Chapter I

Introduction

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"That's one small step for man, one giant leap for mankind" - These were the words of Neil Armstrong, when he first landed on the moon. 20th July, 1969 was a historic day when man, who had already proved his supremacy on the earth, conquered the new frontier of space. In the following decades space activities were limited to either research or military purposes.

Though the then undivided Russia and United States are considered the pioneers of space activities, India can boast of being the first to utilize space technology. Like the concept of zero and the Pythagoras theorem[1], which are gifts of India to the world, space technology is also a gift of India to the world. Tipu Sultan first used war rockets during the war against the British in 1792 and surprised the world. The great Indian space scientist Dr. Vikram Sarabhai can be considered as the father of modern space technology. Though India was a latecomer in modern space activities, today it is one of the five nations that have placed its own satellite in orbit using an indigenous Geo-Satellite Launch Vehicle (GSLV).

The importance of space technology cannot be denied, for it not only encompasses within its sphere the discovery of new planets or calculating the distance of the sun from the earth, but also includes various fields like communications, agriculture, weather and education, and the possibility of space tourism and colonies on other planets in the near future. It can be said that possibility is only

[1] *Baudhayan sulva sutra, 1000 B.C.*

limited by imagination. In earlier times, several of today's realities like submarines and aircraft seemed to be figments of a science fiction writer's imagination. Today, space tourism is on the threshold of taking off on a commercial scale. On 28th April, 2001, Dennis Tito, a California-based multi-millionaire, became the first ever space tourist. Launched into space in a Russian Soyuz capsule, Tito proved that travelling beyond the Earth's gravity was not just the province of a select few, but that anyone with drive, determination - and at this point in history, a lot of money - could become an astronaut.

The 21st century is thus witnessing commercialization of space, giving rise to a number of socio-economic, political and legal issues. The last two centuries have witnessed dramatic changes with the world transforming from an agricultural society, where manual labour was the critical factor, to an industrial society where the management of technology, capital and labour provided the competitive advantage. Then in the Nineties, the information era was born, where connectivity and software products are driving the economy of a few nations. In the 21st century, a new society is emerging where knowledge has replaced capital and labour as the primary production resource. Efficient utilization of knowledge can create comprehensive wealth and also improve the quality of life - in the form of better health, education, infrastructure and other social indicators. The ability to create and maintain the knowledge infrastructure, develop knowledge workers and enhance their productivity through creation, growth and exploitation of new knowledge will be the key factors in deciding the prosperity of this Knowledge Society. As we progress from one society to another, we have been adding value to the processes followed in the previous societies. Info-space technology can do tremendous value addition in the way we have been doing agriculture, industry, education, health care, etc.

Space has lost none of its fascination in the years since 1969 when the first human being first set foot on the moon. What is significant here, however, is the fact that space technology has become one of the key tools of the modern industrial and information society in the intervening years. 'Space' has thus become the new buzzword not just for science fiction but for all the developed and developing countries.

Some of the main space applications are telecommunications, earth observation and positioning and navigation systems. Significant benefits have been derived for the society at large from these applications and further progress could be achieved in the coming decades. However, the future of the sector looks bleak, because the development of commercially viable applications has proved very difficult. As a result, both the industry and the financial community are hesitant to embark upon the development of a good many potentially promising applications. This situation is leading a number of countries already active in space to reassess their overall space strategy. Many of them are facing difficult choices, in particular on the overall level of effort that should be devoted to space, on how that effort should be allocated, and on the role that could be expected of the private sector. Moreover, there is a growing feeling among experts that the policy and regulatory frameworks that currently govern space activities are unlikely to be able to meet the challenges of the future or to provide the necessary support to the further development of the commercial space sector. Hence there is an urgent need to address this present hot issue through adequate common acceptable legislation before it turns out to be a fire ball.

There is also a need to bring awareness of the potential hazards of unplanned and indiscreet utilization and commercialization of space. Rapid growth in the commercialization of space activities, which were

essentially the domain of Governments earlier, has made a qualitative change in the spread of space benefits across the world. New scientific discoveries have helped in sharply focusing our attention on the environmental problems facing the world community. Sustainable development has rightly become the watch word for the survival of humanity in the new millennium. It would be relevant and timely to take stock of the recent advances in space science and technology and develop a comprehensive road map for promoting its wide-spread application.

1.1 Area of the Study

The trend of globalization has actually turned into commercialization. There is hardly anything left now on the earth which is not commercially exploited including some very natural biological and personal activity like the carrying of a baby by a woman. With the concept of surrogate motherhood even the pregnancy of a woman has been commercialized. After commercializing everything on the earth including the earth, man has set his eyes on space. Space is the new global market. Traditional patterns of international relations as well as of international law are increasingly varying due to impressive changes in technology and science (e.g. internet, telecommunications) and due to changes in global politics. It is therefore more than appropriate to study in detail whether and in how far space laws either reflect those fundamental changes or need to be reshaped in order to meet the challenges of the 21st century, as most of the present legal provisions related to space are capable of addressing the issues related to research and defence uses of space and not its commercialization.

International Space Law has begun losing its relevance following the newer developments in space. It had so far led to an orderly development in space activities but advancement of technology has opened up new possibilities. The International legal fraternity and space scientists will have to work together to face new challenges like space debris, security of space assets, weaponisation of space and dual use applications.

There is also the issue of sovereignty. Does a satellite launched by one country, travelling over another country in orbit violate the sovereignty and the privacy of the people of that country? Through technological advancement in space, can one country violate the right of privacy of an individual, which is considered as a fundamental right in many progressive countries, including India, which has recognised Right of Privacy as an integral part of A. 21 of the Constitution? Though this issue seems to be very trivial, it is highly complex in nature. With the commercialization of space, this issue would turn out to be a burning issue. Einstein once said that he does not know how the third World War would be fought, but the fourth World War would definitely be fought with stones. Einstein was not sure at the time of making this historic statement about 'how', i.e. the war technology to be used in the third World War, but now it is pretty sure about 'for', i.e. for what the third World War would be fought. The third World War would not be fought to grab a few thousand kilometres of area of another nation, neither would it be fought for economic benefits; it would be for establishing supremacy over space and outer space. If I borrow from the imagination of Arthur C. Clark, the renowned writer of science fiction, then the third World War would be fought to establish supremacy over the moon, mars and other planets; some of them may not be a part of our galaxy but may have signs of life.

Besides, though data collection on the environment has so far been related to the protection of the environment, the highly sensitive question of national security has always been present. The industrialized countries can use modern technology to influence world markets on the basis of the information obtained by remote sensing and of which the sensed state was unaware. It also affects the citizens' right of the 'Right to privacy'. Hence a comprehensive legal regime for undertaking space activities in a sustainable manner is the need of the hour.

1.2 Meaning of Space

Space has interested people from all walks of life through the ages, though differently. It is used differently in different fields of study and hence it is difficult to have a specific and clear definition of space that would be applicable to all fields. It can only be defined within a specific context.

In the field of astronomy, space refers collectively to the relatively empty parts of the universe. Space is the relatively empty space between celestial bodies such as stars, planets and moons. Any area outside the atmospheres of any celestial body can be considered "space". Outer space is used to distinguish it from airspace (and terrestrial locations). Although space is certainly spacious, it is not always empty, and can be filled with matter. In fact, outer space is not completely empty (i.e. a perfect vacuum) but contains a low density of particles, predominantly hydrogen plasma, as well as electromagnetic radiation, dark matter and dark energy. The boundary between space and Earth's atmosphere is conventionally set at the Karman line,[2]

[2] *www.wikipedia.org*

which lies at an altitude of 100 km (62.1 miles) above the Earth's sea level.

The United States designates people who travel above an altitude of 80 km (50 miles) as astronauts. During re-entry, roughly 120 km (75 miles) marks the boundary where atmospheric drag becomes noticeable, depending on the ballistic coefficient of the vehicle.

Outer space within the solar system is called interplanetary space, which passes over into interstellar space at the heliopause. The vacuum of outer space is not really empty; it is sparsely filled with several dozen types of organic molecules discovered to date by microwave spectroscopy. According to the Big Bang Theory, 2.7 K blackbody radiation was left over from the 'big bang' and the origin of the universe, and cosmic rays, which include ionized atomic nuclei and various subatomic particles. There is also gas, plasma and dust, and small meteors and material left over from previous manned and unmanned launches that are a potential hazard to spacecraft. Some of this debris re-enters the atmosphere periodically.

The absence of air makes outer space (and the surface of the Moon) ideal locations for astronomy at all wavelengths of the electromagnetic spectrum, as evidenced by the spectacular pictures sent back by the Hubble Space Telescope, allowing light from about 13.7 billion years ago – almost to the time of the Big Bang – to be observed. Pictures and other data from unmanned space vehicles have provided invaluable information about the planets, asteroids and comets in our solar system.

While not being an actual perfect vacuum, outer space contains such sparse matter that it can be effectively thought of as vacuum. The

pressure of interstellar space is about 10 pPa[3] (1×10^{-11} Pa). For comparison, the pressure at sea level (as defined in the unit of atmospheric pressure) is about 101 kPa (1×10^{5} Pa).

Contrary to popular belief, a person suddenly exposed to the vacuum would not explode, freeze to death (space may be cold, but it is mostly vacuum, a perfect insulator; the main temperature worry for space suits is how to get rid of naturally generated body heat), or die from boiling blood, but would take a short while to die by asphyxiation. Air would immediately leave the lungs due to the enormous pressure gradient. Any oxygen dissolved in the blood would empty into the lungs to try to equalize the partial pressure gradient. Once the deoxygenated blood arrives at the brain, death would quickly follow. Water vapour would also rapidly evaporate from exposed areas such as the lungs, cornea of the eye and mouth, thus cooling the body.

In geography, space is called land, and has a relation to ownership (in which space is seen as property). While some cultures assert the rights of the individual in terms of ownership, other cultures will identify with a communal approach to land ownership, while still other cultures such as Australian Aboriginals, rather than asserting ownership rights to land, invert the relationship and consider that they are in fact owned by the land. Spatial planning is a method of regulating the use of space at land-level, with decisions made at regional, national and international levels. Space can also impact on human and cultural behaviour, being an important factor in architecture, where it will impact on the design of buildings and structures, and on farming.

[3] *Pascal unit*

Ownership of space is not restricted to land. Ownership of airspace and of waters is decided internationally. Other forms of ownership have been recently asserted to other spaces – for example to the radio bands of the electromagnetic spectrum or to cyberspace.

Public space is a term used to define areas of land collectively owned by the community, and managed in their name by delegated authorities. Such spaces are open to all, while private property is the land owned by an individual or company, for their own use and pleasure.

Abstract space is a term used in geography to refer to a hypothetical space characterized by complete homogeneity. When modelling activity or behaviour, it is a conceptual tool used to limit extraneous variables such as terrain.

1.3 Space ... The Final Frontier

During the 19th century a number of science fiction stories were published in France which soon became popular throughout the world. They were written by Jules Verne, who has also written several other fictional tales, which uncannily have turned out to be prophesies of the future. For instance, his work, '*20,000 leagues under the sea*', spoke about an underwater vehicle that could remain under the water without surfacing for days together, at a time when submarines were not yet invented. Another book was titled '*De la Terre a la Lune*' and was written in 1865, which narrated man's entry into outer space at a time when flights even within the earth's atmosphere were still unheard of. Another science fiction writer, Arthur C. Clarke, wrote '*2001 – A space Odyssey*', which detailed a space flight, at a time when going into space was unimaginable for human beings. Jules Verne

also took up the theme of lunar visits in his books, *From the Earth to the Moon* and *Around the Moon.* Robert A. Heinlein's short story *The Menace from Earth,* published in 1957, was one of the first to incorporate elements of a developed space tourism industry within its framework. During the 1960s and 1970s, it was a common belief that space hotels would be launched by 2000. Many futurologists around the middle of the 20th century speculated that the average family of the early 21st century would be able to enjoy a holiday on the Moon.

Exploration of Outer Space, studded with exotic galaxies, stars and planets, has always fascinated humankind, from time immemorial. Space platforms, with their ability to view through the entire electromagnetic spectrum have unveiled the magnificent panorama of the vast cosmos, tracing our history back to the origin of the universe itself. Hundreds of exotic, compact and massive stars such as X-ray stars, Gamma ray bursters, Neutron stars, Pulsars and even a few Black Holes have now been discovered. While infrared and ultraviolet explorers have provided direct evidence for the birth of the stars and galaxies, Space Telescope has been continuously extending our reach into the depths of the universe, bringing distant worlds closer to our vision. We have been able to explore the turbulent interior of the Sun, as well as the breath-taking geological features of the solar system planets and comets. The discovery of extra-solar planetary bodies has provided a new impetus to look for the presence of life and also intelligence elsewhere in the universe. Extensive investigations carried out in space biology, space sciences and material processing under micro gravity conditions have been paving the way for future commercial exploitation of space.

Space exploration is the use of astronomy and space technology to explore outer space. Physical exploration of space is conducted both

by human spaceflights and by robotic spacecraft. All man-made satellites are a form of unmanned or manned space stations. Unmanned Space travel includes the sciences of Spacecraft Propulsion, Rocket launch technology, Rocket, Astro-dynamics, Unmanned space missions, and others. Manned Space travel further includes the sciences of Microgravity environment, Space transport, Manned space missions, Interplanetary travel, Interstellar travel and Generation ship.

Space exploration has often been used as a proxy competition for geopolitical rivalries such as the cold war. The early era of space exploration was driven by a 'space race' between the Soviet Union and the United States; the launch of the first man-made object to orbit the Earth, the USSR's Sputnik 1, on 4th October, 1957, and the first Moon landing by the American Apollo 11 craft on 20th July, 1969 are often taken as the boundaries for this initial period. The first human spaceflight was Vostok I, carrying Russian cosmonaut Yuri Gagarin on 12th April, 1961. The spacecraft completed one orbit around the globe, lasting about 1 hour and 48 minutes. Gagarin's flight opened an entirely new era in space exploration – human spaceflight. The first spacewalk was undertaken by Aleksei Leonov) in 1965, and the launch of the first space station (Salyut 1) was in 1971. However, the first man-made objects to reach space were Nazi-Germany's V2 rockets, used as early as the Second World War.

After the first 20 years of exploration, focus shifted from one-off flights to renewable hardware, such as the Space Shuttle program, and from competition to cooperation as with the International Space Station. The Earth is by far the most explored object in the Solar System.

The Earth is explored and observed by Earth observation satellites. The hole in the ozone layer was found from an artificial satellite that was exploring the Earth's atmosphere. The Americans were the first to discover the existence of the Van Allen belts around the Earth. These belts contain radiation trapped by the Earth's magnetic fields, which currently prevent habitable space stations from being placed above 1000 km. The Russians were the first to take pictures of the far side of the moon; something that was never visible to humans. It was discovered that the far side was more heavily cratered. The American Apollo missions returned rocks from the moon, which support the theory that the Moon was once part of the Earth.

1.4 Future Explorations of Space

From the 1990s onwards, private interests began promoting space tourism and now private space exploration of the Moon. In the 2000s, China initiated a successful manned spaceflight program, while Japan and India also plan future manned space missions. Larger government programs have advocated manned missions to the Moon and possibly Mars sometime after 2010.

Dozens of private projects have been announced. Among them, Bigelow Aerospace has plans to build the first in-orbit hotel within the decade. The Google Lunar X-Prize also promotes private space exploration by offering first and second place prizes totaling $30 million for the first privately funded robotic lunar landing. Companies such as White Label Space or Astrobotics are studying mission concepts for the purpose of entering teams. Space Exploration Technologies Corp also performed a successful flight of their Falcon 1

launch vehicle[4]. Virgin Airlines has announced taking vehicles up into space.

1.5 Space Technology - Going into Space for Earth

Space technology is technology that is related to entering space, maintaining and using systems during spaceflight and returning people and things from space. Every day technologies such as weather forecasting, remote sensing, GPS systems, satellite television, and some long distance communications systems critically rely on space infrastructure. Of sciences astronomy and Earth sciences (via remote sensing) most notably benefit from space technology.

Computers and telemetry were once leading edge technologies that might have been considered "space technology" because of their criticality to boosters and spacecraft. They existed prior to the Space Race of the Cold War but their development was vastly accelerated to meet the needs of the two major superpowers' space programs. While still used today in spacecraft and missiles, the more prosaic applications such as remote monitoring of patients, water plants, highway conditions, etc. and the widespread use of computers far surpasses their space applications in quantity and variety of application.

Space science is an all-encompassing term that describes all of the various science fields that are concerned with the study of the Universe, generally also meaning "excluding the Earth" and "outside of the Earth's atmosphere". Originally, all of these fields were considered part of astronomy. However, in recent years the major sub-fields

[4] *http://en.wikipedia.org/wiki/space_exploration*

within astronomy, such as astrophysics, have grown so large that they are now considered separate fields on their own. There are eight overall categories that can generally be described on their own; Astrophysics, Galactic Science, Stellar Science, non-Earth Planetary Science, Biology of Other Planets, Astronautics/Space Travel, Space Colonization and Space Defence.

Astronomical methods are the equipment and techniques used to collect data about the objects in Space. Radio astronomy includes radio telescopes; devices that receive and record radio waves from outside the Earth. They record cosmic microwave background radiation resulting from the Big Bang, Pulsars and other sources. A space telescope is a telescope orbiting or traveling from the Earth, such as the Hubble space telescope.

Broadly defined, the space sector includes all public and private actors involved in the provision of space-enabled products and services. They are a part of a long value-adding chain that starts upstream with the manufacturers of space hardware (e.g. launch vehicles, satellites, earth stations) and ranges downstream to the providers of space-enabled products (e.g. GPS-based car navigation systems) and services (e.g. satellite-based services or direct-to-home video services) to final users.

Space is such an alien environment that attempting to work in it requires new techniques and knowledge. New technologies originating with or accelerated by space-related endeavours are often subsequently exploited in other economic activities. This has been widely pointed to as beneficial by space advocates and enthusiasts favouring the investment of public funds in space activities and programs. Political opponents counter that it would be far cheaper to

develop specific technologies directly if they are beneficial and ridicule this justification for public expenditures on space-related research.

In 1903, Konstantin Tsiolkovsky, the Russian space pioneer, had published a paper in which he had anticipated human expansion in outer space by using liquid fuel rockets[5]. In 1932, Vladimir Mandl published the first monographical study on space law[6]. During the years preceding World War II space technology made significant progress in countries like Germany, USSR, and USA. The boost provided to these activities resulted in the Sputnik I becoming the first satellite to orbit the earth in outer space in 1957. In April 1961, Yuri Gagarin became the first person to go into space, and in 1969 Neil Armstrong became the first person to set foot on a celestial body other than the earth, i.e. the moon. By then, it had become apparent that legal rules were necessary to avoid confusion and undesirable practices in the use of outer space. The escalating space technology made space law a necessity and a reality.

1.6 Rationale of the Study

Like the race for supremacy over land by establishing colonies in the 17th and 18th centuries, the race has now begun for establishing supremacy over the domain of space. The respective air space over various territories is owned by the respective countries and there are laws governing the use of this air space. Air space is being used commercially for passenger travel. Outer space is being used for launching satellites for various purposes like weather forecasting, communication, surveillance, etc. But since the earliest times, human

[5] *B.V. Rauschenbach, 'Thirty Years of the Space Age', Invited paper for the Congress of the International Astronautical Fedration, (Brighton, 1987)*
[6] *V. Mandl, Das Weltraum-Recht: Ein Problem der Raumfahrt, 1932.*

beings have had a natural inclination to maximize the use of everything possible. After using and depleting the natural resources of land, our attention turned to exploiting the wealth of the deep seas. The disastrous results of the unbridled use of nature's gifts on land and in water have not deterred us. The focus of attention of the world now is space. The developed countries are all set to replicate the age-old but time tested theory of the British to conquer the world. The British entered into an unknown new territory first as traders and then ruled them. There was a time when it was said that the sun never sets on the British Empire. The reason for this was that the 'Union Jack' could always be seen unfurled in every part of the world, as they had subjugated major parts of every known continent on the earth, with the exception of Antarctica (and the reason was that it was uninhabited). Now the same theory is being applied to space. The developed countries and more particularly the US in the name of research are making an attempt to reach other planets only with a long term goal of using the rich minerals of those planets in future for their own benefits. But a more sinister plan of these countries is to colonise the planets in future. Exploration of space to unravel its deep mysteries is not the only aim of space voyages. Commercializing space by tourist space flights and building colonies on other planets is no longer a part of science fiction but a possibility of the near future. Russia, Europe and the United States are already vying to become the leaders in this space race.

Besides tourism, another point on their agenda is the offer, although at an exorbitant price, to put the ashes of the dead into orbit, instead of sprinkling them over land or immersing them into water. Besides, space debris is an important concern and not one to be dismissed lightly. All this has immense potential for not just political issues but

also legal ones. Hence it has become imperative that a study be carried out on the various aspects of commercialization of space.

Throughout the history of mankind, all the wars including the two World Wars were fought only to have the control over the territories of other nations. The first two World Wars were fought to prove supremacy over land but the third World War, if fought at all, would be for supremacy over space. To prevent this from happening, we require a strong international legal regime of space laws so as to bind all nations.

1.7 Scope of the Study

It may be noted that 'space' does not mean only outer space. The term space may mean different things in different fields of study. The meaning of space to geography and to astronomy is taken within the ambit of this study. Thus space for the purpose of this study includes –

(i) Air space, i.e. the space over land, within the atmosphere of the earth, which is owned by the respective nations, and

(ii) Outer space, i.e. the area outside the atmosphere of the earth, which is not owned by anyone.

This study covers the legal aspects of commercial air travel, encroaching on the air space of other countries, broadcasting and telecasting via satellites in outer space, and the significance of commercialization of outer space. It also examines the various laws

relating to space in India and in some of the countries that are leading in space technology today.

1.8 Objective of the Study

- To evaluate the concept and meaning of 'space'
- To study the developments taking place in the field of space activities and space technology
- To study the legal, economic, political and social impacts of commercialisation of space activities
- To bring about awareness about the vast potential of space benefits by the application of space technology in various fields
- To promote the greater use of space technology in order to reap maximum benefits by commercially exploiting this relatively unexplored field
- To create awareness of the potential hazards of unplanned and indiscreet utilization and commercialization of space
- To study various national laws and international treaties related to space and its utilization
- To make a comparative study with similar legislation in other countries of the world

- ✶ To take note of the challenges of the new millennium to commercialization of space activities

- ✶ To study the intellectual property aspects of space and their implication on commercialization of space

- ✶ To suggest changes in existing space laws in order to meet the challenges of the 21st century

- ✶ To recommend a comprehensive legal regime for space activities in a sustainable manner

1.9 Hypotheses of the Study

Keeping in view the broad objectives of this research work, certain hypotheses have been formulated:

- ⇨ Space is a relatively unexplored frontier

- ⇨ Space activities are inevitable and necessary for the progress of humankind

- ⇨ Commercialization of space is the new field of activity for the developed and developing countries

- ⇨ Space activities have a vast potential for benefits not only to science but also to commerce

- ⇨ Commercialization of space activities is causing tremendous increase in passenger air traffic

- ⇨ Commercialization of outer space will lead to space tourism and increased outer space traffic

- ⇨ Present laws are inadequate to efficiently regulate the increasing air traffic and there is a likelihood of traffic jams in air and space

- ⇨ Colonization of space can lead to property disputes and new laws will be needed to deal with them

- ⇨ Unplanned and unbridled commercialization can not only cause environmental hazards but also affect the safety and security of weaker nations

- ⇨ The right of underdeveloped countries to protect their privacy from satellite remote sensing is being violated by the developed countries

- ⇨ Developed countries can use data gathered by remote sensing to influence world markets

- ⇨ The existing space laws are insufficient to prevent exploitative commercialization of space

1.10 Methodology of the Study

Space is an inalienable part of the universe, and laws regarding air space and outer space have legal, social, economic and political

repercussions on every country, whether developed or developing. Doctrinal methods have been adopted for this research work, because it could not be properly conducted purely by the experimental or non-doctrinal method.

The relevant data and information has been collected from statutory enactments, published rules of National and International Conventions and Rules evolved by the judiciary from time to time in specific cases relating to the use of space. The relevant material has been thus collected from various primary and secondary sources. Material and information has been collected from both legal sources and socio-economic sources like original judgments of various National and International Courts, National and International Journals, Research Papers presented at National and International Seminars and other published works, websites, etc. A comparative analysis has been made of various treaties and Legislation.

1.11 Scheme of the Study

Chapter I is the introductory chapter. It clarifies the need for conducting this study and the rationale behind it. It also specifies the objectives of undertaking this study. The hypotheses framed for the purpose of this study are listed out in this chapter. Besides, the scope of the study is also examined while explaining the meaning of space. The scheme frame of the entire study is laid out in this part.

Chapter II deals with the concept of space in detail. The various applications of air space are examined in depth. It covers the various aspects of space utilization, civil aviation, problems associated with aviation, defence, communications and other uses of air space. The

repercussions of commercializing air space, including environmental impact, have been examined. The recreational part of air space, i.e. using it for different types of air sports has also been included.

Chapter III deals with outer space applications. The Big Bang Theory regarding the origin of the universe and the probable existence of Black Holes has been touched. Satellites and their myriad uses to human beings for various purposes like telecommunications, environment monitoring, weather forecasts, etc. been studies in detail in this chapter. The pros and cons of remote sensing have been laid out. Various aspects of space voyages, right from the benefits of space technology to human beings, to space travel and extraterrestrial life have been considered. The prospects of space colonisation and its probable repercussions have been studied. Recent developments in the field of space technology have also been studied. Last but not the least, is the moon mission of India, the Chandrayaan mission.

Chapter IV In this chapter the benefits of commercializing space activities have been juxtaposed with the problems and disadvantages associated with it. Various aspects of space tourism, private enterprise vis-à-vis government enterprise in the space sector, future of space travel, potentiality of space colonies along with the arguments for and against establishing them, have all been considered in depth. The ultimate marketing gimmick, i.e. advertising in space has been touched briefly.

Chapter V examines the concept of space as property that can be owned or bought and sold. Hence property rights and disputes have been considered, both real property and intellectual property. The inevitable result of colonising space and owning property in space, i.e. space debris and traffic control have also been studied.

Chapter VI contains a review of international treaties and conventions on space, both air space and outer space. A comprehensive analysis of the existing legislation regarding space, and its shortcomings has been made. Thus laws dealing with aviation, aviation terrorism, exploration in outer space, etc. have been studied in detail.

Chapter VII describes the role of the judiciary in safeguarding territorial rights over air space with reference to specific cases. A few cases connected to outer space have also been examined.

Chapter VIII, the concluding chapter, gives some suggestions in regard to aviation and laws related to aviation terrorism. It also makes recommendations for a comprehensive law on space activities in order to ensure better and more profitable utilization of space without disregarding environmental concerns, while simultaneously ensuring the safety and security of underdeveloped countries. Emphasis is also laid on the need for developing suitable space legislation in the country.

1.12 Utility of the Study

Space holds as much fascination for humans today as it did almost 40 years ago when the first man landed on the moon. But in this intervening period, space technology has become a key tool for the modern industrial and information society. Television and telephoning via satellite, for instance, are just a part of everyday life that is hardly associated with space any more. The American GPS system revolutionized positioning on earth, water and in the air. Space-based earth observation - alongside navigation and communication - will increasingly play a decisive role in the discharge of government and

societal tasks such as the areas of environmental protection, traffic surveillance, disaster management and in connection with security matters. Hence space technology has the potential to beneficially or adversely affect every country in the world, depending on its use and even more on the laws regulating it, and no country, however small, can afford to ignore it.

This research work was carried out keeping in mind the various aspects of commercialisation of space activities in the Indian context. India, the world's largest democracy, is also one of the fastest developing countries of the world. Though the first war rockets were used by an Indian as far back as 18th century, the fast paced developments in space technology have left us lagging. Hence, a study of the space activities and their commercialization and regulation will be of interest and use in the present context. India entered the field of civil aviation in the last century and today boasts of several private operators, perhaps the largest in any single country. This study will be helpful in assessing our position vis-à-vis other countries. It will help to bring about an awareness of the latest developments in space science and their potential benefits. It will highlight the need for commercializing space in a planned and sustainable manner. At the same time, it will also point out the hazards of indiscreet and unlimited exploitation of space. It will help to strike a balance between scientific progress and sustainable development. This study will also be useful to academicians and policy makers besides students and professionals.