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LEGAL REGULATION OF REMOTE SENSING: SOME CRITICAL ISSUES

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Abstract

Technology in present era has become ubiquitous and indispensable part of human life. The equitable use of various technologies for the sustainable development of mankind has been much necessitated. An area, wherein equal access is imperative is the outer space, which has been termed as the common province of mankind. Though the laws of space have been put in black and white years ago, these laws certainly require a revisit as these laws were developed at a time when space activities were confined to exploration of the unknown celestial bodies and development of space probes. The related systems and space regulations that it established were state-centric and allowed for the use of space by states and their entities only for peaceful purposes. But the increasing commercialization, privatization and deregulation of space activities and the ongoing processes of globalization have destabilized and disturbed the international space regime. The present paper examines the technology relating to remote sensing satellites, its development and the international legal framework placed for its regulation. At the same time, the paper delves into the critical legal issues associated with the remote sensing technology pertaining to the equal access and dissemination of data and there military uses. The paper also calls for a treaty on remote sensing to be negotiated and concluded under the auspices of the United Nations, thereby setting a legal framework for regulation of the international market of remote sensing.

I Space exploration and space use programmes

THE SUCCESSFUL launch of Sputnik, the world's first artificial satellite heralded the age of space and opened the door to space. On October, 2012 that space age baby turned 57. It has now grown in bulk and put on sufficient weight. During the intervening period over 80 successful missions have been launched to the moon, one to Mercury, 40 to Venus, 38 to Mars, eight to Jupiter, one each to Uranus and Neptune and a pioneering craft is on its way to Pluto. Missions have been sent to asteroids and comets, and hundreds of satellites of all sizes are circling

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the earth. There also have been scientific missions like Hubble Space Telescope whose worldly photographs have often captured the imagination of the public. In what appears to be a spectacular success in space science mankind has moved from brief joints in space to walking on the moon. In a recent expedition twelve US astronauts walked on the surface of the moon and cumulatively spent three days there. The success of international space programmes and now the decision of the US administration to take people back to the moon and then to the Mars indicate the directions in which space exploration and space use programmes are moving.

It is worth noting that since the launch of Sputnik there has been a heavy emphasis on space applications which has changed the way of life in several respects. While space technology and satellite systems have revolutionized the fields of communications, the satellite systems have been instrumental in the fields of long distance communications, direct television broadcasting, data network, maritime communication, disaster relief communications and cellular phones. Space applications have also benefited the fields of medicine, education and meteorology. Likewise, the remote sensing technology has ushered in an era of new means of resource surveys and management. Data from remote sensing satellites are used for several applications - agricultural crop acreage and yield estimation, drought monitoring and assessment, flood mapping, wasteland management, water resources management, urban development, marine prospecting, forest resources, forest fire detection and monitoring, fishing vessel monitoring, power supply, mobile telephone network, land, taxation *etc.*

Realizing the increasing importance of space technology, a dozen or so countries have launched a wide variety of space programmes to further their national interests in general and to achieve the goals of sustainable development in particular. Although the space rivalry between the US and the (former) Soviet Union (which the launch of Sputnik I had fostered and the cold war politics had reinforced in the early years of space age) seems to have abated and greater cooperation now exists between nations in space, there is hardly any commonality of approach of space powers in their space programmes which is primarily guided by their national interests, their own vision and their priorities. Moreover, the desire of space powers like the US to maintain their economic and strategic hegemony in space and to resort to unilateral measures and cartels like MTCR for this purpose continues to make an abiding influence on their space policies.

Just as the development of navigation led to the appearance of the law of the sea and development of aviation to the law of the air, the spectacular successes achieved by man in the exploration and use of outer space led to the establishment of an international legal regime on space[1] which consists of

1. See, Christol, *The Modern International Law of Outer Space* (1982); J.E.S. Fawcett, *Outer Space* (1984); M.N. Shaw, *International Law* 479-86 (2003).

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multilateral treaties,[2] soft law instruments and general principles of law recognized by civilized states. It is worth noting that a large part of space law was developed at a time when space activities were confined to exploration of the unknown celestial bodies and development of space probes and related systems and space regulations that it established were state-centric and allowed for the use of space by states and their entities only for peaceful purposes. But the increasing commercialization, privatization and deregulation of space activities and the ongoing processes of globalization have destabilized and disturbed the international space regime.

While the commercialization of space activities is definitely a positive development as it has allowed an increasing number of countries to take advantage of space technology including satellite communications, remote sensing and other applications for national, economic and social development, it has also increased the risks of advanced space technologies being used for aggressive military purposes. Further, such commercialization may result in high costs of space services with attendant grave consequences for developing countries' access to their benefits. It may also drive some of them to invest their scarce resources in space systems rather than investing in education and training that is necessary to develop local expertise and competence in the use of space systems and technologies. It in turn presents a big challenge to the international community as well as countries with space capabilities to take appropriate steps to make space services available to all interested countries at affordable prices. Against this background this paper attempts to give a brief outline of legal regulation of remote sensing.

II Remote sensing: history, definition, kinds and application

Satellite remote sensing is a prime example of the space application for the benefit of mankind. It is a science as well as art of acquiring information about an object or phenomenon by the use of sensing devices, without being in physical or intimate contact with the object. In this technique electromagnetic radiation (EMR) is used as a method of information. Remote sensing involves information

2. Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other bodies, Jan.27, 1967, 18 U.S.T. 2410,2410, 610 U.N.T.S.215 (hereinafter Outer Space Treaty); Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects launched into Outer Space, April 22, 1968, 19 U.S.T.7570, 7I.L.M 151 (hereinafter Rescue Agreement); Convention of International Liability for Damage Caused by Space Objects, Mar.29, 1972, 24 U.S.T 2389, 961U.N.T.S.187 (hereinafter Liability Convention); Convention on Registration of Objects launched into Outer Space, Jan.14, 1975, 28U.S.T.695, 1023 U.N.T.S.15 (hereinafter Registration Convention); Agreement Governing the Activities of States on the Moon and other Celestial Bodies, Dec.18, 1979, 1353 U.N.T.S.3, 18I.L.M. 1434 (hereinafter Moon Agreement). See United Nations Treaties and Principles on Space Law, *available at*: http://www.unoosa.org/oosa/en/spacelaw/treaties. stml (last visited on Sep. 27, 2007).

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transmission from a location considered to belong to outer space to the earth and transformation of information received on earth into understandable data. Remote sensing can therefore also be considered as "including the monitoring/processing, storing, value-adding and disseminating of data as being integral parts of the whole remote sensing process".[3]

Definition and kinds of remote sensing

As for the definition of remote sensing several definitions were proffered before the UN General Assembly in its resolution 41/65 defined it to mean and denote "the sensing of the Earth's surface from space by making use of the properties of electromagnetic waves emitted, reflected and diffracted by the sensed objects, for the purpose of improving natural resources management, land use and the protection of the environment".[4] According to another definition 'remote sensing' refers to the detection and analysis of resources on earth by sensors carried by aircraft and spacecraft".[5] Collection of data concerning objects, materials and situations on the earth by means of sensors 'mounted into fast moving aircrafts on land, at sea, in the air and in space' and data processing for 'quantification, qualification and mapping purpose' are the two functions of remote sensing.[6] It is done by using satellites orbiting the earth for the purpose of obtaining a 'large scale picture and repetitive view of the surface of the earth, thereby making it possible to monitor changes in the earth environment without interruption through all the seasons and in almost any conditions all year round".[7]

Scientists divide remote sensing in two categories: passive remote sensing and active remote sensing.[8] In passive remote sensing the reflected or emitted electromagnetic radiations from the natural resources are detected with the help of sensors. On the other hand, active remote sensing is done by 'first transmitting electromagnetic radiation down to the object and then reading the reflected energy'.[9] Remote sensing is also classified in terms of wavelength regions. Remote sensing so

3. Patric Salin, cited in Aylia Licor, "Satellite Remote Sensing: Commercialization of Remote Sensing. Is the Use of Satellite Derived Information for Military Purposes in Violation of the Peaceful Purposes Provision of the Outer Space Treaty?" 14 *ILSA Journal of International and Comparative Law* 207-224 (2007) at 216.

4. Principles Relating to Remote Sensing of the Earth From Outer Space, G.A. Res. 41/65 UN Doc. A/ Res. 41/65, Annex 1(a), Dec. 3, 1986.

5. UNISPACE, 1982, cited in Licor, *supra* note 3 at 276.

6. S. Hempenius, quoted in Licor, *id*., at 216.

7. Delter Vagts and Ivan, A. Vlasic, Charles C. "Okolie's International Law of Remote Sensing and Outer Space" *AJIL* 86 (1992) at 221 (Book Review).

8. Remote Sensing,*available at*: http://en.wikipedia.org/wiki/remote_sensing (last visited on Sept. 27, 2012).

9. Weaver, quoted in Licor, *supra* note 3 at 217.

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classified are thermal infrared remote sensing, microwave remote sensing and visible and reflective infrared remote sensing. It is important to note here that the quality of satellite imaging depends on the nature of resolution of the remotely sensed area. Resolution impacts collection and is best explained with the following relationship: less resolution, less detail and large coverage, more resolution, more detail but less coverage.[10] The resolution is measured in meters and it defines the smallest object that could be detected by satellite sensors. The resolutions are classified into four categories: spatial resolution, spectral resolution, radiometric resolution and temporal resolution. The quality of resolution also depends on the altitude of the orbit. Lower altitudes provides for a narrower span of vision but a better resolution, military and reconnaissance satellites need a narrow vision, but it does not serve the need of commercialization of remote sensing which requires one meter or less than one meter resolution. The new satellites now provide 'multispectral' color readings which can distinguish specific colors, and multiple shots from different angles and provide three-dimensional viewing.[11]

Development of satellite remote sensing

While satellite remote sensing is a recent phenomenon which dates back to the late 1950 and early 1960s, remote sensing as such is very old. Our earliest ancestors used to see the landscape by standing on a high cliff or tree. The balloonist 'Tournacron (alias Nadar) made photographs of Paris from his balloon in 1858.[12] Messenger pigeons, kites and unmanned balloons were used for early images.[13] But those primitive methods of remote-sensing were not useful for map making or for scientific purposes. The modern discipline of remote sensing arose with the development of flight. Development of systematic aerial photography for military surveillance and reconnaissance purposes, which began in World War I reached a climax during the cold war with the use of modified aircraft such as the P-51, P-38, RB-66 and the F4-C, or specifically designed collection platforms such as the U2/ TR-1, SR-71, A-5 and the OV-1 both in overhead and stand-off collection.[14]

With the development of artificial satellites in the latter half of the 20th century satellite remote sensing began to progress. In the beginning this new technology was used only for the purposes of meteorology and military reconnaissance. But with the launch of the first remote sensing satellite, named the

10. *Supra* note 8.

11. Susan M. Jackson, "Cultural Lag and the International Law of Remote Sensing", *Brook.* XXVIII *J. Int'l L.* 853 at 858 (1998).

12. *Supra* note 8.

13. *Ibid.*

14. *Ibid.*

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Earth Resources Technology Satellite (ERTS) by NASA in 1972, and development of several remote sensing systems by other countries, the use of remote sensing for other purposes also began. Various earth observing and weather satellites such as Landsat, Nimbus and more recent missions such as RADARSAT and UARS the process of global measurements of various data for civil research and military purposes began on a large scale.[15] Remote sensing also acquired new dimensions and use as a result of space probes to other planets. Thus, remote sensing studies in extra-terrestrial environment began to be conducted. Synthetic Aperture Radar aboard the Magellan spacecraft provided detailed topographic maps of Venus. Likewise, instruments aboard SOHO allowed studies to be performed on the sun and the solar wind.[16] Remote sensing system was further developed with the introduction of image processing of satellite imagery. Recent developments include the introduction of online web services for easy access to remote sensing data (mainly low / medium – resolution images) like Google Earth.[17] Availability of such services have made remote sensing more familiar to the big public and has popularized the science.

Remote sensing in India

India did not lag much in building, launching and maintaining its own remote sensing satellites.[18] It began to develop its remote sensing satellite program soon after the successful demonstration flights of Bhakara-1 and Bhakara-2 satellites launched in 1979 and 1981 respectively. The object of this program is to support the national economy in the area of agriculture, water resources, forestry and ecology, geology, watersheds, marine, fisheries, and coastal management. While the initial versions of its remote sensing satellites composed of the 1 (A, B, C, D), the latter versions are based on their area of application, such as Oceansat, Cartosat, Resourcesat. Other satellites have alternate designations based on the launch number and vehicle (P series for PSLV).[19] The fleet of IRS satellites will be further strengthened by the launch of RISAT, OCEANSA-2, RESOUCESA-2,

15. *Ibid.*

16. *Ibid.*

17. *Ibid.*

18. Soumya Ghosh, *Identification of Tidal Power Site in the Coastal Regions of West Bengal with the Help of Remote Sensing And Cost Benefit Analysis With Linear Turbulence (Cobalt) Algorithm* (Master's Degree Theses, Jadavpur University, 2012) *available at*: http://dspace.jdvu.ac.in/bitstream/123456789/18267/1/Acc.%20No.%20DC%2025pdf (last visited on Nov. 30,2012).; K.Kasturirangan, "Remote Sensing in India-Present Scenario and Future Thrusts" 23*Journal of the Indian Society of Remote Sensing* 1-6. (Mar. 1995).

19. Indian Remote Sensing Satellite, *available at*: http://en.wikipedia.org/wiki/Indian_Remote_ Sensing_Satellite. (last visited on July 30, 2012).

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RESOURCESAT-3, CROARTOSAT-3, OCEANSAT-3. The National Natural Resources Management System for which the Department of Space (DoS) is the nodal agency, provides operational remote sensing data services. Data received from the IRS satellites is received and disseminated by several countries all over the world. The National Remote Sensing Hyderabad is the nodal agency for reception, archival, processing and dissemination of remote sensing data in the country. This agency acquires and processes data from all Indian remote sensing satellites like CARTOSAT-1, CARTOSAT-2, RESOURCESAT-1, IRS-ID, OCEANSAT-1, TES and TES as well as foreign satellites like TERRA, NOAA and ERS. It is noteworthy that the Indian Remote Sensing System is the largest constellation of remote sensing satellites for civilian use in operation today in the world. The constellation now has eight satellites in operation. All these are placed in polar sun-synchronous orbit and provide data in a variety of spatial, special and temporal resolutions.[20]

Remote sensing applications

Remote sensing is being used for air and water pollution surveys, ocean fishing surveys, and land use planning. Data from Indian remote sensing satellites is being used for the following purposes: pre-harvest crop area and production estimation of major crops; drought monitoring and assessment based on vegetation condition, flood risk zone mapping and flood damage assessment, hydro-geomorphological maps for locating underground water resources for drill wells; irrigation command area status monitoring; snow-melt run-off estimates for planning water use in downstream projects; land use and land cover mapping, urban planning, forest survey, wetland mapping, environment impact analysis, mineral prospecting, coastal studies; integrated mission for sustainable development for generating locale specific prescriptions for integrated land and water resources development in 174 districts.[21]

Data acquired from the remote sensing satellites have also been found useful in location of sub-surface supplies of water, examination of land features for locating mineral resources and in enhancing civil engineering and coastal zone management.[22] Besides, remote sensing has been used for verification of compliance with arms control treaties. Imagery by the SPOT not only helped in the search for remains of the victims of the crash of Pan American Flight 103 in Scotland, but also provided evidence of the Chernobyl nuclear disaster in the former Soviet Union.[23] Remote

20. For future remote sensing program in India. See. ISRO, Department of Space, 'Report of the Working Group on "Space on the Eleventh Five Year Plan Proposals 2007-2012 for Indian Space Programme".

21. See *supra* note 19.

22. See Licor, *supra* note 3 at 217.

23. *Ibid.*

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sensing application also includes monitoring of deforestation in areas such as the Amazon, the effects of climate change on glaciers and Arctic and Antarctic regions, and depth sounding of coastal and ocean depths.[24] Remote sensing has replaced costly and slow data collection procedure on the ground without disturbing the areas of objects about which data is collected.[25]

New remote sensing technology promises other benefits too. Thus, thanks to commercialization of remote sensing imagery companies are now offering photographs of homes, neighbourhoods, and traffic patterns taken from space.[26] Further, as already noted remote sensing technology is being used for military purposes. If remote sensing is likely to encourage states both to conceal their military facilities and invent ways to deceive their adversaries, techno-optimists point out that with new breakthroughs in remote sensing technology there is likelihood of the detection of such cheating.[27] Satellite Aperture Radar (SAR) is capable to penetrate through cloud cover and haze, unlike conventional sensors. Further, the new Moving Target Indicator (MTI) can use the doppler radar for the SAR to determine the tank movement (if any). [28] With commercialization and dissemination of the remote sensing imagery the possibility of monitoring of installations in countries that are not parties to the Non-Proliferation Treaty has increased.[29] Remote sensing can also be useful in monitoring of egregious arms transfer.[30]

With the advent of the internet technology and its common use it is now possible for individuals to view high resolution imagery of certain places and digital images can be downloaded by them with no inconvenience at their own home.[31] But technology is a double-edged sword. Commercial dissemination of remote sensing imagery has also increased the opportunities available for terrorists to get valuable information about a country and to locate facilities they seek to destroy.[32] It is speculated that those with enough money or connections to obtain a small aircraft and hand-held global positioning satellite receiver could easily navigate to a critical facility and then, conceivably blow it up.[33] Fortunately, remote sensing technology also provides solution to this problem by making it possible to find out the locations

24. *Supra* note 8.
25. *Ibid.*
26. Licor, *supra* note 3 at 219-20.
27. Jackson, *supra* note 11at 880.
28. *Ibid.*
29. *Ibid.*
30. *Ibid.*
31. Licor, *supra* note 3 at 226.
32. *Ibid.*
33. Jackson, *supra* note 11 at 878.

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and build up of terrorist camps through a close scrutiny of states engaged in international terrorism.[34]

Commercialization of remote sensing

As noted above that commercialization of remote sensing imagery began with the launching of the US Earth Resources Technology. And as a result of a chain of events including the end of cold war, spread of democracy to a large part of the globe, economic globalization, advances in the area of remote sensing resulting in demand for the remote sensing data for both military and civilian purposes, launching of remote sensing satellites by countries like France and Russia and resulting competition in the commercial market accelerated the pace of commercialization of remote sensing to such a great extent that there is now a big international commercialization market for the remote sensing data.

As there is no international legal framework to deal with the market for remote sensing data, it is largely being regulated by the states that are major commercial players. The US Land Remote Sensing Commercialization Act, 1984[35] was enacted in order to maintain worldwide leadership of the US in civil remote sensing. That Act aimed to foster the US commercial standing in the field of remote sensing but failed in attaining the objective because of concerns about national security. Moreover, the Act had the effect of impacting the international commitments of the US to provide for non-discriminatory access to data gathered by remote sensing by substantially increasing the data prices which made the data unaffordable to many developing countries. For these reasons the Act was replaced by the Land Remote Sensing Policy Act in 1992 for the purpose of actively promoting commercialization of remote sensing. The 1992 Act aims to encourage future commercial opportunities in remote sensing through the following measures: support to investments in new remote sensing technologies, removal of unnecessary restrictions on the dissemination of privately gathered data streamlining of the licensing process for private sensing systems, and encouragement to growth of the market for remote sensing data. In 1994, the Clinton administration announced a new policy to allow the US companies more liberty to sell remote sensing images in the international market. Three years later in 1997, the Defense Authorization Act was enacted to ban non-federal United States entities from collecting or disseminating one-meter or better resolution satellite imagery of Israel or of any other country specified by the President. While these US initiatives fostered commercialization of remote

34. *Id.* at 880.

35. For discussion of the U.S. Domestic Remote Sensing Legislation. See, Jackson, *supra* note 11 at 860-69.

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sensing they also impacted the principle of non-discriminatory access to remote sensing data by regulating the release of high resolution data by subjecting them to domestic laws, policies and security and foreign affairs interests.

Consequences of commercialization of remote sensing

The commercialization and open dissemination of remote sensing data is a mixed bag. It should hopefully enable many countries to procure the information for obtaining of which they would have had to spend considerable amount of money and resources to produce and operate the space-based remote sensing systems. It is also believed that commercialization of remote sensing has the potential to reduce the asymmetry of information between developed and developing countries provided free-market principles were allowed to operate and an international regulatory framework was put in place to promote the 'open skies policy' in respect of the dissemination of the data gathered by remote sensing satellites.[36] Proponents of commercialization and open dissemination of remote sensing data claim that it will promote international stability faster rather than undermine it by reducing the tension caused by the search for such data.[37]

But the aforesaid claimed advantages of commercialization remote sensing imagery are contested by a number of scholars who think that distribution of that data will not be obtained asymmetrically by less-developed, developing and developed countries. This lack of symmetry in information is likely to handicap a sensed state in any bilateral treaty negotiations. Moreover, it will put the countries without remote sensing capabilities at a greater disadvantage in relation to the developed countries; while the latter can acquire military or strategic advantage by obtaining and using the remote sensing imagery of the natural resources, military bases, and defenses of the former, the countries without such capabilities will remain helpless in the matter. Further, the availability of satellite imagery will foster conflicts in the third world and encourage rival nations to 'spy, target, and destroy each other's military and defences'.[38] It also has been observed that 'the use of remote sensing and new weapons will feed on each other. [39]

III International legal framework for regulation of satellite remote sensing

Remote sensing is a space activity and as such is governed by the broad legal principles of international space law set out in major space law treaties. But as every

36. *Id.* at 884-85.

37. *Id.* at 879.

38. Brown's observation cited in *supra* note 11 at 877.

39. *Id.* at 878.

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space activity is required by the Outer Space Treaty to be carried out in accordance with international law, including the United Nations Charter, in the interests of maintaining international peace and security and promoting international cooperation and understanding,[40] remote sensing activities are also subject to international law, including the UN Charter and the Space Treaty, 1967 and the relevant instruments of International Telecommuni-cations Union.[41] Although there is till to date no international convention on remote sensing, the UN General Assembly Resolution 41/65 of 1986 seeks to fulfill this void in international law by establishing a non-binding international framework for the regulation of remote sensing activities. Against this background an attempt is made below to provide an outline of legal regulation of remote sensing under international law under two sub-heads: Major space treaties and principles on remote sensing.

Major space treaties

The Outer Space Treaty, 1967 the constitution of outer space and the foundation of the international legal regime on outer space reiterates the principle of non-appropriation of outer space.[42] It, however, guarantees states parties freedom of exploration and use of outer space and celestial bodies without discrimination of any kind, on a basis of equality and in accordance with international law.[43] The treaty further declares that there shall be free access to all areas of celestial bodies, recognizes the freedom of investigation in outer space, including the moon and the celestial bodies and imposes an obligation on states to facilitate and encourage international cooperation in such investigation.[44] The exploration and use of outer space is to be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or social development.[45] Such exploration and use are to be made in accordance with international law, including the UN Charter, in the interest of maintaining international peace and security and promoting international cooperation and understanding.[46]

The treaty goes further and formulates in article IV the principle of partial demilitarization of outer space and complete demilitarization of celestial bodies. Article VI makes states parties internationally responsible for all national activities in outer space carried out by both governmental and non-governmental entities. As

40. Outer Space Treaty, Art. III.
41. Principle III, G.A. Res. 41/65 of 1986, *supra* note 4.
42. *Supra* note 40, art. II.
43. *Id.*, art. I.
44. *Id.*, art. I(3).
45. *Id.*, art. I(1).
46. *Id.*, art. III.

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per this provision activities of non-governmental entities in outer space, including the moon require authorization and continuing supervision by the appropriate state party to the treaty. The treaty also includes stipulations pertaining to promotion of international cooperation in the peaceful exploration and use of outer space and celestial bodies and prevention of potentially harmful consequences of experiment on outer space and on celestial bodies.[47]

The treaty refers to 'astronauts' as envoys of mankind and makes states parties duty bound to render assistance to the crews of spaceships in the event of accident, distress, emergency or unintended landing and envisages a safe and prompt return of astronauts after such landing to the state of registry of their space vehicle in question.[48] This provision has been further elaborated and complemented by the Rescue Agreement of 1968. Under article 1 of this agreement upon receipt of information or discovery about astronauts in distress, the contracting party concerned shall immediately communicate with the launching authority and immediately make a public announcement by all appropriate means of communication. It shall also notify the Secretary General of the United Nations to enable him to disseminate the information without delay by all appropriate means of communication at his disposal.

The Rescue Agreement establishes obligations with regard to rescue of and assistance for the personnel of a spacecraft who, owing to accident, distress or unintended landing, land in the territory under the jurisdiction of a contracting party.[49] The contracting state parties which are in position to do so shall, if necessary, extend assistance in search and rescue operations for the personnel of a spacecraft who have alighted on the high seas or in any other place not under the jurisdiction of a state.[50] If, owing to accident, distress, emergency on unintended landing, the personnel of a spacecraft land in territory under the jurisdiction of a contracting party or have been found on the high seas or in any other place not under the jurisdiction of any states, they shall be safely and promptly returned to representative of the launching authority.[51] Upon receipt of information or discovery pertaining to the return of a space object or its component parts to earth in territory under its jurisdiction or on the high seas or in any other place not under the jurisdiction of any state, the state concerned shall notify the launching authority and the Secretary General of the United Nations.[52] There is also a duty to recover the object or component parts and return the same in the circumstances enumerated in the Rescue Agreement.

47. *Id.*, art. VII.
48. *Id.*, art. V.
49. Rescue Agreement, art. 2.
50. *Id.*, art. 3.
51. *Id.*, art. 4.
52. *Id.*, art. 5.

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Returning to the Outer Space Treaty, article VII makes the launching state internationally liable for damage to another state party to the treaty or to its natural or juridical persons by space object launched by it or its component parts on the earth, in airspace or in outer space, including the moon and other celestial bodies. The Liability Convention, which purports to develop and concretise the liability obligations assumed by the states under the Outer Space Treaty, provides for the payment of compensation in accordance with international law and the principles of justice and equity for any damage caused by space objects. The convention has established two types of liability regime - (1) absolute liability to pay compensation for damage caused by a space object on the surface of the earth or to aircraft in flight,[53] and (ii) fault liability for damage caused elsewhere or to persons or property on board a space object.[54] The Convention also contains provisions relating to joint and several liability,[55] claims related procedure[56] and claims commission to settle the compensation dispute in the event of failure of diplomatic negotiations under article IX.[57]

Turning to jurisdiction and control over a space object launched into outer space and over any personnel thereof, while in outer space or in a celestial body, the Outer Space Treaty makes it clear that the state of registration of that object retains jurisdiction and control over it and its personnel.[58] The Registration Convention also provides for registration of information regarding space objects, such as their purpose, location and parameters with the UN Secretary-General. As is well known, the purpose of this convention is primarily to make the identification of the launching state in case of causing of damage due to launching of space objects. Where the application of the provisions of this convention has not enabled a state party to identify a space object which has caused damage to it or to any of its natural or juridical persons, or which may be of a hazardous or deleterious nature, other states parties are enjoined by this convention to respond to the greatest extent feasible to a request by that state party or transmitted through the U.N. Secretary-General on its behalf, for assistance under equitable and reasonable conditions in the identification of the object.[59] Notably, in this convention, with the exceptions of articles VIII to XX, references to states shall be deemed to apply to any international intergovernmental organization which conducts space activities provided the organization declares its acceptance of the rights and obligations set out in this

53. Liability Convention, art. II.
54. *Id.*, art. III.
55. *Id.*, art. V.
56. *Id.*, arts. VII to XI.
57. *Id.*, arts. XIV to XX.
58. *Supra* note 40, art. VIII.
59. Art. VI, Registration Convention.

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convention and if a majority of states members of the organization are states parties to this convention and the Outer Space Treaty.[60]

It is also essential to point out two things in regard to involvement of private actors in space activities. According to Wassenbergh situations where problems may arise for commercial enterprises are: (1) in the case of an inter-governmental organization when only a minority of members are parties to the Outer Space Treaty and the Liability Convention, and (2) in the case of non-governmental organization, if it is run by non-governmental entities of a state which is not a party to the Outer Space Treaty.[61]

The international community has also responded to the problem of the use of nuclear power sources in outer space. Principle 4 of the U.N. General Assembly Resolution[62] provides that a launching state shall, prior to the launch, ensure that a thorough and comprehensive safety assessment is conducted and made publicly available. Where a space object with nuclear power source board is malfunctioning with a risk of re-entry of radioactive materials to the earth, the launching state shall inform states concerned and the UN Secretary-General about it[63] and respond promptly to request for further information or consultations sought by other states.[64] Principle 8 provides that states shall bear responsibility for national activities involving the use of nuclear power sources in outer space, whether such activities are carried on by governmental agencies or by non-governmental entities. Under principle 9 each state which launches or procures the launching of a space object and each state from whose territory or facility a space object is launched shall be internationally liable for damage caused by such a space object or its component parts.

The Agreement Governing the Activities of States on the Moon and other Celestial Bodies, 1979 is another international legislation of far-reaching significance. After noting the achievement of states in the exploration and use of the moon and other celestial bodies and recognizing that the moon as a natural satellite of the earth has an important role to play in the exploration of outer space, the agreement formulates a number of principles with the avowed objectives of promoting on the basis of equality the further development of cooperation among states in the exploration and use of the moon and other celestial bodies and preventing the moon from becoming an area of international conflict. This agreement is meant to apply to other celestial bodies within the solar system other than the earth.[65] It however, does not apply to extra-terrestrial materials which reach the surface of the

60. *Ibid.*

61. Cited in Deidrics – Verschoor, *An Introduction to Space Law* 111 (1999).

62. U.N. General Assembly Resolution 47/68 (Annex.).

63. Principle 5.

64. Principle 6.

65. The Moon Treaty, art. 1.

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earth. Its main substantive provisions include use of the moon exclusively for peaceful purposes,[66] the exploration and use of the moon as the province of all mankind,[67] the moon and its natural sources as the common heritage of mankind[68] and prohibition of national appropriation of the moon by any claim of sovereignty,[69] freedom to pursue activities in the exploration and the use of the moon,[70] establishment of manned and unmanned stations on the moon,[71] adoption of practical measures to safeguard the life and health of persons on the moon,[72] freedom of scientific investigation[73] and exchange of scientific and other personnel on expeditions to or installations on the moon,[74] jurisdiction and control of states over their personnel, vehicles, equipment facilities, stations and installations on the moon.[75] The agreement goes further and prohibits not only any threat or use of force or any other hostile act on the moon but also the establishment of military base, installations and fortifications, the testing of any type of weapons and the conduct of military maneuvers on the moon.[76] States are also forbidden to place in orbit around or other trajectory to or around the moon objects carrying nuclear weapons or any other kinds of weapons of mass destruction or place or use such weapons on or in the moon.[77] It is obligatory for states parties to inform the Secretary General of the United Nations as well as the public and the international scientific community, to the greatest extent feasible and practicable, of their activities concerned with the exploration and the use of the moon.[78] Information on the time, purposes, locations, orbital parameters and duration shall be given in respect of each mission to the moon as soon as possible.[79] Further, information on the results of each mission, including scientific results shall be furnished upon completion of the mission.[80]

The Moon Agreement provides for the establishment of an international regime to govern the exploitation of the natural resources of the moon when such exploitation is about to become feasible. The main purposes of the international

66. *Id.*, art. 3.
67. *Id.*, art. 4.
68. *Id.*, art. 11(1).
69. *Id.*, art. 12(2).
70. *Id.*, art. 2.
71. *Id.*, art. 9.
72. *Id.*, art. 10.
73. *Id.*, art. 6.
74. *Id.*, art. 6.
75. *Id.*, art. 6(3).
76. *Id.*, art. 3.
77. *Id.*, art. 3(3).
78. *Id.*, art. 5.
79. *Ibid.*
80. *Ibid.*

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regime to be established shall include: (a) the orderly and safe development of the natural resources of the moon; (b) the rational management of those resources; (c) the expansion of opportunities in the use of those resources; (d) an equitable sharing by all states parties in the benefits derived from those resources, whereby the interests and needs of the developing countries, as well as the efforts of those countries which have contributed either directly or indirectly to the exploration of the moon shall be given consideration.[81]

Before the establishment of a detailed regime, provisions of article 6(2) of the Moon Agreement will remain applicable. The article states: 'In carrying out scientific investigations and in furtherance of the provisions of this Agreement, the States Parties shall have the right to collect on and remove from the moon samples of its mineral and other substances. Such samples shall remain at the disposal of those states parties which caused them to be collected and may be used by them for scientific purposes. States parties shall have regard to the desirability of making a portion of such samples available to other interested states parties and the international scientific community for scientific investigation'. States parties may in the course of scientific investigations also use minerals and other substances of the moon in quantities, appropriate for the support of their missions. This provision is supportive of private initiatives during the period of exploration of natural resources of the moon and there is nothing in the Moon Agreement which could be seen as being against private initiatives, investment and interests, notwithstanding some misinformation on this count in some official circles.

However, only a limited number of states have ratified this treaty. The main reasons for this are its common heritage of mankind provision and also a general lack of interest of states in the international space regime. But this situation is likely to change with the recent American decision to resume exploration of the moon and to use its resources for missions to Mars. With the successful launching of moon missions by China, India and others, there is now a renewed global interest in the development of a legal regime to govern the moon and other celestial bodies. Interest in the Moon Agreement has already been created by the activities of several private entities in the US and other countries that are selling pieces of land on the moon.

As previously stated, liability and jurisdictional issues relating to astronauts are addressed in article VIII of the Outer Space Treaty and article 12 of the Moon Treaty. These provisions, however, do not adequately address modern exigencies of outer space activity such as collaboration in space stations where repair missions and salvage activities may call for multinational crews, joint space exploration calling for multiple space technology and even transport to outer space of passengers.[82]

81. Art. 11(7), Moon Agreement.

82. Abeyratne, *Frontiers of Aerospace Law* 62, 70 (2002).

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Writing in 1997, K.H. Boekstigel aptly stated that 'Article IX does not provide for any formalized dispute settlement procedure, let alone a binding decision by any particular body, should the parties not be able to agree on a settlement'.[83] Article IX of the 1972 Liability Convention provides for diplomatic negotiations for settlement of a claim in the first instance and in the event of their failures for the establishment of a claims commission at the request of either of them. But the final decision of such commission shall only be a recommendatory award which the parties are required to consider in good faith. It is only an optional declaration provided by the parties to the Liability Convention in accordance with the General Assembly Resolution 277 (XXVI) of 29 November, 1971 which can make the decision of the commission binding on the parties to the dispute on a reciprocal basis. But this opportunity too has been used only by a limited number of states. For this reason one can concur with the view of Kopal that Committee on the Peaceful Uses of Outer Space (COPUOS) and its legal sub-committee should 'ponder the possibility to develop a system of dispute settlement regarding space activities which would include in addition to different means of negotiation appropriate binding method of resolution of such disputes'.[84]

Before proceeding further, it is essential to emphasize that the international space law making process virtually came to a grinding halt after the successful conclusion of the Moon Treaty. True, the intervening period has witnessed the adoption of an International Convention on International Interests in Mobile Equipment and of some General Assembly resolutions on subjects like remote sensing and direct television broadcasting but the first is important only to a limited number of states, while the latter instruments are not binding. Among several reasons responsible for deceleration of the international space law-making process the first and foremost is the nature of the process of drafting of the international agreement which is detailed, laborious, and time consuming. But what has decelerated the process more is the periodic increase in the membership of the COPUOS which has seriously affected its functioning, and the consensus rule through which it makes decisions. Experts are of the opinion that the consensus rule, which worked relatively well in the past, has made the process of law making more difficult today because it gives veto power to some of the space faring states to block the decision for inclusion of new items to the agenda of the COPUOS. Monopoly in decision making by a small minority of powerful states in the COPUOS ensured by the requirement of consensus is also responsible for preference being given by this body to adopt non binding resolutions and avoid the drafting of binding agreements.

83. Cited in Kopal, UNISPACE WORKSHOP at 9.

84. Kopal, 1999 UNISPACE WORKSHOP at 10. In this context a reference should be made to ILA Convention on the Settlement of Disputes Related to Space Activities, adopted in 1998 at Taipei.

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It must be recognized that the five space treaties concluded between 1967 to 1979 have only established legal principles to govern the exploration and use of outer space by states and state owned entities and do not lay down specific rules to regulate space activities. Further, many space activities which are being undertaken today by states and private operators are either inadequately regulated or not regulated at all. Significant changes that have occurred in the global geopolitical situation in all these years and challenges posed by substantial increase in the variety of space activities, especially those that are being undertaken by private enterprises for commercial purposes also raise serious doubts about the efficacy and relevance of existing treaty rules.

As evident from the above, all space treaties discussed above are relevant when analyzing remote sensing activities. Yet what is most relevant in this context is the Outer Space Treaty. The general and guiding principle outlined in article I are the common interest principle as well as the freedom principle. As seen above, the common principle postulates that 'Outer Space' being a territory held in common should be explored and used for the further benefit and in the interests of all countries, irrespective of their degree of economic or scientific development. When extended to remote sensing, this principle requires that remote sensing activities should be carried out for the benefit and in the interest of all countries, irrespective of their degree of economic, social or scientific and technological development. Likewise, the freedom principle postulates that each state is free to use the outer space so long as such use does not adversely affect the use of other states. This principle along with the principle of non-appropriation of outer space in the name of sovereignty is relevant to the legality of remote sensing of the territory of one state by another state without the consent of the former. Article IV is relevant to analyzing the legal issues relating to use of remote sensing for military purposes since it relates to military activities in outer space and preserves outer space for 'peaceful purposes'. The Moon Treaty will also be relevant to remote sensing if the outer space activities on the moon and other celestial bodies involve such activity.

The remote sensing principles

The UN General Assembly resolution on the Principles relating to Remote Sensing of the Earth from Outer Space, 1986 contains fifteen principles the draft of which was finally prepared by a working group within the United Nations Legal Sub-Committee of the COPUOS after seventeen years of 'heated debate' on several contentious issues that arose from the conflicting positions of states on the specific aspects of remote sensing. In the process of compromise necessary to reach consensus, a delicate balance was made in the principles by accommodating variant interests and differing viewpoints of the states having remote sensing capabilities and states without such capabilities. In a bid to secure the consensus care was also

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taken to address the concerns of the developing countries, and to provide for promotion of the international community's interests in the protection of earth's natural environment and assistance in case of natural disasters. Being a compromise solution, the principles exhibit all the weaknesses of such solution. It has been contended by a commentator that in the process of accommodating the conflicting interests of states to secure the necessary consensus, the principles have been 'watered down to the point where they only restate general concepts of international space law or formalizes existing customary practice'.[85]

Although the text of the instrument embodying the principles follows the format of a treaty, and could have been presented in the form of a treaty the idea was abandoned in favor of designating it as 'Principles' because of lack of consensus among nation states at that time. The fact that the remote sensing technology itself was in a state of evolution also led the negotiators to go for the formulation of certain broad principles. Another reason responsible for the abandonment of the idea of a treaty on remote sensing probably lay in the negative attitude of some of the space powers who did not wish to subject themselves to a detailed set of rules a breach of which would entail international responsibility.[86] Be that as it may, the 'Principles' constitute non-enforceable and not-legally binding international law. As a soft law instrument it has that legal significance which is generally attributed to this newly emerging source of international law.[87] Some scholars go even further and contend that the General Assembly resolution enshrining the 'Principles' could either be seen as 'instant customary international law' or at least as constitutive of evidence of *opinio juris* which is a necessary element for the development of customary international law.[88] Though this proposition might seem attractive on a close analysis of state practice is at the best debatable for atleast three reasons. *First*, the principles cover only those remote sensing activities, the purpose of which is to use imagery for the purpose of improving natural resources management, land use and the protection of the environment and accordingly do not cover other modern applications of remote sensing. *Secondly*, commercial remote sensing is not entirely addressed by the principles and its regulation has been virtually left to the municipal

85. Feder, cited by Jackson, *supra* note 11 at 872.

86. V.S. Mani, 'The Emerging Legal Regime of Remote Sensing: A General Survey" in Mani et al. (eds.), *Recent Trends in International Space Law and Policy* 235-54 (1997).

87. On 'Soft Law', see Chinkin, 'The Challenge of Soft Law: Development and Change in International Law, *ICLQ* 38 (1989), 850; A.E. Boyle, 'Some Reflections on the Relationship of Treaties and Soft Law' 48 *ICLQ* 901 (1999).

88. Feder, cited in Jackson, *supra* note 11 at 873.On quasi-legal effects of U.N. G.A. resolutions. See, O.Y. Asamoah, *The Legal Significance of the Declarations of the General Assembly in the United Nations* (1966); Castaneda, *Legal Effects of United Nations Resolutions* (1969); B.C. Nirmal, *Right to Self-Determination in International Law* 47-59 (1999).

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legislation. No wonder, critical issues thrown open by commercial remote sensing which will be discussed later are unaddressed by the principles. For instance, the operations of reconnaissance satellites, monitoring of strategic treaty compliance and peace-keeping operations by remote sensing and intellectual property issues related to dissemination of data gathered by it call for a comprehensive international legislation to deal with these and similar other issues. *Thirdly*, state practice of some of space powers is at variance with the prescriptions of the principles.

Now turning to remote sensing principles as set out in the 'Principles', they include *inter alia* protection of the environment,[89] protection of mankind from natural disasters,[90] carrying remote sensing activities for the benefit and in the interest of all countries,[91] applicability of international law including the UN Charter and the Space Treaty and the relevant instruments of International Telecommunications Union to remote sensing activities,[92] equal access policy in respect of data,[93] state responsibility for activities of remote sensing satellites,[94] compensation for harms or damage resulting from remote sensing from space,[95] need to pay attention to the needs of developing countries in the pursuit of international cooperation and giving of information to the Secretary-General of the U.N. by states which carry out a programme of remote sensing.[96]

The principles establish the United Nations Secretary-General as the recipient of all information on national programs[97] and set out the goal for the United Nations and its relevant agencies within the United Nations system to promote international cooperation, including technical assistance and coordination in the area of remote sensing.[98] It is in these principles, commentators argue lies the significance of the principles.[99] These principles one may be tempted to believe that if a nation state fails to get access to the relevant sensing data because of its inability to afford the price for the same or technical or political reasons, the UN would be failing its mission of promoting peace and equality among nations.[100]

The principles also establish the need to promote international cooperation in the area of remote sensing in other provisions as well. Thus, principle V enjoins the

89. Principle X.
90. Principle XI.
91. Principle II.
92. Principle III.
93. Principle IV.
94. Principle XIX.
95. Principle XIII.
96. Principle IX.
97. *Ibid.*
98. Principle VIII.
99. Jackson, *supra* note 11 at 872.
100. Licor, *supra* note 3 at 221.

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remote sensing state to promote international cooperation in remote sensing activities. To this end, they shall make available to other states opportunities for participation in such activities in each case on 'equitable and mutually acceptable terms'. Under principle VI, such states are encouraged to enter into agreements or other arrangements to provide for the establishment and operation of data collecting and storage stations and processing and interpretation facilities, in particular within the framework of regional agreements or arrangements wherever feasible. Principle VII imposes an obligation on the remote sensing states to make available technical assistance to other interested states on mutually agreed terms. Principle XI elaborates the obligation of cooperation by requiring the remote sensing states to make available any other relevant information to the greatest extent feasible and practicable to any other state particularly any developing country that is affected by the remote sensing at its request. Principle XIII establishes the obligation of the remote sensing state to upon request, 'enter into consultation with a State whose territory is sensed in order to make available opportunities for participation and enhance the mutual benefits to be derived therefrom'.

As would be evident from the foregoing, the principles referred to above are in the nature of general and broad guidelines and 'lack the specific content necessary to lay a regulatory framework' for the industry and merely reiterates the principles already codified in the basic Outer Space Treaty.[101] To say, so however, is not to underestimate the significance of the principles in providing an international framework for regulation of remote sensing. What is needed to be recognized in this context is that recent technological advancements in the area of remote sensing causing substantial change in the nature of the remote sensing imagery and its availability on the commercial market have created an urgent need to re-open the debate on all critical issues concerning the use of this space activity and resolve them in such a way as to provide binding rules for the regulation of commercial remote sensing operations.

IV Critical issues

In this section some of critical issues pertaining to remote sensing activities that need to be addressed in a satisfactory manner are examined.

National security and sovereignty concerns

Remote sensing activities have been seen as constitutive of a threat to national security and sovereignty[102] of the sensed state since the advent of the remote sensing technology and its use for various purposes. The third world countries viewing

101. De Saussure, cited in Jackson, *supra* note 11 at 872.

102. B.C. Nirmal, 'Sovereignty in International Law' *Soochow Law Journal* 1-51 (2006).

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remote sensing of their territories by the sensing states without their prior consent argued that as sovereignty on resources extends, to information regarding the same, gathering of data concerning them without their prior consent amounts to infringement of their sovereignty. They not only questioned the nation's right to collect and disseminate remotely sensed data concerning another nation but also asserted their right of access to data gathered over their territories before they are disseminated to others. Under general international law, the legality of information gathering depends not on the nature and location of data but rather on the place from which the data is gathered.[103] Since the outer space is a territory held in common by all states and this common territory is open to exploration and use for the peaceful purposes by all states, the space powers brushed aside the issue of prior consent and successfully prevailed upon other countries to accept that no state has the right to prohibit remote sensing systems to take images of its territory.[104] As a result of the remote sensing activities of states having such capabilities in all these years, a customary international law rule conferring a right on states to operate remote sensing satellites in space and take photographs of the territories of other states is said to have developed. Christol observes that states through the practice of remote sensing have created a sovereign right to gather information and that "(t)he principle of 'open skies' for such gathering has been accepted".[105] But new remote sensing technology and commercial dissemination of the satellite images pose new threats to national security and sovereignty of the least developed countries requiring a re-consideration of this view. As one commentator aptly notes, 'commercialization of remotely sensed data has demonstrated that nations will never be safe and they will always face a threat either from their own citizens or from other nations'.[106] These days when one can view high resolution imagery of certain places by using his home computers and easily download digital images, the use of remotely sensed data by the wrong people, especially, the terrorists can be a problem of national security.[107] The problem before states is, therefore, how to defend their national security from being jeopardized by the dissemination of remotely sensed images of their military bases and operations to their own citizens or other nations. As the matter stands now, they cannot prohibit taking of satellite imageries of their territories nor can they prevent the dissemination of remote sensing data to other states. All that they can do is to impose restrictions, including those limiting the sale of remotely sensed data, on their own companies but what the guarantees that secondary

103. B.L. Deekshatulu et al. 'Overview of the Legal Aspects of Remote Sensing', in V.S. Mani et al. (eds.), *Recent Trends in International Space Law and Policy* 221-34 (1997) at 224.

104. *Ibid.*

105. Cited in Jackson, *supra* note 11 at 455.

106. Licor, *supra* note 3 at 220.

107. *Ibid.*

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dissemination will not occur because once such data enters the commercial market there is nothing to prevent the same from falling in the hands of anti-social elements.[108] In other words, 'the commercialization of remote sensing images has made it almost impossible to control who uses what and where'.[109]

Equal access

The current international remote sensing regime is built on the edifice of two fundamental principles namely, 'open skies principle' and 'the equal access principle'. The latter principle is laid down in article XII of the 'Principles' which provides that 'as soon as the primary data and the processed data concerning the territory under its jurisdiction are produced, the sensed state shall have access to them on a non-discriminatory basis and on reasonable cost terms'. It is not open to a sensing state to discriminate against the sensed state for supply of data on account of reasons of economic, social, scientific and technological status of the latter. The right of a sensed state to access to data includes access to the primary data, the processed data and analysed information.[110]

While the principle of equal access has gained foothold in international law, more often than not technical, commercial and other considerations in satellite operations come in the way of its implementation and certain users (for instance those of least developed countries) may find difficulty in having access to data due to a variety of factors. Access to remote sensing data depends on range of earth station, existence of an agreement between distributor and operator, impact of programme satellites, cost of data archival, time taken in product generation and supply, commercial considerations of operators, cost of infrastructure, *etc.*

National security concerns and foreign policy of a remote sensing state, can also come in the way of the implementation of the 'equal access principle'. Unilateral statutory controls imposed by some of the remote sensing states on the collection and distribution of remote sensing data will prevent the sensed states from having an access to the most precious secrets of the former category of states but their natural resources, military bases, and defenses are out in the open for everyone to see. What is more worrisome is the extra-territorial operation of some of the domestic remote sensing legislation. The Land Remote Sensing Policy Act, 1997 and the 2000 Regulations Relating to the Licensing of Private Land Remotse Sensing of Space Systems are illustrative of this trend. Under the Regulations (2000), the US Government has been given power to exercise control over the operation of a

108. *Id.* at 221.

109. *Id.* at 218.

110. Principle XII, Remote Sensing Principles of 1986.

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foreign remote sensing satellite and to limit the collection or distribution of its data in the case of launching of a satellites by an American company.

Dissemination of remote sensing data

There are four predominant views on dissemination of remote sensing.[111] The first view raises the question of the legality and desirability of remote sensing conducted without the prior consent of the sensed state. The second view accepts the legality of remote sensing but seeks to limit it to situations in which the sensed state is given prior notice or has given consent to the remote sensing activities. The third view accepts the general legality and necessity of remote sensing but seeks to prohibit third parties from receiving data about the resources of the senses state. The fourth view is known as the 'open skies' doctrine and permits the dissemination of remotely sensed data to "all interested parties, including states, individuals and organizations on a non-discriminatory basis'. Proponents of this view including the US, UK and Germany give following reasons in its support.[112] *Firstly*, remote sensing satellites are not able to detect invisible political boundaries. *Secondly*, problems addressed by remote sensing satellites are of global or at least regional proportion. *Thirdly*, it is unlikely that countries obtaining LANDSAT data could 'effectively operate ground stations under a restrictive dissemination system'. *Fourthly*, 'a restrictive dissemination system would exacerbate the division between technologically advanced and less advanced countries'. The 'Open Skies' doctrine embodies the spirit of article 19 of the Universal Declaration of Human Rights, 1948.[113] Further, the U.S. Freedom of Information Act, 1988 requires the government to provide citizens access to sensed data.

The U.N. G.A. Resolution 41/65 enshrining the 'remote sensing principles' reiterates the 'open skies' doctrine but this doctrine is a qualified one as open dissemination envisaged by it is subject to principles designed to benefit the sensed states, especially sensed developing countries. Jackson after considering the conflicting views of techno-pessimists and techno-optimists convincingly argues that advantages of open dissemination outweigh its disadvantages and on the basis of her analysis makes a fervent plea for adhering to the 'open skies' policy.[114] But the only way this

111. Jackson, *supra* note 11 at 874.

112. Carl Christol, *The Modern International Law of Outer Space* 734 (1982), mentioning reasons given by a former legal advisor to the U.S. Department of State in favour of the open skies doctrine.

113. The UDHR states that every person has the freedom of opinion and expression without interference and the freedom to 'seek, receive and impart information and ideas through any media and regardless of frontiers.

114. Jackson, *supra* note 11at 876.

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doctrine according to her can truly work 'is if all participants adhere to it'.[115] 'The only practical way to ensure this', she observes 'is to create a workable remote sensing regulation system which supports and enforces the "open skies" doctrine.[116]

It is humbly submitted that several new developments like war on terror, heightened national security concerns of developing countries emanating from new remote sensing technology, commercialization, globalization and global movement for human rights protection have taken place since the endorsement of the 'open skies policy' in 1986. It is, therefore, desirable that these developments along with the disadvantages of open dissemination of the remote sensing data be given due consideration while considering the open dissemination policy. As international space law, like any other branch of public international law, is required to adapt itself according to the needs of the international community and in response to new challenges thrown up by science and technology to mankind, it cannot afford to cling to a doctrine which was promulgated when remote sensing technology was not advanced and commercialization of remote sensing had just begun.

Responsibility for remote sensing activities

It is well established that remote sensing activities could be carried out by states, international organizations and non-governmental entities. Non-governmental entities could also include privately owned ventures. The concerned state or states are under a legal duty to regulate these activities. States operating remote sensing satellites are held responsible for their activities. They have to ensure that such activities are conducted in accordance with the principles on remote sensing and the norms of international law.[117] International responsibility for remote sensing activities and the obligation to ensure their conformity with the above mentioned principle are regardless of whether such activities are carried out by government or non-governmental organizations or through international organizations to which such states are parties.[118] In case of harm or damage resulting from remote sensing from space the rights of compensation to the affected parties are governed by article VI of the Outer Space Treaty and by the 1972 Liability Convention for Damage. This principle is also elaborated in the 'Remote Sensing Principles' of 1986.

Military use of remote sensing data

As already noted, at its beginnings remote sensing was primarily used as reconnaissance satellite for the military. Currently remote sensing imagery is being

115. *Ibid.*
116. *Ibid.*
117. *Supra* note 110.
118. *Ibid.*

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used for civil and military purposes and all imageries are for grabs regardless of who collects them. The million dollar question is whether the military use of remote sensing satellite is legal. Any attempt to answer this question would depend on the compatibility of this activity with the requirements of international law, including the UN Charter and the Outer Space Treaty. In particular, answer to this question depends on the meaning of the expression 'peaceful purposes' which appears in article IV of the Outer Space Treaty. As is well known, the scope of this provision is unclear and scholars are divided in their views in respect of its delineation. For the purpose of the present discussion, this provision calls for consideration of two different issues: to, what areas of outer space the 'peaceful purposes' requirement should apply and what is meant by 'peaceful purposes'.[119] According to one school of thought the provisions allows states to use certain areas of space for military purposes. In sharp contrast, the second theory holds that all outer space should be used for peaceful purposes. Regarding the meaning of 'peaceful purpose' the United States and some of the western countries have consistently held that these terms mean 'non-aggressive' rather than non-military purposes. This view has been refuted by the third world countries who hold the view that the term 'peaceful' is a synonym of 'non-military' and hence all uses of the satellites for military purposes is non-peaceful and therefore in violation of the Outer Space Treaty.[120] India has also held this view from the very beginning. But at a time when India a major space power and also a player in the commercial market of space services and space products is facing serious security threats from different quarters including terrorist organizations operating within its territory and form abroad, it has perhaps become imperative for it to reconsider its position on the military use of remote sensing activities.

Intellectual property rights and remote sensing data

The increasing privatization and commercialization of space related activities has added new urgency to develop an effective international framework for addressing space related intellectual property issues. Intellectual property rights cover a wide array of private property rights that exist over intangible intellectual creations and intellectual property and include *inter alia*, rights relating to literary, artistic and scientific works and inventions in all fields of human endeavor. Remote sensing raises complex issues relating to copyright protection in the remote sensing data and patent in remote sensing technology.

So far as protection of research and development in remote sensing satellites and other related equipments is concerned, the Paris Convention for the Protection of Industrial Property may be of some relevance. But as the International Bureau

119. Licor, *supra* note 3 at 213.

120. *Id.* at 214.

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of WIPO in an issue paper published in 2004 has pointed out, application of the convention provisions to space related activities including remote sensing would give rise to a number of problems. The first problem is related to interpretation of article 5 *tes* of the Paris Convention which provides that there is no infringement of the rights of a patentee in the case of the use on board vessels and the use of devices forming the subject of the patent in the construction or operation of aircraft or land vehicles of other countries of the Paris Union, or of accessories of such aircraft or land vehicles, when those aircraft or land vehicles temporarily or accidentally enter the said country. The next pertinent question requiring consideration is whether WIPO should specify that the laws applicable to inventions in the territory of a state will apply to spacecraft registered in that state. Again, whether there should be standardization of contractual clauses on the protection of inventions and confidential information created or used in international cooperation agreements between space faring nations. Further, the applicability of national/regional intellectual property laws in outer space and enforcement of intellectual property rights therein is hotly contested and debatable.

But neither the main body of current international space law contains any rules expressly dealing with intellectual property rights nor does the TRIPs Agreement seem to have been drafted with the outer space and its applications in mind.[121]

This fact also becomes clear when one considers copyright related issues in the context of remote sensing which impact this activity in two ways, namely: They may put a sensed developing state at disadvantage while negotiating an agreement or arrangement with the sensing developed state for having access to data relating to its own natural resources or physical and other features despite several safeguards provisions in the 'Remote Sensing Principles' discussed earlier; and the unauthorized use of such data by others in violation of the copyright claims of the sensing states in information resulting from the processing of the primary raw data, its subsequent analysis and interpretation. Issues related to these matters are intertwined and their answer depends on the nature of information and process of its creation, and fulfillment of the criteria of copyrightability *viz*., labour, skill and judgment. It is important to note that article 10(2) of TRIPs Agreement which also covers 'data base' provides as follows: 'Compilation of data or other material, whether in machine readable or other form, which by reason of the selection or arrangement of their

121. On space related intellectual property rights issue, See generally G.J. Mossirighoff, "Intellectual Property Rights in Space Ventures" 10 *Journal of Space Law* 107-38 (1982); Luxembeig and Mossinghoff, Intellectual Property Rights and Space Activities, 13*Journal of Space Law* 8-21 (1985); S.G. Sreejith, "The Patent Law for Outer Space related Intellectual Property Right Issues: An Odyssey into TRIP's" 45 *IJIL* 180 (2005); A.M. Balson, "Space Technology and International Cooperation: The Role of Intellectual Property" in Francis Lyall and Paul B. Larsen, *Space Law* 503.

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contents constitute intellectual creation shall be protected as such. Such protection, which shall be without prejudice to any copyrights subsisting in the data or material itself. Needless to say, this provision has been enacted in the context of computer programs and it is doubtful whether it extends to remote sensing data as well. Even when it is assumed for the sake of argument that this provision also extends to such data, the next question that will confront us is whether remote sensing data could be considered as an intellectual creation on account of the selection or arrangement. Arguably, the primary data *i.e.* the raw materials or unenhanced data do not satisfy this criterion as they are mainly magnetic waves transformed into numeric signals by satellites and hence do not constitute an intellectual creation. By contrast, processed data and analysed information may probably satisfy this criteria. Manufacturers of spacecrafts and satellites of diverse variety including remote sensing satellites may claim protection of trade services marks in their products by virtue of article 15(1) of the TRIPs Agreement. According to this provision the nature of the goods or services to which a trade mark is to be applied shall in no case form an obstacle to registration of trade marks. But TRIPs provisions relating to an effective check on the infringement of trade marks in their application may pose problems as they are applicable only to visibly infringing goods. It is therefore submitted that intellectual property rights issues relating to remote sensing calls for elaborate regulation.

V Concluding remarks

The pace of technological change exceeds society's ability to assimilate and manage it. When somehow society manages to catch up, new technological breakthroughs create need for it to respond, causing a never ending circle of replication. The study of the dynamics of interaction between space technology and public international law in the specific context of remote sensing in this paper supports this broad proposition. But as achieving a healthy balance between space technology and international law is necessary for harnessing the limitless potential of space technology for the benefit of all mankind and containing the misuse of the technology for destructive purposes, the United Nations, particularly COPUOS and General Assembly should move ahead to negotiate new treaties to bridge the current gap between the two and promote the codification and progressive development of international law. Remote sensing technology has developed so quickly that it has outpaced current international legal systems thereby raising a wide array of troubling issues regarding its use. In order to address these issues a treaty on remote sensing should be negotiated and concluded under the auspices of the United Nations. The proposed treaty should provide a legal framework for regulation of the international market of remote sensing. The treaty should be so designed as to ensure the ready and non-discriminatory access to satellite imagery

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in all forms of civil, commercial and peace-keeping purposes and prohibit the use of force against all remote sensing satellites that are operating in accordance with international law. It is also imperative that the treaty addresses the operations of reconnaissance satellites, specify the rights and obligations of sensing and sensed states and provide solutions to intellectual property rights issues that may arise in sharing of benefits of remote sensing.

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