SPACE LAW WITH SPECIAL REFERENCE TO SPACE DEBRIS

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'A hundred times every day I remind myself that my inner and outer life depend on the labors of other men, living and dead, and that I must exert myself in order to give in the same measure as I have received and am still receiving'.

—Albert Einstein

Space law is an area of the law that encompasses national and international law governing activities in outer space. International lawyers have been unable to agree on a uniform definition of the term "outer space". It has also well accepted that outer space generally begins at the lowest altitude above sea level at which objects can orbit the Earth, approximately 100 km (62 miles).It is to be noted that space law began with the launch of the world's first artificial satellite by the Soviet Union in October 1957. The Spacecraft named- Sputnik, (the satellite) was launched as part of the International Geophysical Year. Since then, space law has evolved and assumed more importance as humankind has increasingly using the space from place spotting to weather forecast.

Since 1957, bilateral and multilateral talks started taking place. The International Law Association(ILA) set up Space Law Committee 50 years ago during the Fifty-eighth Conference of the Association (New York, 1958). In 1959 the UN also created a Committee on the Peaceful Uses of Outer Space (COPUOS). The ILA Space Law Committee is a permanent observer to COPUOS. The COPUOS, in turn, created two sub- committees-the Scientific and Technical Subcommittee and the Legal Subcommittee. Since then, the COPUOS 'Legal Subcommittee' has been a primary and first forum for discussion and negotiation of international agreements relating to outer space.

In the 1963, Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space, and Under Water ("Partial Test Ban Treaty") banned the testing of nuclear weapons in outer space.

Under the auspices of COPUOS, following Five international treaties were negotiated and drafted—

1. The 1967 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies (Outer Space Treaty). *Article 1 of the Outer Space Treaty declares the principle of 'freedom scientific investigation in outer space', and*

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encourages States to 'facilitate and encourage international cooperation in such investigation'.

2. The 1968 Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space (Rescue *Agreement*).
3. The 1972 Convention on International Liability for Damage Caused by Space Objects (*Liability Convention*).
4. The 1975 Convention on Registration of Objects Launched Into Outer Space (Registration Convention).
5. The 1979 Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (Moon Treaty). As a sequel to that, Member States of the European Space Agency, Japan, Russian Federation and the United States of America entered into an agreement in 1998 concerning cooperation on the *Civil International Space Station* (the Space Station Agreement).
6. The UN Committee on the Peaceful Uses of Outer Space developed these recommendations into a set of guidelines which were adopted by the UN in 2008.
7. Recommendations by *the Inter-Agency Space Debris Co-ordination Committee (IADC)* for 'Space Debris Mitigation Guidelines', 2002
8. The adoption by the UN General Assembly, on 21 December 2007, the '*United Nations Guidelines on Space Debris Mitigation*' (UNGA Res. 62/217).

Above treaties have been entered as many countries have started using space by sending their satellites for various purposes. Some of them have stopped working as they completed their lifetime or have become useless since they achieved their purpose or become defunct because of some technical snag or malfunctioning.

What is Space Debris?

In the light of the above treaties, several space crafts/satellites weather testing instruments, orbit-stations and space missiles were sent to space. Almost all are in the space and their presence in the space has caused a great concern as some of become defunct or their life span has completed. Some of them have also disintegrated in the space. Therefore, much junk/debris (also called 'artificial space debris') has collected in the space. This space junk, also known as space pollution, is assuming threatening dimensions. For example, On 11 January 2007, a Chinese ground-based missile was used to destroy the *Fengyun*-1C spacecraft, an aging satellite orbiting more than 500 miles in space since May 1999. Although the test was hugely successful, it caused great concerns to both the military and scientific communities.

Article 1 (c) of the *Buenos Aires International Instrument on the Protection of the Environment from Damage Caused by Space Debris*, 1994 has defined the term Space debris as—

- '*man-made objects in outer space, other than active or otherwise useful satellites, when no change can reasonably be expected in these conditions in the foreseeable future*.
- *Space debris may result, inter alia, from*:
- *Routine space operations including spent stages of rockets and space vehicles, and hardware released during normal maneuvers*.
- *Orbital explosions and satellite breakups, whether intentional or accidental*.
- *Collision-generated debris*.
- *Particles and other forms of pollution ejected, for example, by solid rocket exhaust*.
- *Abandoned satellites*.'

Space debris or 'artificial space debris' is the unusable, unserviceable space-crafts or parts of space crafts i.e. objects in Earth orbit that do not serve a functional purpose. Space debris generally refers to man-made material in orbit that no longer serves a useful purpose. Accor ding to some estimates, 95% of all man-made objects currently in outer space can be classified as 'space debris'.[1] These objects range from sub-millimeters to meters in diameter, are difficult to detect and can have impact velocity on collision of up to 15 km/s.[2] Their speed can play havoc at such speeds; studies show that an impacting particle of 1 g mass compares by approximation with the explosive energy of 10 g of dynamite.[3]

Various types of debris[4] identified are as follows:

(a) Defunct spacecraft, such as satellites that have ended their useful life. Commercial satellites have an average lifespan of only around 15 years, due to the harsh radiation environment in space;

(b) Spent rocket bodies used to launch satellites into orbit;

(c) objects released during missions, such as waste vented from the Space Shuttle;

(d) Small fragments caused by collisions, explosions or deterioration of active satellites or larger pieces of debris.

Recently in February 10, 2009, the first collision between two satellites (an active US communications satellite, the other a defunct Russian satellite) occurred 800km (in Lower Earth Orbit) above Northern Siberia. They collided at a speed of over 40,000km/h, causing complete break-up of both satellites. The collision created around 1400 catalogued debris objects.

Disastrous Consequences

This threatening dimension of the problem has been described as follows- 'In shattering the old weather-watching satellite into hundreds of large fragments, the Chinese created a large—debris cloud. The debris is now spreading all around the earth, the majority of them residing in very long-lived orbits. The debris cloud extends from less than 125 miles (200 kilometers) to more than 2,292 miles (3,850 kilometers), encompassing all of low Earth orbit.' As of 27 February 2007, the U.S. military's Space Surveillance Network had tracked and cataloged 900 debris fragments greater than 5 centimeters in size, large enough to create potentially serious collision problems. The total count of objects could go even higher based upon the mass of Fengyun-1C and the conditions of the breakup, which could have created millions of smaller pieces. The Chinese test has demonstrated that the actual system.'[5] Therefore, Space debrishas become a source of increasing concern. The scientific and engineering communities have studied the problem of space debris for decades; large space debris has been tracked and catalogued. Looking to the shocking results, they have warned of the dangers. The increased pace of small debris has also been identified and studied to know their likely fallouts.[6]

Maureen Williams has also identified it as major threat to mission space in following words—'Space debris is an increasing threat to security in outer space. In addition to active satellites—as well as abandoned or inactive satellites—orbiting the Earth, small particles originating from collisions between these objects, known as *"second generation debris"* imply an extremely serious risk of collision with active satellites, sometimes with untold consequences. These small particles because of their size cannot be detected from Earth at the present state of the art. They travel at very high speeds (roughly 8km per second) and there are currently tens of thousands of those pieces in outer space'.[7]

The China's catastrophic destruction of a defunct weather satellite has created an orbiting blizzard of long-lived shards. This breached international guidelines covering the mitigation of space debris, which are defined by the *Inter-Agency Space Debris Coordination Committee* (IADC). The China's motivation for exploding the satellite was unclear, but this act has demonstrated that Chinese delegates had has developed the technique to intercept such object. Since IADC guidelines were ignored, there is urgency that these guidelines be incorporated in domestic law.

According to one estimate 'if space operators simply continue to operate as they do currently, the growth in debris will be such that spaceflight in near-Earth orbit will be paralyzed within 100 years'.[8] The risk of collision and destruction of satellites launched would be unthinkable. Even immediate complete cessation of space activities will not help to reduce the amount of debris currently in orbit. There would be self-sustaining chain which in turn will produce more debris. The object launched are permanently in the orbit unless the fall on the ground,

which will cause loss to man and material on the earth. Thus, it has become very difficult to remove debris and clean the orbit.

Looking to widespread ramifications of the space debris, it has become a matter of grave concern.[9] *Reasons of this concern* are:

a. The proliferation of objects in the sky can adversely affect ground-based astronomical observations, which depend on extremely high sensitivity and resolution.

b. Such debris also great threat space-based observatories, since the consequences of the impact of even a small particle of space debris could be catastrophic for such satellites.

c. They are also threat to the space crafts in the space as in 1996 the French CERISE spacecraft was struck and partially disabled by the impact of a fragment of an exploded Ariane upper stage.

d. Presence of such debris results in over-crowding in the space. This will be major problem in times to come.

e. Any accident also results into chain reaction including environmental pollution.

f. There is no mechanism to clean the space debris present in low-Earth orbit at present.

g. Falling of such debris on earth also causes loss to man and material.

h. We have to take care of the legal issues that would be involved in destroying or removing space debris owned by another State.

i. Fixing the liability in such cases invokes many other aspects of the problem.

During last decade, various efforts have been made to contain and control this problem. Major space agencies have been developing a set of *orbital debris mitigation guidelines* aimed at stemming the creation of new space debris and lessening the impact of existing debris on satellites and human spaceflight. A draft of these guidelines was unanimously approved by the United Nations in 2008. Several States are either in the process of implementing or have already implemented these voluntary measures. One of the options is the establishment of an international regime for dealing with orbital debris, similar to the Missile Technology Control Regime, or perhaps the *Limited Test Ban Treaty* of 1963.For example, the *NASA Procedures and Guidelines of 2007* and the *U.S. National Space Policy* of 200 have come out with some guidelines to tackle debris problem. Recently about 3,000 experts from around the globe met at the 61st *International Astronautical Congress (IAC)* to discuss all facet of 21st century space activity.[10] This problem also involves issues *like jurisdiction and control over space debris, international responsibility for space debris, their identification and, finally, liability for damage caused by space debris. Environmental pollution is also connected with it*.

Legal frame work

The State liability and State responsibility has always been recognised from the very inception of the space mission started. When the Cosmos 1954, an erstwhile Soviet Union satellite, fell in Canada in January 27, 1978, the than Soviet Union was asked to pay compensation only. Many scholars have voiced their concern and come out with various theories of state liability. As Rode Verschoor recommended for setting up the international warranty fund[11] and Haley suggested for mandatory insurance of such loss. The Tokyo Conference of the International Law Association (1964) declared that if space activity is conducted by a private entity on the territory of a state, that private party should be held responsible for the loss.

A study of the present day international Agreements/Conventions or Resolutions passed by the U.N. General Assembly would reveal that there is no comprehensive legal frame work available at present. Articles VI–IX of the *Outer Space Treaty of 1967* provides for the liability and registration. The Convention establishes a regime of consultation, registration, international responsibility and liability for damage caused by objects (which includes component parts of such objects) launched into space. The liability is based on 'fault theory'. That would mean that if space debris hit another space object, the launching state producing the debris would be responsible unless it was a distinct change of trajectory of the other space object which made it crash into the space debris. It is also impossible to trace the origin of the debris or the part which causes damage to other objects or other space craft or physical damage to sensitive instruments. Moreover, the complaining state has to show some negligence on the part of the debris-producing State as per requirement of the fault theory. The requirement of the foresee ability and reasonableness will also be looked into.

Article 14 (1)of the *Agreement Governing the Activities of the States on the Moon and other General Bodies*, 1979 also held that the States to the treaty must bear the international responsibility for all space activities carried on their land –whether 'carried on by the governmental agencies or non-governmental entities'. The above motioned Outer Space Treaty deals with the activities in the space, but this treaty encompassed the space launching activity on land also. Accordingly, all private space activities[12] carried on by private entity requires prior authorization by the State and continuing supervision of the concerned/appropriate state. In both the circumstances, liability is strict. Thus, it has introduced the doctrine of 'vicarious liability' of the originating state for the loss caused by the space activities. But the treaty is silent about the personal liability of the non-governmental actors. It require that domestic laws must take care of such liability as the U.K. has tried to regulate private space activities by Passing the *Outer Space Act*, 1986.

The International Law Association (ILA) adopted in 1994 a *Draft Instrument for the Protection of Damage Caused by Space Debris*. This Draft Instrument and explicitly makes states internationally and 'strictly liable' for damage caused by

'space debris' originating from objects launched by them into space. A duty has imposed on the States to cooperate to implement the Draft Instrument and the reduction and control of 'space debris.' An obligation has also been imposed to negotiate 'in good faith' with other states to whom the proposed or foreseen production of space debris is of concern. The dispute resolution mechanism has also been provided by the instrument. But the loop side of the Draft resolution is its non-binding nature. The *STSC (the Scientific and Technical Subcommittee)*—a sub-committee of *the United Nations Committee for the Peaceful Uses of Outer Space (COPUOS)*, has taken a positive step in this direction with the recent decision to produce a high-level space debris mitigation document, with completion scheduled in 2007. In 1999, it gave its provided an understanding of the debris environment, assessed risks and analysed debris mitigation measures being undertaken by various operators. The *Inter-Agency Space Debris Coordination Committee (IADC)*, an international forum of national and regional space agencies, developed a 'Mitigation Guidelines to reduce space debris emissions', in the year 2003. The IADC Mitigation Guidelines include two main aspects (a) orbital explosions of satellites (both during and post-mission) should be avoided through venting of residual fuel, discharging of batteries and depletion of flywheels and momentum wheels,(b) satellites in near-Earth orbit should be de-orbited after their functional lifetimes, preferably crashed directly into an ocean. Caution must be taken that the debris does not reach to earth as to avoid damage to people. In 2005, the STSC resolved to create a concise space debris mitigation document based on the IADC report, providing high-level qualitative guidance to states.[13] This development is disheartening as these Reports are only recommendatory in nature.

Report of the Scientific and Technical Subcommittee on its forty-fourth session, held in Vienna from 12 to 23 February 2007 suggested two type of measures to deal with space problem—(a) to curtail the generation of potentially harmful space debris in the short term, which includes curtailment of the production of mission-related space debris and the avoidance of break-ups, (b) to limit their generation of space debris in long term which includes end-of-life procedures that remove decommissioned spacecraft and launch vehicle orbital stages from regions populated by operational spacecraft.

The seven guidelines have been adopted by the U.N. Scientific and Technical Subcommittee of COPUOS (*Committee on the Peaceful Uses of Outer Space*) for the launch, mission and disposal phases of spacecraft and launch vehicle orbital stages were as follows:

- *limit debris released during normal operations;*
- *minimize the potential for break-ups during operational phases;*
- *limit the probability of accidental collision in orbit;*
- *avoid intentional destruction and other harmful activities;*
- *minimize potential for post-mission break-ups resulting from stored energy;*

- *limit the long-term presence of spacecraft and launch vehicle orbital stages in the low Earth orbit region after the end of their mission; and*
- *limit the long-term interference of spacecraft and launch vehicle orbital stages with the geosynchronous Earth orbit region after the end of their mission.*

Above mentioned guideline have become the guidelines reached the status of UN Guidelines on Space Debris Mitigation in 2007.

Liability

As the cost of damage or destruction of a satellite by space debris could run to many millions of pounds the *UN Liability Convention of 1972* provides that liability for incidents in space falls on the state responsible for the launch of the offending object. There are several complicated problems in applying this Convention. There are various types of debris which have not been addressed by it, e.g. if a collision is caused by an object too small to track, it may be impossible to identify the launching state; a claimant must prove that the launching state was negligent. It is difficult to identify a particular negligent act that created a debris object; a state must prove causation. When two objects collide in space, both states involved could claim the other caused the collision. Till this date, no case has been pursued under this Convention. *The Outer Space (UK) Act, 1986* requires UK based companies to indemnify the government prior to launch, without limitation, against all liability.

India and Space debris

Indian scientists were aware of this problem from the time they started working on space mission. The *Indian Space Research Organization* (ISRO) has realized the importance of the current space debris scenario and its impact on the effective utilization of space technology for the improvement in the quality of life on the Earth. ISRO has worked on various aspects of space debris including mitigation measures. It has been observed and realized that most of space debris has originated from 'On-orbit explosions of spacecraft and upper stages'. These breakups are caused by a wide variety of causes: battery failure, over-pressurization and/or ignition of fuels, accidental collisions, deliberate detonation, etc. It has adopted the method of '*vehicle passivation*', i.e. removal of all forms of stored energy, which would eliminate most such events. Other effective measures include the expulsion of residual propellants by burning or venting, the discharge of batteries, the release of pressurized fluids, safing of unused destruct devices, etc'. This mechanism has been adopted in India's launch vehicles. PSLV and GSLV, and the satellites IRS, INSAT and GSAT were designed in such a way that no 'operational debris' is created in the launch and deployment phases of the mission. Moreover, ISRO's communication satellites in GSO are designed with margins for re-orbiting to a higher orbit at the end of their useful life. Various mechanisms have been developed by Indian scientists.[14] It is to be noted that India is a member of the *UN Committee on the Peaceful Uses of*

Outer Space (UNCOPUOS); and through ISRO's membership in the *Inter-Agency Space Debris Coordination Committee (IADC)*,[15] India is contributing significantly to the international efforts to solve and mitigation of space debris problem.

In cases of space debris accidents liability may be on land or in space, we have to invoke the principle of 'absolute liability' in place of the principle of 'strict liability'. The Supreme Court[16] has declared that in modern scientific era with hazardous and dangerous activities, under law of tort the principle of absolute liability is the only answer for the loss arising of space accident or from space debris on earth.

This development and efforts by various international bodies shows the various efforts have been made in this direction to bring out universally accepted instrument to contain and control the problem of space debris including responsibility and liability of the state government for non-governmental entities. But looking to the newer developments in the era of globalization and commercialization much has to be done.

In the light of above discussion, it is suggested that there must be some international binding instrument which must include (a) international responsibility, cooperation, liability provisions, (b) a technical 'code of conduct' along the lines of the Mitigation Guidelines, (c) these guidelines should be incorporated into national licensing regimes for space activities, (d) technical rules (binding mitigation measures), (e) the scientific and economic imperatives must also be taken into account. There is also an urgent need to pass a comprehensive law to govern the space activities-including the activities by non-governmental entities in India, encompassing the international principles of liability and responsibility. Looking to the 'future wellbeing of humanity' and sudden rise in private commercial space activities, there is an urgent need that all-inclusive legal frame work must be evolved as early as possible.

Endnotes

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