin, in July 20, 2021

by the Space Tourism Society (2019), which says that “space tourism is the most logical endeavor for commercial enterprises to pursue towards the goal of expanding humankind into space”, reiterates the significance of having commercial operations. However, monetary barriers primarily would restrict space tourism from becoming mass tourism in the near future. Therefore, considering the limitations, space tourism shall remain a Niche tourism category. According to Dileep and Kurien (2021), it is even more challenging to refer to space tourism as a niche tourism category as the scope of the market size will remain very small in the immediate future.

The term space tourism encompasses different forms of journeys into Space as well as engaging in some activities that are associated with Space. While definitions mostly include space tourism as the journeys into Space, a section of such journeys does not go into Space beyond the Karman Line, which is considered the imaginary line that distinguishes Earth's atmosphere from Space. The Kármán line, which is 100 km above the Earth's sea level, is the imaginary boundary between Earth's atmosphere and Outer Space. NASA (2021) clarifies that “For purposes of spaceflight, some would say at the Karman line, currently defined as an altitude of 100 km (60 miles). Others might place a line 80 km (50 miles) above Earth's mean sea level. But no sharp physical boundary marks the end of atmosphere and the beginning of space”. Most of the recent space tourism flights have not crossed the Karman Line.

Moreover, the current attempts aim at having short-duration flights up to the Karman Line or below that; they may not go into the actual Space. Still, those passengers can experience the weightlessness and view the Earth as a globe while on the flight. Moreover, apart from those sub-orbital flights, orbital and beyond orbital space flight experiments are also progressing rapidly, strengthening space tourism significantly.

Furthermore, the framework of space tourism encompasses more aspects as well. Non-flight space tourism activities are also there. For instance, Stainton (2022), opines that the space tourism concept is a broader term encompassing not only the temporary movement into Space by the people having an interest in Space but also the

visits to space-focused museums, watching rocket launches, and trips to destinations popular for stargazing are part of space tourism. She defines space tourism as the “... act of taking part in activities that involve or are related to space, either for business or leisure purposes”. The following categorization of space tourism by Laing and Crouch (2004) helps to understand the diversity involved in space tourism.

1. Virtual: Use of Virtual Reality (VR) helmets that enable people to have a bird’s eye view into Space
2. Terrestrial: Tourism activities without having a flight, but involves space camp, theme park, a space museum, and similar activities together which can provide a space experience.
3. Near-space: Short trips into high altitudes, within the atmosphere on the supersonic flight to enable the people to experience weightlessness, high altitude sightseeing, etc.
4. Suborbital: Suborbital flight takes people to sufficiently high altitudes by which tourists can watch the Earth’s curvature and the blackness of Space without leaving Earth’s orbit.
5. Low Earth orbit (LEO)/ High Earth Orbit (HEO): These provide actual orbital experiences ranging from hours to days or weeks.

Therefore, space tourism involves various activities ranging from days-long orbital flights to visiting Space-related museums. Some of the terrestrial space tourism activities have been happening for several decades. However, the emergence of space tourism as a complete form of tourism gave way to increased significance for such activities.

14.3 Evolution of Space Tourism

Though the journey into space as part of scientific exploration began some decades ago, its commercial version only emerged recently. The commercial voyages to space became a reality only by the beginning of the twenty-first century. Yet, Lappas (2006) is of the opinion that the commercial space market, like satellite-based services, has existed since 1970 and has been increasing. Decades ago, in 1967, Barron Hilton, the then president of Hilton Hotels, disclosed his vision for a hotel on the moon (Tasci et al., 2020), and it was an inspiration for those who wished to have commercial flights into space. The attempts to develop commercial space tourism passed through different phases. According to Von der Dunk (2011), from a legal perspective, three distinct eras can be identified in the evolution of space tourism.

1. First era: It was with a limited number of players and stakeholders, which mainly consisted of a handful of governments or their agencies (and occasionally inter-governmental organizations), along with private players such as the manufacturers of certain essential facilities, services, etc. The 1960s and 70s marked significant decades in this era.

Table 14.2 Major milestones in the history of space tourism

Some of the major milestones in the evolution of space tourism are listed below

- 1961; the first astronaut flew to Earth's orbit
 - 1968: Pan Am airlines proposed plans for commercial flights to the Moon
 - 1981: First privately funded manned suborbital rocket for space tourism was designed by Robert Truax (VolksRocketX-3)
 - 1986: The Shuttle Challenger disaster occurred and it pointed out the importance of cautions in space flight
 - 1990: The Space Transportation Association (STA) was formed
 - 1998: Space Adventures, Ltd. was formed in Virginia, USA
 - 1999: XCOR Aerospace Company based at the Mojave Spaceport, Mojave, California, USA was formed
- The Russian commercial space flight company MirCorp was formed
- 2001: First commercial space tourist Dennis Tito traveled to ISS (28 April–6 May)
 - 2003: MirCorp was closed after Mir's demise in 2001
 - 2004: Virgin Galactic Company was established in Las Cruces, New Mexico, USA
 - 2006: FAA of the USA issued the rules and regulations that will govern private human space flights
 - 2010: Space X successfully orbited and recovered its first Dragon space capsule, which marked the first attempt of a private company to return an orbiting space craft to earth
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Source Adapted from Chang (2015)

2. Second era: In this era, private participation increased, and their involvement in space activities got enhanced dramatically by launching services or operating space objects themselves. As private participation increased, states started to enact national space laws, licensing systems, and other supervision mechanisms. Yet, manned spaceflight was not part of those operations by the private sector.
3. Third era: Manned spaceflight became a reality, and the commercialization process was gaining significance and intense efforts are in place to commence commercial operations into the space.

Some important steps in the history of space tourism are shown in Table 14.2.

According to Goodrich (1987), there were attempts from the private sector to have commercial trips to Space during the 1980s, and they approached NASA for the same. But the attempts weren't encouraged. The quest for having low-orbit space flights for tourists continued by Pacific American Launch Systems, Inc. and Society Expeditions, based in USA, and attempts were there to have a series of low-orbit passenger flights using Pacific American's planned Phoenix single-stage-to-orbit spacecraft. These attempts fueled the scope of commercial space tourism, and the efforts continued. By the dawn of the new millennium, space travel began. Yet, only a handful of Billionaires could make the dream possible. By the end of the 1990s, there was a deal between the Russian company MirCorp and the American company Space Adventures Ltd. to have a space trip to Mir space station, and Dennis Tito was chosen as the first paying passenger. Yet, that planned trip didn't take place, and later, the trip was arranged to the ISS on a Russian spacecraft Soyuz TM-32 for seven days (Britannica.com/space tourism). On 28 April 2001, Dennis Tito, an American engineer, and entrepreneur, could have a sojourn into Space. The following

year, Mark Richard Shuttleworth also traveled to Space with a recreational objective. Gregory Olsen, Anousheh Ansari, Charles Simonyi. etc., followed them. All these trips were to International Space Station (ISS). Table 14.1 consists of the list of early commercial space tourists.

After those trips to ISS, there was a long gap of almost a decade to have the next series of commercial trips into space. Meanwhile, the commercial firms involved in space tourism kept experimenting with spacecraft suitable for commercial space journeys. There were some accidents and setbacks, yet the efforts have continued. By this decade, the space journey began once the pandemic issue got settled. The companies such as Blue Origin and Virgin Galactic could conduct low earth orbit or sub-orbital flights with four or more space tourists for very short durations. In the meanwhile, there were multi-day trips to ISS as well. Still, Space tourism is in the nascent stage and has miles to go to make it a viable space tourism segment in the realm of global tourism.

14.4 Importance and Limitations

Space tourism is still regarded as a futuristic segment of tourism. If the current space tourism activities continue, the space tourism sector will grow substantially. The predictions on the future of space tourism are awesome. According to the “Space Tourism - Global Market Trajectory & Analytics” report, the global market for Space Tourism is estimated at US\$651 Million in the year 2020, and it is expected to reach a revised contribution of US\$1.7 Billion by 2027. Sub-orbital tourism alone would reach US\$1.5 Billion by 2027. While the US market would turn out to be \$175.3 million, China is forecast to have a market size of US\$401.6 million (reported on businesswire.com). The space tourism sector would generate a significant number of new jobs and capabilities. Around 600 people have been confirmed for Virgin Galactic flights in the future, along with over 8,000 interested potential buyers registered by 2018 for space trips in the future. Though the predictions are there, the scope for the space tourism economy primarily depends upon the related technological advancements. Experiments of the flights are still going on.

In fact, Space tourism is still an unaccounted sector economically except for some industry estimates and predictions. According to Webber (2013: 142), “the importance of space tourism cannot be overstated, partly because of the economic benefits it will bring, partly because of the new perspectives it will provide to all future space tourists, and partly because of the airline-like operating experience with reusable space vehicles, and the associated economies of scale of launch operations that will result”. Once the technological platform for regular operations is ready and the sector becomes affordable for more sections of the people, the economic benefits of space tourism will be visible. As of now, the increasing commercialization of space tourism activities and explorations led to drastically reduced launch costs, enabling an increased human presence beyond the biosphere. This change can be expected more in the years to come as well (Spector et al., 2017).

Ensuring a viable space tourism industry depends on the economic prospects as well; from the perspective of the potential to create a profitable business, which, according to Penn and Lindley (2003), the revenue generation has to be good enough to meet the operating expenses (mainly with regard to propellants, maintenance, spares, flight crews, and insurance), vehicle amortization costs, and research and development (including test and engineering) costs, in addition to the yield required as the return on investment. Reducing the cost per flight, increasing reliability based on the risk and safety aspects, and ensuring lesser vehicle turnaround time are essential. Penn and Lindley (2003) also point out that the focus of development may be on operability, reliability, and cost rather than performance. Table 14.3 describes the advantages and disadvantages of space tourism.

In 1987, Goodrich identified certain barriers to enter into the space tourism sector, which includes limitations associated with transportation technology, extremely high capital requirement, high space travel cost, profit, mental and physical health requirements, safety, legal aspects, government regulations, the inhabitability of space, etc. These limitations are still prevailing. As of now, the transport technology for commercial low-orbit and sub-orbital trips has improved. Yet, there is scope for further improvement, and the widespread usage is to be explored further.

The technology development for trips to outer space, into the planets, etc., is in the nascent stage only. It is not that every company can start commercial space tourism.

Table 14.3 Space tourism: the Pros and Cons

Pros
1. Space tourism can turn out to be a new thriving economic activity, even when the world economy is facing a recession. It can offer employment to thousands of people, and developing new versions of spacecraft/aircraft would generate employment scope for many skilled people
2. There will be further scope for space exploration and innovations, along with the sector's progress. Moreover, there is a possibility for identifying potential hazards dangerous to Earth
3. The increasing popularity draws more investments
4. The emerging technologies would be beneficial for other domains, in addition to space missions
5. Further space exploration can lead to better weather predictions, resource identification on other planets, etc.; explore the scope of life in other parts of the universe, etc
6. A new form of thrilling tourism shall emerge, which adds to the diverse tourism options
Cons
1. Space travel on a commercial basis is still vulnerable to troubles of varied sorts, including health hazards
2. Wastage of resources for unsuccessful ventures
3. There may be unhealthy competition for superior technology, and the issue of opportunity cost will remain
4. It is accessible only to the 'super rich'
5. The lack of a legal framework can cause trouble
6. There will be increased atmospheric pollution, etc

Source Modified from Jagyasi, P., A Guide to Space Tourism by Dr Prem Jagyasi, retrieved from <https://drprem.com/travel/space-tourism-guide/>

The sector necessitates large sums of investment to venture into space tourism. Travel cost is also exorbitant. Only Billionaires can think of space tourism now.

Moreover, the sustenance of the sector is also at stake as the scope for profit at this point in time is meager. To become a participant, one has to possess perfect health conditions. Moreover, a lot of training and practice is needed. The efforts needed and the time required for this are very high. Moreover, many technological requirements are there to enable humans to withstand the space environment for long periods.

Furthermore, some legal concerns are yet to be discussed. Space is a no man's land until now, but once commercial operations become successful, there can be issues. How to define the boundaries, etc., could pose problems. Furthermore, the carbon emission issue associated with space tourism is yet to be debated. It may be there in the debates without much delay. These limitations also act as challenges for the space tourism sector.

14.5 Type of Space Tours

Space tourism classification is available in different formats in tourism literature. Crouch et al. (2009) identify four distinct space tourism types: high-altitude jet fighter flights, atmospheric zero-gravity flights, short-duration sub-orbital flights, and longer-duration orbital trips into space. Earlier, terrestrial or land-based forms of space tourism (simulations) were also identified as part of space tourism (Crouch, 2001). In the future, interplanetary space tourism for a longer duration can also be seen. According to Spector (2020), sub-orbital space flight, orbital flight, and beyond orbit flight are the types in the space tourism category. The major categories of space tourism are introduced below.

14.5.1 *Terrestrial Space Tourism*

In fact, tourism literature does not have many references on terrestrial space tourism, barring a few definitions. However, terrestrial space tourism is linked to Astro-tourism as well. The term encompasses a range of activities like astronomical observations, watching rocket launches, visits to air and space-related museums, camps, theme parks, displays, and exhibitions, having virtual reality experiences, etc. (Tasci et al., 2020: 1). The tendency to move to different places to engage in astronomical observations is an old trend. According to Crouch (2001), terrestrial tourism began with the journey of astronomical observers, moving from place to place in order to observe astronomical events and objects. There are specific locations from where the enthusiasts can view the astronomical wonders and the outer world objects.

Astronomical observatories are there in many places in the world. Telescopes of varied capacities are used for astronomical observations. Kennedy Space Centre in

Cape Canaveral is an example where a large number of people visit to get more knowledge about space and space-related objects. Some visit such centers for research as well. Some travel to locations where the gaze of solar and lunar eclipses is possible. Aurora viewing and even star gazing can be considered in this category. Rocket launch stations are also visited by people, particularly when the launching or receiving spacecraft takes place. Museums are connected to space technology and science, and having Virtual Reality (VR) enabled experiences too attracts visitors. Virtual reality planetaria are also being set up, and the users can navigate the virtual space and choose from various locations to explore.

14.5.2 Sub-orbital Space Tourism

Sub-orbital flights aim to reach up to Karman Line, experience a few minutes of weightlessness, and view the curvature of the Earth from outside the atmosphere. These flights require a speed of 3,700 mph (6,000 km/h) to reach the Karman Line. When the spacecraft reaches outer space, the trajectory intersects the atmosphere and then falls back to Earth's atmosphere, i.e., suborbital launch makes a trajectory that causes the spacecraft to re-enter the atmosphere. It cannot complete one orbital revolution, as the sub-orbital flight will have a low speed/velocity compared to the orbital spacecraft. The flight goes up to the height from where the experience of weightlessness and views of the curvature of the Earth can be had (Tasci et al., 2020). The flight may go up to 80,000 feet so that the curvature of the Earth can be seen well (Smith, 2000). Sub-orbital flights can be adventurous and educational while experiencing a sample spaceflight. Sub-orbital spaceflight will be a more popular tourist activity, and point-to-point travel can be possible soon (Cater, 2010). In due course, the tourists can experience a few minutes of weightlessness.

14.5.3 Orbital Space Tourism

These flights cross the Karman Line and make a complete orbital revolution. What makes the difference between orbital and sub-orbital flight is the speed at which a vehicle travels. Orbital velocity is required for an orbital flight, whereas the others require lower speed only. According to NASA, the speed to reach the Kármán line and return to Earth requires is less than one kilometer per second, but to remain in orbit beyond the Kármán line requires a speed of 7.8 km per second and therefore, the capacity of spacecraft to have orbital flights have to be much greater, like having a velocity of over 11 km per second (Reported in Spector et al., 2017).

Currently, Orbital space flights have a speed of up to 17,400 mph (28,000 km/h) and go to an altitude up to 125 miles (200 km) above Earth (Mann, 2020, reported in Tasci et al., 2020). An orbital launch causes a trajectory that allows the spacecraft to stay in orbit around the Earth. In addition, there are Orbital space tourism attempts

intended to travel to the ISS, which orbits about 400 km above Earth. In fact, Orbital space tourism began when Dennis Tito made his space tourism attempt and reached the International Space Station, which circles the Earth (von der Dunk, 2013).

14.5.4 Beyond Orbital Space Tourism

The desire to travel to the moon etc., with a leisure motivation has been there for a long, and the aim of beyond orbital tourism mission is to realize that dream. As of now, it is a distant dream only that cannot attain soon. Beyond orbital touristic spaceflight attempts to reach ‘escape velocity’ and break free from Earth’s gravitation pull to reach the Moon or Mars. The current experiments and commercialization attempts focus mainly on sub-orbital and orbital flights. It is predicted that along with the evolution of space tourism to higher levels, the number of spaceflight participants will increase, and the sub-orbital and orbital flights will inevitably give way to lunar holidays and trips to Mars. Meanwhile, space tourism will be strengthened to be a full-fledged industry capable of truly opening the frontier of space to human beings. Table 14.4 describes some space tourism packages available now on sale.

Table 14.4 Space tourism packages for sale now

The following are some of the space tourism packages that are notified to attract the potential buyers. The company name and the title of the packages along with a brief description about the package are given

1. Virgin Galactic: Suborbital Joy Ride
A 90-min ride to 50 km above sea level in Spaceship Two space plane. A few minutes of zero-gravity experience during descent
 2. Blue Origin: Quick Rocket Trip to the Kármán line
A 12-min ride to the Kármán line, ride can go up to 100 km above the sea level of earth
 3. SpaceX: Multi-Day Orbital Voyage
Three-day stay inside SpaceX’s Dragon capsule circling around Earth with three crew mates, and the flight altitude claims to be 574 km above the earth
 4. Axiom Space/SpaceX: Vacation on International Space Station
A 10-day trip to the International Space Station, including a week-long stay in the orbital lab
 5. Roscosmos: Customized Trip to International Space Station
A 12-day trip to the International Space Station
 6. Space Perspective: “Hot Air Balloon” to Stratosphere
Package for six-hour ride to stratosphere in a balloon-borne pressurized capsule, up to an altitude of 30 km above earth
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Source Cao, S. (2021). Every space tourism package available in 2021 ranked: From \$125K to \$60 million. *Observer*, retrieved from <https://observer.com/2021/11/commercial-space-travel-roundup-spacex-blue-origin-virgin/>

Table 14.5 Types of spacecraft/tools used in space tourism

Different types of spacecraft are used in the realm of space tourism. The spacecraft used in orbital, sub-orbital, and high altitude flights are different. The following are the different spacecraft/tools used in Space tourism

Sub-orbital space tourism companies and the tools

1. XCOR: Lynx Suborbital Vehicle
2. Virgin Galactic:SS2/WK2
3. Airbus Defense & Space: Space plane
4. Blue Origin: VTVL Vehicle
5. SNC: Dream Chaser

Orbital Space tourism Tools

1. Soyuz (Russian spacecraft with two parts-Soyuz capsule and Soyuz rocket)
 2. International Space Station (ISS) of NASA
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Source Chang (2015)

14.5.5 Zero-G Tours

The ZERO-G trips are organized to experience weightlessness without reaching the height of the Karman Line. Parabolic Flights are there, which can provide a weightless effect. According to NASA (2011), “Experimenters can test technologies applicable to the low-gravity levels such as those on the Moon or Mars in microgravity for 15 to 30s during parabolic flights on Zero-G Corporation’s modified Boeing 727 airliner. The aircraft has an open, padded interior and flies a series of short parabolic trajectories to repeatedly simulate the desired gravity levels” (NASA 2011). It can undertake parabolic arcs to create a weightless environment so the passengers can float, flip, and soar as if they are in space. Specially trained pilots are there to operate these kinds of flights, and those flights are maneuvered between approximately 24,000 and 34,000 feet altitude. At the same time, each parabola takes ten miles of airspace to perform and lasts about one minute from start to finish (incredibleadventures.com).

There are some other flight experiences as well. For instance, the MiG-29 Edge of Space Flight takes people to the stratosphere in a supersonic fighter jet, which usually involves reaching an altitude of 20 to 22 km from where the earth’s curvature can be seen, and the sky is dark. In contrast, people can see into the dark space as well (Henderson & Tsui, 2019). Examples of spacecrafts/tools used in space tourism are presented in Table 14.5.

14.6 Leisurenaut: A Tourist?

The term Leisurenaut sounds interesting. It was seen in a featured article mentioning the sub-orbital space tourists as leisurenauts in the following way. “At present, leisurenauts are still an elite class, but the events of the day suggest we’re closer than ever to seeing that change” (Coldewey, 2021). Indeed, every traveler cannot be called a tourist for multiple reasons. Some may not be traveling to visit, whereas others

may not spend the minimum duration in the place visited. A sub-orbital space tourist may not be spending one full day in space as part of the trip. Yet, they are called a tourist both in the tourism literature and in news reports tourists. The term Leisure-naut seems good to be viewed from that angle. They travel with a strong desire to have the pleasure of experiencing the weightlessness and adventure of being in space along with viewing mother earth from above. The leisure aspects associated with tourism are certainly there in the trip. On the other hand, they are restricted travelers like astronauts. They have to undergo training to become part of the space journeys, though, for sub-orbital flights, the training may be for some hours to a few days compared to the extensive training required to become orbital space tourists.

Orbital tourism involves the movement of people into space for more than a day, and those tourists can certainly be classified under the category of tourists. Yet, in tourism literature, different references are there, like tourism is a social process by which the movement of people generates different kinds of interactions between the host and the visiting communities in the place visited. However, despite having these kinds of mismatches in considering the travelers in the space as tourists, tourism has expanded to include a wide variety of travelers, and space tourists are indeed a kind of leisure tourists.

14.7 Privatization and Commercialization: Is Space Tourism a Predecessor for Larger Commercialization of Space?

Space tourism is poised to evolve into a significant commercial activity within a few decades. Therefore, private participation is key to the progress of space tourism (Spector et al., 2017). In fact, privatization is not just in spaceflight operations, but the leading space tourism firms are also involved in research, development, and technological innovations as well. All of these would undoubtedly contribute to the progress of space tourism to the next level. There were different targets to achieve by the end of the second decade of this millennium, but due to the delay in technical advancements, the progress of space tourism could not attain the expected pace.

Moreover, the pandemic has slowed down the progress further. Yet, by 2021, sudden dynamism emerged in space tourism by having back-to-back sub-orbital flights with space tourists on board who wished to experience the weightlessness and gaze at the Earth from the top. High altitude flights and sub-orbital flights are becoming more affordable. Actual commercialization of space tourism will take a bit more time, only when the sector becomes affordable and accessible for more sections of society. Currently, only the super-rich can think of going to space. Peeters (2010) shares the same opinion, which says that when the supply of commercial spaceflights is smooth and sufficient, and point-to-point (P2P) commercial space transport becomes a reality, the space tourism market will become a major one.

Beery (2012), citing the case of the USA, argues that Space tourism is a predecessor of an agenda of large-scale commercial activities in space. According to him, “Space tourism is an initial step in the wider commercialization of outer space. The success of space tourism may allow for even greater activity in space with immense private participation. In a broader context, private space travel contributes to the emergence of a new post-Cold War geography of outer space.....Moreover, further private space activity could bring with it, in the form of new spaceports, aerospace clusters and labor and capital flows, a corresponding geography on Earth—a geography that is far from determined” (Beery, 2012: 32).

Sub-orbital space tourism is ready to be a full-fledged commercial activity. Orbital space tourism may take place in a limited manner. Once more accommodation options in space become available, orbital space tourism will get a fillip. Beyond the orbit space tourism may take more time to become a commercial activity. It demands more technological advancements to take place to have to become a commercial sector and to attract people to visit the planets that are away from the Earth. Currently, space tourism is forecasted as a high-profit margin business in the future. Beery (2012: 28) states, “The entrepreneurs of aerospace and space tourism foresee massive profits and other benefits through the commercialization of space and have been thus willing to invest in the development of new private space vehicles”. As per the ongoing trend, the sub-orbital tourism segment can soon become a commercial activity and expand in the coming decades. Yet, Space tourism will remain a Niche tourism segment considering the number of people who can participate in those activities. Moreover, space tourism is undoubtedly a special interest activity. Indeed, investment is flowing into the sector now, and it can further invigorate space tourism’s evolution.

14.8 Who Are in the Business?

Commercial space tourism has begun, and several private firms are directly or indirectly involved in the space tourism business. Space tourism has not yet been established as a profitable business; instead, every stakeholder is seeking to realize space tourism’s economic potential and progress further to expand it. Virgin Galactic, Blue Origin, and Space Exploration Technologies Corporation (Space X), three major players in space tourism, compete among themselves. They have already made some flights and proven the capability to have leisure sub-orbital trips. Currently, they are focusing more on sub-orbital leisure tourism. In addition, Space Adventures and Axion Space have already conducted successful orbital tours. Along with Virgin Galactic, Space Adventures, XCOR, and Rocketplane-Kisler are also competing in the orbital space tourism sector.

In the sub-orbital sector, Virgin Galactic claimed to be the first space line that could provide weightlessness and breathtaking views of the Earth. In early July, they conducted sub-orbital flight with Sir Richard Branson, its owner, along with

three others on board. Their feather technology combines the advantages of capsule-designed spacecraft and winged space vehicles into one elegant system ([www.virgin galectic.com](http://www.virgin.galectic.com)). SpaceX is another private company capable of returning a spacecraft from low Earth orbit, and in 2012 their Dragon spacecraft became the first commercial spacecraft to deliver cargo to and from the International Space Station. SpaceX has ambitious plans to have beyond the orbit space trips to Mars sometime in the future and also to have a space hotel. In 2020, SpaceX became the first private company to take humans there as well (www.spaceX.com). Also, SpaceX claims that they are working on the next generation of fully reusable launch vehicles capable of carrying humans to Mars and other destinations in the solar system. Blue Origin is also engaged in having reusable launch vehicles and in-space systems that are safe and low cost and serve the needs of all customers.

Efforts of Blue Origin include flying astronauts to space on New Shepard, developing reusable liquid rocket engines, developing an orbital launch vehicle with New Glenn, building next-generation space habitats, and ensuring trips to the Moon (www.blueorigin.com). Armadillo Aerospace works on sub-orbital space tourism for the common public and cooperates with Space Adventures, another high-profile space tourism company. Masten Space Systems is involved in developing new space vehicles which can be reused. Spaceport America is in an attempt to make a commercial spaceport. Bigelow Aerospace is proceeding with the efforts to develop space stations.

International Space Station (ISS), which is actually built for research purposes, is currently the center of accommodation in space. Some years ago, the National Aeronautics and Space Administration (NASA) declared that International Space Station (ISS) should be opened to commercial activities, including space tourism. NASA is opening the International Space Station (ISS) to tourists as well to raise more funds for other space exploration projects (Astronauts and National Space Administration [NASA], 2019). Hilton Hotels aim to have a space hotel through a co-funding mode. Bigelow Aerospace, by Budget Suites of America hotels owner Robert Bigelow, tries to have an accommodation center in space shortly. Space Island Group plans to make a ring-shaped, rotating “commercial space infrastructure” almost 400 miles above the Earth’s surface. Space Island also has plans for a posh hotel in space. This commercially developed, owned, and operated space station will be built in low Earth orbit, with the main goal of creating a human habitat in space. It is expected to operate soon.

Orbital Assembly Corporation is planning to open a luxury space hotel called Voyager Station by 2027. It would be able to accommodate 280 guests and 112 crew members (Architectural Digest). NASA sent a “robot hotel” to the International Space Station, and it is also known as “Robotic Tool Stowage”, which is essentially a protected parking space for robots when not in use, helping to protect them from potential dangers (Etherington, 2019).

14.9 Space Tourism: Motivation and Demand

A space trip is a dream for many. As of now, only some thousands could book space tourism trips. According to recent statistics, less than 50 people could only make a trip to space. Those interested would like to seek the experience of being in space, the weightlessness, and see the Earth and other planets from a different location. Generally, the need for adventure and exploration constitutes some of the prime motivations for space tourism. It's a desire for exploration and adventure that has been there with human beings from their evolution stage. Experience of viewing the Earth is a significant aspect of being in space. The space remains black, and the Earth gets visible from an extremely high altitude which would be an incredible view. According to Reddy et al. (2012), the motivational factors behind space tourism include the vision of Earth from space, weightlessness, high-speed experience, unusual experience, and scientific contribution. Laing and Frost (2019) identified several space travel motivations, and those include thrill-seeking or risk-taking (example for hedonic experience); challenge, curiosity, spirituality, and nostalgia (eudaimonic examples); and seeking distinction or a desire to motivate and assist others.

According to Crouch et al. (2009: 442), “younger and male respondents were significantly more interested in space tourism and, as might be expected, there was a strong positive association between current risk-taking behaviour in recreation and leisure activities and a desire to travel into space”. Currently, space tourism demand consists of middle-aged people as only rich business people can afford to have these trips. However, once it becomes more affordable, the trend may change as youngsters would like to seek adventurous trips to space. As of now, only the elite, rich population could succeed in booking seats for flight sojourns. According to Crouch et al. (2009), space tourism customers are likely to be highly sensitive to price, and there is heterogeneity between respondents regarding how they are likely to react to price while selecting the type of space tourism. Also, the study points out that the demand determinants include the nationality of the operator, the physical requirements needed from the passengers, the level of passenger space or crowding, and the extent of pre-flight training required.

Moreover, the factors such as age, gender, education, and level of risk-bearing capacity can influence the buying decision-making. Cost, safety, and product design factors impact space tourism aspirants (Crouch et al., 2009). Space tourism is a diverse sector that involves orbital, sub-orbital, terrestrial trips, etc. The demand characteristics and demographics can vary. Moreover, space tourism is still developing, and identifying the demand characteristics at this point is not very relevant. Yet, the tendency of adventure-seeking, good health conditions, enthusiasm to experience weightlessness, etc., would be significant factors among space tourists. Supply-related factors can also become significant determinants. For instance, the reputation of the space tourism company can influence the space tourist when making a decision. According to Laing and Chouch (2004), nationality, education, gender, age, and the level of risk-taking behavior have a significant role in space tourism decision-making.

14.10 Ethical and Legal Aspects of Space Tourism

Space tourism, as of now, is the most unregulated regime in the parlance of tourism. There is a lack of regulation concerning compensation and fairness in determining ownership of the space environment (Toivonen, 2020). Being in such a nascent stage, there won't be many legal aspects as well. Moreover, putting a lot of restrictions can temporarily or permanently hamper the urge and experiments of those involved in space tourism. Once commercialization takes place, there is a possibility to have more rules, regulations, and conditions associated with space travel. Essential aspects are related to the safety, insurance of the people traveling, and sustainability. Moreover, how to regulate the flights by different nations into Space as there is no clarity on boundaries or anything of that sort. "International space law is ambiguous as too accommodating suborbital activities. While some provisions of the UN outer space treaties seem to exclude them, generally, there is no explicit condition in terms of reaching orbit as a requirement for application. In the absence of a uniform international regime, each state has the sovereign right to regulate human suborbital flights operating within its airspace" (Masson-Zwaan & Moro-Aguilar, 2013: 243).

According to Marsh (2006: 1826), "Space is a dangerous environment, and the legal minimums required for space tourism have yet to be established. If a business is to operate ethically in Space, first, it has to establish what the dangers are and what its liabilities might be. Since space tourism is largely unregulated at present, companies would be well advised to consider the liabilities of other tourism areas and strive to surpass their minimums to ensure the safety of their passengers". In the USA, some basic regulatory frameworks are there. Regarding sub-orbital flight, a regulatory regime to support sub-orbital space tourism has been established in the USA, with the FAA appointed as the regulatory agency (Webber, 2013).

Sustainability concerns are limited now, as only very limited activities are taking place at this point. Space tourism can socially result in a rich versus poor divide (Toivonen, 2020), as only the elite rich can now access space tourism. Space tourism initiatives also lead to emissions of varied kinds, which are yet to be discussed seriously (Scott, 2020). While considering space tourism, it is a fact that the countries that currently have the space launch capability and access to space exploration are indeed among the highest per capita polluters and greenhouse gas emitters contributing to the global climate emergency (Scott, 2020). According to Ross and Vedda (2018), rocket emissions in the stratosphere can lead to stratospheric heating and thermal changes, which can eventually contribute to Ozone depletion, alter the net radiative balance, and enhance radiative forcing. In addition, launch vehicles can have different orbital detritus (Duval & Hall, 2015). Moreover, a majority of the activities may take place in Space, and those effects on the life of people on earth are yet to be identified.

14.11 Future of Space Tourism

More than 40 people could venture into space tourism as of now. Some have made orbital space tourism by traveling to and staying in the ISS. Others could make sub-orbital flights and experience the weightlessness for a short duration. Space Adventures (trips to ISS), Blue Origin, SpaceX, and Axiom Space (trips to ISS) have already conducted space tourism tours. The sector is wide open and poised to evolve further. According to Cohen (2016), the main paradoxes inherent in the space tourism development initiatives include the limitations on human cosmic expansion; the subversion of adventure in space tourism; the banalization of the sublimity of space tourism experience; and the deflowering of the pristinity of other celestial bodies due to space tourism. The future prospects of each type of space tourism also depend on the willingness and capacity of the buyers, emerging technologies capable of carrying the passengers to space, and the price at which the services can be offered. Also the possible factors that affect the future may include competition, the scope for the economy of scale, the socio-economic circumstances, legal and regulatory frameworks, demographical factors, and the emerging concerns linked to the environment (Crouch et al., 2009). Cole (2015) identifies the following phases of space tourism evolution, which will help to get a clearer picture of the future of space tourism.

1. **Pioneering:** The product will be nearer to adventure travel than to luxury hotel style. Orbital accommodation will be safe but Spartan. Customers will be relatively few—from hundreds to thousands per year; prices will be high, \$50,000 and up.
2. **Mature:** This phase will see the demand growing, and the flights will depart from many airports. Tickets to orbit will cost less, with thousands to hundreds of thousands of passengers per year.
3. **Mass:** Orbital facilities will grow from being just clusters of pre-fabricated modules to large orbiting structures for hundreds of guests with a range of orbital entertainments. Ticket prices will fall to the equivalent of a few thousand dollars. Moreover, the number of passengers may go from hundreds of thousands to millions of passengers per year.

According to Spencer (2004), an exclusive phase is there after the preliminary stage of space tourism evolution. In that stage, the market will be limited only to wealthy and adventurous people. Currently, sub-orbital tourism is passing through that stage. It may be followed by the Rapid growth phase (the mature phase), which will see substantial cost reduction due to maturing technology, the economy of scale, and competition. Space tourism is a highly ambitious sector, as the endeavor to travel to other planets has already begun. It may take more time, but the firms involved in space tourism claim such will happen soon. Cohen (2016: 1) also argues that “Human space tourism, at present limited to the vicinity of the Earth, might expand to the Moon and other planets, especially Mars, in the future, but will in all probability fall short of the aspiration to reach the stars. Even its modest present aims face

considerable obstacles and risks, which keep its progress significantly short of the optimistic prognoses of a few decades ago". Flight to Moon is certainly a strong desire of many, and a few space tourism companies announced its possibility in the years to come. Another ambitious attempt is to have trips to Mars, which may not be possible very soon. Johnson and Martin (2016) could predict the emergence of the following types of space tourism in the future.

1. Citizen space exploration: an emancipatory form of space travel, a sort of exploration of outer space as a social space by all those who are able to visit space. It's a combination of the concepts of citizen science and citizen space exploration.
2. Personal spaceflight: A more individualistic and lifestyle-oriented model of space travel for those with the capability.

Whether the trips to Moon or Mars will be possible on a commercial basis soon or not, the sector is poised to grow further, and sub-orbital flights will be possible commercially in the immediate future. Orbital flights also will increase. The scope for beyond the orbit leisure trips is not there shortly, though such can emerge at any point in the future. Moreover, the terrestrial forms of Space tourism have been growing, and the sector is poised for further evolution.

14.12 Conclusion

The world is eagerly waiting for the commercialization of space tourism, not only to experience the weightlessness and to watch the curves of the earth from space but also to reach locations that have been thought inaccessible since time immemorial and to stay in space hotels for days. The desire for space travel has been there with many, yet space tourism has not grown to provide the space tourism experience to everyone interested. Currently, it is accessible only to a few billionaires. Moreover, orbital earth tourism has to advance further to make it real and affordable for more people. In addition to the cost factor, the space tourism sector is waiting to see much more advancements in space travel technology to ensure frequent and regular flight services that are safe in all respects and affordable for a large section of the global society. Furthermore, the world is curiously waiting for a successful leisure flight beyond orbit, mainly to the Moon and Mars. If all such takes place, space tourism will turn out to be a significant sector in global tourism.

References

- Architectural Digest, data retrieved from <https://www.architecturaldigest.com/story/worlds-first-space-hotel-open-2027>
- Beery, J. (2012). State, capital and spaceships: A terrestrial geography of space tourism. *Geoforum*, 43, 25–34. <https://doi.org/10.1016/J.GEOFORUM.2011.07.013>
- Britannica.com, retrieved from <https://www.britannica.com/topic/space-tourism>

- businesswire.com, retrieved from <https://www.businesswire.com/news/home/20210129005293/en/Global-Space-Tourism-Market-Trajectory-Report-2020-2027-Suborbital-Tourism-is-Projected-to-Account-for-1.5-Billion-of-the-Total-1.7-Billion-Market--ResearchAndMarkets.com>
- Cater, C.I. (2010). Steps to space; opportunities for astrotourism. *Tourism Management*, 31, 838–845.
- Chang, Y.-W. (2015). The first decade of commercial space tourism. *Acta Astronautica*, 108, 79–91.
- Chang, Y.-W., & Chern, J.-S. (2013). From spirit of St. Louis to SpaceShipTwo: A study on the challenge of future space tourism development. *Journal of Aeronautics, Astronautics and Aviation, Series A*, 45(2), 135–154.
- Cohen, E. (2016). The paradoxes of space tourism. *Tourism Recreation Research*. <https://doi.org/10.1080/02508281.2016.1239331>
- Coldewey, D. (2021). Virgin Galactic and Richard Branson celebrate launch of first passengers into space, Tec Crunch, retrieved from <https://techcrunch.com/2021/07/11/virgin-galactic-and-richard-branson-celebrate-launch-of-first-passengers-into-space/>
- Cole, S. (2015). Space tourism: Prospects, positioning, and planning. *Journal of Tourism Futures*, 1(2), 131–140. <https://doi.org/10.1108/JTF-12-2014-0014>
- Crouch, I.G. (2001). The market for space tourism. *Journal of Travel Research*, 40(2), 213–219.
- Crouch, I.G., Devinney, M.T., Louviere, J.J., & Islam, T. (2009). Modelling consumer choice behaviour in space tourism. *Tourism Management*, 30, 441–454. <https://doi.org/10.1016/j.tourman.2008.07.003>
- Dileep, M.R., & Kurien, A. (2021). *Air transport and tourism: Interrelationships, Air transport and tourism: Interrelationship, operations and strategies*. London: Routledge.
- Duval, D.T., & Hall, C.M. (2015). Sustainable space tourism. New destinations, new challenges. In C.M. Hall, S. Gössling, & D. Scott. (Eds.), *The Routledge handbook of tourism and sustainability*. Routledge, pp. 450–459.
- Etherington, D. (2019). NASA will launch a 'robot hotel' to the Space Station on its next SpaceX resupply mission, retrieved from <https://techcrunch.com/2019/12/03/nasa-will-launch-a-robot-hotel-to-the-space-station-on-its-next-spacex-resupply-mission/>
- Goodrich, N.J. (1987). Touristic travel to outer space: Profile and barriers to entry. *Journal of Travel Research*, 26, 40–43.
- Henderson, L.I., & Tsui, K.H.W. (2019). Air transport: A tourism perspective, retrieved from <https://www.sciencedirect.com/topics/social-sciences/space-tourism>
- incredibleadventures.com, retrieved from <https://incredible-adventures.com/zero-g-how.html>
- Johnson, R.M., & Martin, D. (2016). The anticipated futures of space tourism. *Mobilities*, 11(1), 135–151. <https://doi.org/10.1080/17450101.2015.1097034>
- Laing, J., & Crouch, G. I. (2004). Vacationing in space: Tourism seeks “new skies.” In T.V. Singh (Ed.), *New horizons in tourism: Strange experiences and stranger practices*. Cambridge, MA: CABI Pub. <https://doi.org/10.1079/9780851998633.0000>
- Laing, J., & Frost, W. (2019). Exploring motivations of potential space tourists. In *Space tourism* (Tourism Social Science Series, Vol. 25). Bingley: Emerald Publishing Limited, pp. 141–161. <https://doi.org/10.1108/S1571-504320190000025008>
- Lappas, V. (2006). Space tourism. In D. Buhalis & C. Costa (Eds.), *Tourism business frontiers. Consumers, products and industry*. Oxford: Elsevier Butterworth-Heinemann.
- Loizou, J. (2006). Turning space tourism into commercial reality. *Space Policy*, 22(4), 289–290.
- Marsh, M. (2006). Ethical and medical dilemmas of space tourism. *Advances in Space Research*, 37(9), 1823–1827.
- Masson-Zwaan, T., & Moro-Aguilar, R. (2013). Regulating private human suborbital flight at the international and European level: Tendencies and suggestions. *Acta Astronautica*, 92(2), 243–254. <https://doi.org/10.1016/j.actaastro.2012.11.002>
- NASA. (2011). The Zero Gravity Corporation (“Zero-G”) offers Zero Gravity trips using a modified Boeing 727 aircraft (Boeing 727–200, G-FORCE ONE), retrieved from https://www.nasa.gov/centers/dryden/multimedia/imagegallery/flight_opportunities/Inside_Zero-G_1600.html
- NASA. (2021). The Edge of Space, retrieved from <https://science.nasa.gov/edge-space>

- National Space Administration (NASA). (2019). NASA opens international space station to new commercial opportunities, private Astronauts, retrieved from <https://www.nasa.gov/press-release/nasa-opens-international-space-station-to-new-commercial-opportunities-private>
- Peeters, W. (2010). From suborbital space tourism to commercial personal spaceflight. *Acta Astronautica*, 66, 1625–1632.
- Penn, P.J., & Lindley, A.C. (2003). Requirements and approach for a space tourism launch system. *Acta Astronautica*, 52(1), 49–75. [https://doi.org/10.1016/S0094-5765\(02\)001170](https://doi.org/10.1016/S0094-5765(02)001170)
- Reddy, M.V., Nica, M., & Wilkes, K. (2012). Space tourism: Research recommendations for the future of the industry and perspectives of potential participants. *Tourism Management*, 33(5), 1093–1102.
- Ross, M., & Vedita, J.A. (2018). The policy and science of rocket emissions, Centre for Space Policy and Strategy. https://aerospace.org/sites/default/files/2018-05/RocketEmissions_0.pdf
- Scott, M. (2020). A space tourism destination: Environmental, geopolitical and tourism branding considerations for New Zealand as a ‘launch state’. *Journal of Sustainable Tourism*. <https://doi.org/10.1080/09669582.2020.1817049>
- Smith, L.V. (2000). Space tourism: The 21st century “frontier”. *Tourism Recreation Research*, 25(3), 5–15. <https://doi.org/10.1080/02508281.2000.11014920>
- Space Tourism Society. (2019). Philosophy: A logical progression into the future, retrieved from <http://spacetourismsociety.org/about/philosophy/>
- Spector, S. (2020). Delineating acceptable risk in the space tourism industry. *Tourism Recreation Research*, 45(4). <https://doi.org/10.1080/02508281.2020.1747798>
- Spector, S., Higham, E.S.J., & Doering, A. (2017). Beyond the biosphere: Tourism, outer space, and sustainability. *Tourism Recreation Research*, 42(3). <https://doi.org/10.1080/02508281.2017.1286062>
- Spencer, J. (2004). *Space tourism. Do you want to go?* Burlington: Apogee Books Publication.
- Stainton, H. (2022). Space tourism explained: What, why and where, retrieved from <https://tourismteacher.com/space-tourism/>
- Stimac, V. (2021). Is space tourism worth it? <https://science.howstuffworks.com/is-space-tourism-worth-it-news.htm>
- Tasci, A.D.A., Fyall, A.D., & Fu, X. (2020). Social representations of space travel: Modeling the antecedents and outcomes. *International Tourism Research*, 23(4). <https://doi.org/10.1002/jtr.2430>
- Toivonen, A. (2020). Sustainability dimensions in space tourism: The case of Finland. *Journal of Sustainable Tourism*. <https://doi.org/10.1080/09669582.2020.1783276>
- Von der Dunk, G.F. (2011). Space tourism, private spaceflight and the law: Key aspects. Space, Cyber, and Telecommunications Law Program Faculty Publications, 60. <https://digitalcommons.unl.edu/spacelaw/60>
- Von der Dunk, F.G. (2013). Beyond what? Beyond earth orbit? ...! The applicability of the registration convention to private commercial manned sub-orbital spaceflight. Space, Cyber, and Telecommunications Law Program Faculty Publications, 84. <http://digitalcommons.unl.edu/spacelaw/84>
- Webber, D. (2013). Space tourism: Its history, future and importance. *Acta Astronautica*, 98, 138–143.
- Wittig, M.C., Beil, P., Sommerock, F., & Albers, M. (2017). *Rethinking luxury: How to market exclusive products and services in an ever-changing environment*. LID Publishing.
www.blueorigin.com
www.spaceX.com