INDIAN JOURNAL OF LEGAL REVIEW

(P) Volume I and Issue I of 2023

ISBN - 978-81-961097-8-3

Published by

Institute of Legal Education

https://iledu.in

THE MOUNTING PROBLEM OF SPACE DEBRIS

Author - AYUSH B. GURAV, STUDENT AT ILS LAW COLLEGE, PUNE

Best Citation - AYUSH B. GURAV, THE MOUNTING PROBLEM OF SPACE DEBRIS, Indian Journal of Legal Review (IJLR), 1 (1) of 2023, Pg. 07-12, ISBN - 978-81-961097-8-3.

Abstract

The gateway of space has opened up a new frontier for the progress of mankind. The journey of space expedition has ushered transcendental development in space science. But with increasing space activities an unprecedented risk has emerged, the risk of space debris. The increased activities and the launch of space objects by the space-faring nations gave rise to certain regulations in the form of treaties and conventions with potential relevance to space debris. However, there is a terrifying large gap when it comes to dispute resolution, liability protocol and compensation mechanisms.

India, as a space-faring nation aim for social benefits with long-term sustainability of outer space activity as a key guiding principle. Its standpoint on space debris, "common but differentiated responsibility" to maintain space environment has been supported by many developing countries.

The subject matter of International Space Law particularly on the issue of Space debris is still in its nascent stage. However, a humble attempt is made in this Article to analyze the mounting problem of Space debris with respect to International as well as Domestic viewpoint.

Keywords

Space Debris, Orbital Debris, UNCOPUOS, ISRO, Space Junk, IADC, Sustainable space environment.

Introduction

The Space age began with the launch of Sputnik by former USSR on 4th Oct, 1957. Soon it was followed up by a launch of satellite by USA in January 1958. Since then, many more launches took place from France, Japan, China, India and Israel demonstrating their independent access to Space with their own orbiting satellites. Space applications have today reached a significant level to impact day-to-day life of people.[9] Such a tremendous growth of Space field in a short span has its own unavoidable side effects. Most significant of these is the growth of Space Debris.[10]

The near-Earth environment is muddled with man-made orbital debris in addition to the naturally occurring micro meteoroids.[11] These artificial (man-made) and natural (meteoroid) particles continue to pose a constant threat to the numerous satellites and space shuttles. As pointed out by Taylor,[12] "everything orbiting around Earth poses some level of risk to every other object in orbit," he also states that particles that occur naturally in space and functioning satellites capable of maneuvering should be excluded from the definition of orbital debris. It is crucial to understand that there is no universally accepted definition of debris in the context of space environment. However, the following definition, resulted by combing various criteria has gained some acceptance in the International Community:

"any man-made earth-orbiting object which is non-functional with no reasonable expectation

[9] As, Spacecrafts today carry out functions like Manned missions, communications, remote sensing, science exploration, and navigation.
[10] Debris can be defined as the remains of something broken down, destroyed, or discarded. *Merriam-Webster Online Dictionary, s.v.* "debris," online: http://www.merriam-webster.com/dictionary/debris.
[11] NASA (.gov), What is Orbital Debris? https://www.nasa.gov.
[12] Michael W. Taylor, Orbital Debris: Technical and Legal Issues and Solutions, Institute of Air and Space Law, Montreal, 2006.

INDIAN JOURNAL OF LEGAL REVIEW

(P) Volume I and Issue I of 2023

ISBN - 978-81-961097-8-3

Published by

Institute of Legal Education

https://iledu.in

of assuming or resuming its intended function or any other function for which it is or can be expected to be authorized."[13]

I. Categories of Orbital Debris

Orbital debris can be broadly categorized into four types as follows:[14]

A. Inactive Payloads or Inoperative Objects-

Satellites or related objects which have malfunctioned and are no longer able to maneuver or satellites which have run out of fuel for station-keeping operations, primarily come under this category.

B. Operational Debris-

During normal operations any intact object or component part that was launched or released into space would fall under Operational debris. Number of things could fall into this category such as rocket nose cones, bolts, straps, payload separation hardware, fuel tanks or any other unusual operational objects.[15] Amongst which intact rocket bodies that remain in orbit after a satellite launch is the largest single category.

C. Fragmentation Debris-

Fragmentation debris is the largest category of trackable debris. It is created when a space object breaks apart.[16] This type of debris could be created through collisions[17], deterioration, explosions, or any other means.[18] Explosions being responsible for most of this type of debris accounting for 30 percent of all the cataloged debris.[19] Some explosions are caused intentionally. For instance, the USSR intentionally destroyed several reconnaissance satellites to prevent their recovery by other States.[20] Further, USA tested an air launched anti-satellite weapon in 1985 and in 1986, intentionally caused two US satellites to collide that produced more than 230 pieces of detectable debris.[21]

D. Micro-particulate Matter-

Surfaces of spacecraft are exposed to space environment which can lead to degradation in the optical, thermal and structural integrity of surfaces and coatings with subsequent shedding of materials into the space environment. Indeed, besides degradation, collisions and explosion can also create microparticle debris.

II. International Space Law and Dispute Settlement Mechanism

A need for space regulation was imminent, as the activities in space increased by the space-faring nations. Also, the issue of dispute resolution and compensation mechanisms, along with the liability protocols in case of space debris needed to be addressed.

A. International Space Law-

Amongst different international treaties and conventions, the Outer Space Treaty and the Liability Convention are prominent with their relevance to international space law and to a certain extent to the issue of space debris. Also, in 2007, an important text has been adopted within the United Nations Committee on the Peaceful Uses of Outer Space, (UN-COPUOS) proposing a cooperative approach to solving emerging problems related to space debris.

1. Outer Space Treaty, 1967

The Outer Space Treaty is the first key treaty for foundation of space rules. The treaty contains a measure to not place any weapons of mass destruction, (nuclear or otherwise) in orbit around the Earth or install it on the Moon or any other celestial body or on any station in outer space. It provides for the basic framework on

[13] David Tan, "Towards a New Regime for the Protection of Outer Space as the Province of All Mankind" (2005) 25 Yale J. (citing definition proposed by the International Academy of Astronautics).
[14] Howard Baker, "Space Debris: Legal and Policy Implications."
[15] Examples of unusual operational objects include sewage from the space shuttle, a camera, an astronaut's suit or glove and bags of trash tossed out of manned spacecraft.
[16] Initially forming a loose cloud of particles (debris), overtime these particles gets affected in their own way by gravity and atmosphere drag.
[17] Debris from this type may result from collisions between space object and either natural or artificial orbital debris.
[18] M.A. Smirnov & E.D. Kuznetsov, "Dynamical Evolution of a Cloud of Fragments After a Destruction Event in GEO" in Dansey.
[19] ESA – About space debris, European Space Agency, https://www.esa.int.
[20] Howard Baker, "Space Debris: Legal and Policy Implications."
[21] Nicholas L. Johnson & Darren S. McKnight, "Artificial Space Debris", Malabar, FL: Orbit Book Company, 1987.

INDIAN JOURNAL OF LEGAL REVIEW

(P) Volume I and Issue I of 2023

ISBN - 978-81-961097-8-3

Published by

Institute of Legal Education

https://iledu.in

international space law including the following principles[22]:

> **Article VI**: *State Parties to the Treaty shall bear international responsibility for national activities in outer space.*
>
> **Article VII**: *Each State Party to the Treaty that launches or procures the launching of an object into outer space & each State Party from whose territory or facility an object is launched, is internationally liable for damage to another State Party to the treaty or its natural/juridical persons by such object or its component parts, in air space and outer space.*

Thus, the Outer Space Treaty is significant because it makes a State internationally responsible for the activities of its non-governmental entities occurring in outer space. Also, under Article VII it makes multiple States jointly liable since multiple States may be involved with launch of satellite and creating Space debris.

2. Liability Convention, 1972

The 1972 Convention on International Liability for Damage Caused by Space Objects,[23] also known as the "Liability Convention." It sets forth the rules for personal injury and property damage and for resolution of those issues at the international level. The Liability Convention also clarifies and amplifies the liability regime established by Article VII of the Outer Space Treaty. For instance, Article I and II of the agreement, provide that a country which launches or procures the launching of space objects, or from whose territory a space object is launched, is liable for damage caused on the surface of the Earth or to an aircraft in flight by such space object. However, the notion of liability is not clearly established, with respect to damage caused elsewhere than on the surface of the Earth.

Although, the Liability Convention and the Outer Space Treaty make a State liable for damage caused by any "object or its component parts" which are launched into space.[24] It is important to note, as most scholars concluded, object should not mean solely the "satellite" or the "payload," but also every piece of debris and non-functional payload should fall under the category of "space object" within the meaning of these treaties.[25]

3. UN-COPUOS, 2007 - (the debates and the result)

The issue of mitigation was raised in the Science and Technical (S&T) Sub-committee by some of the developed countries. The sum and substance of the proposals were to create the Space debris mitigation "Standards", which should be legally binding and enforceable, and verifiable at international level.

Indian delegation quickly caught up with the issue of Space debris, by thorough study of the proposal with respect to India's and other developing countries space activities. The approach taken by the Indian delegation in its policy and later in negotiation is as follows:

i. The mitigation measures should be "Guidelines" instead of Standards.
ii. They should not be legally binding under International Law.
iii. They should be implemented on "Voluntary basis" rather than enforcing.
iv. The information to the UN on the debris mitigation activities by member-states will have to be on voluntary basis.

The rational for this approach by India was that Space debris situation at present was largely

[22] UNOOSA, "United Nations Office for Outer Space Affairs", https://www.unoosa.org.
[23] General Assembly resolution 2777 (XXVI) of September 1, 1972; it was negotiated by the Legal Sub-Committee from 1963 to 1972; the convention entered into force in September 1972.
[24] Liability Convention (Art. I-III); Outer Space Treaty (Art. VII).
[25] "Management Issues Concerning Space Debris" in Dansey, A more comprehensive definition of "space object" that would undoubtedly have encompassed the orbital debris was considered during the discussion leading up to the Liability Convention, but wasn't adopted. The proposed definition would've included launch vehicles and all component parts on board detached from or torn from the space object.

INDIAN JOURNAL OF LEGAL REVIEW
(P) Volume I and Issue I of 2023
ISBN - 978-81-961097-8-3
Published by
Institute of Legal Education
https://iledu.in

created and caused by a few developed countries through a large number of launches since beginning of Space age. The developed countries had suggested that number of Space launches should be limited by the new players and to set quotas for the same. This was countered by India as this puts the developing countries and new entrants in a disadvantageous position, compared to developed countries, with respect to Space field.

The Indian delegates countered by stating that Space debris issue should be handled through "common but differentiated responsibility" to maintain space environment. Thus, countries which are responsible for the present level of debris population, should take higher responsibility in respect of limiting the growth of Space debris in future and also in providing knowledge and technology in the areas of Space debris monitoring and mitigation to all space-faring countries.[26]

The Working Group on space debris had a series of meetings and negotiations to finalize the document. The result was UN-COPUOS that is a document titled "Space debris mitigation guidelines of the Scientific and Technical Sub-Committee on Peaceful Uses of Outer Space.[27]

B. Dispute Settlement Mechanism-

1. Presently, the dispute resolution mechanism is informal. Article III of the Outer Space Treaty says that parties to the treaty shall carry on activities "in accordance with international law, including the Charter of the United Nations."
2. Article 33 of the UN Charter says that parties shall first "seek a solution by negotiation, enquiry, mediation, conciliation, arbitration, judicial settlement or other peaceful means of their own choice."
3. If such means fail to achieve a resolution of the issue, Article 36(3) indicates that "legal disputes as a general rule is referred by the parties to the International Court of Justice."
4. In case of dispute following procedure would apply: claims may be asserted on behalf of corporations or individuals by their government. Claims must be presented through diplomatic channels within one year from the date on which cause of action firstly arose. The concerned parties must establish a Claims Commission chosen jointly by both the parties, if the parties do not reach a settlement within one year from the date on which a claim is received by the launching State.
5. If the dispute cannot be solved by negotiation or other peaceful means and endangers the maintenance of international peace and security, then Article 37 requires the parties to refer the matter to the Security Council.

III. The Space debris Mitigation Guidelines

UN General Assembly endorsed through a resolution[28] the Space Debris Mitigation Guidelines of the Committee on Peaceful Uses of Outer Space (UN-COPUOS) in December 2007. The Guidelines were developed with IADC[29] Space debris Mitigation Guidelines as the basis. The fundamental basis of the document is:

- Space debris mitigation measures included in the document are "Guidelines".
- Applicable to mission planning and operation of newly designed Spacecraft and orbital stages and if possible, to the existing ones.
- They are to be implemented by member-states on voluntary basis through their national mechanisms.
- The Guidelines are not legally binding under the international law.

[26] Common but differentiated responsibility – A principle to maintain Space environment with respect to Space debris" M Y S Prasad, Rajeev Lochen, ISRO, Technical paper in IAC 2007, Section E6.3.
[27] "Space debris Mitigation Guidelines of the Committee on the Peaceful uses of Outer space" A/AC.105/C.1/L.291/ADD.2, Annex-IV, UN-COPUOS Report, 2007.
[28] Resolution 62/217 (document A/RES/62/217 dated 10 January 2008).
[29] NASA Orbital Debris Program Office (.gov), Inter-Agency Space Debris Coordination Committee – Space Debris Mitigation Guidelines, 2002.

INDIAN JOURNAL OF LEGAL REVIEW
(P) Volume I and Issue I of 2023
ISBN - 978-81-961097-8-3
Published by
Institute of Legal Education
https://iledu.in

- Exceptions to implementation of the individual guidelines are also recognized.

Further, the seven guidelines in the UN document reflect the need to limit debris released during normal operations, limiting the probability of accidental collisions in orbit, minimizing post-mission break-ups. Limiting the life of Spacecraft in the Lower Earth Orbits (LEO), and re-orbiting Spacecraft from Geosynchronous Earth Orbit (GEO) are also covered in the Guidelines.

The adoption of Space debris mitigation guidelines by UN was a great step forward in evolving consensus among all the sovereign member-states and a cooperative approach to solving emerging problems related to space debris. However, the voluntary guidelines and their non-binding nature may not prove effective and sufficient.

IV. India's Efforts on Reducing Space Debris

A. India's Contribution in space junk-

India still produces much less space trash than the top three polluters: Russia, USA, China. India's contribution is 0.5% till date.[30] In 2019, India tested its ASAT missile which added to the problem of space debris, although the trackable debris have re-entered Earth and burnt out in its atmosphere in subsequent years.[31]

B. Controlled re-entry of decommissioned satellite-

ISRO,[32] successfully carried out a controlled re-entry of the decommissioned satellite: *Megha-Tropiques-1 (MT1)*. The satellite was launched over a decade ago and had reached the end of its operational life. Thus, to reduce space debris in the Low Earth Orbit (LEO) and limit the potential risk associated with it ISRO successfully brought down the satellite in a controlled manner.

C. System to track space debris and safeguard assets-

The ISRO System for Safe and Sustainable Space Operations & Management (IS4OM), is the world's first ever facility dedicated to monitoring space debris and safeguarding assets in space. By mitigating the collision threats from space objects, the system will safeguard all Indian space assets. It will also comply with international guidelines on post-mission disposal and satellite's end of life operations.

D. Reusable Launch Vehicles-

As a space-faring nation India has made meliorates in launch technology to achieve aptitude and independent launch vehicle programs.[33] Recently, India's space industry took a giant leap with successful completion of the Reusable Launch Vehicle Autonomous Landing Mission (RLV LEX) test.[34] Payload such as satellites or spacecrafts are transported into outer space with the use of Launch Vehicles. At present most of the launch vehicles are discarded after a single use or never recovered after expended during the orbital stages. Whereas, using reusable launch vehicles can help reduce the number of new debris generated from future launches.

ISRO is also a part of the Inter-Agency Space Debris Coordination Committee (IADC), an international governmental forum that coordinates global efforts to reduce man-made and natural space debris by sharing research and identifying debris mitigation options.[35]

Conclusion

It is evident with the review of some of the existing conventions regulating space activities that the field of space law is still in nascent stage. There is a critical weakness in the

[30] "Space Situational Assessment 2021" – ISRO, https://www.isro.gov.in.
[31] Space Debris: "India's Contribution and Efforts to Tackle the Problem," ISRO Missions and Discoveries, Civilsdaily, https://www.civilsdaily.com.
[32] Indian Space Research Organisation.
[33] ISRO, "Launch Vehicles" https://www.isro.org.
[34] The Indian Space Research Organization (ISRO) in collaboration with Defence Research and Development Organisation (DRDO), and the Indian Air Force (IAF) on 2nd April, 2023; successfully tested and accomplished the autonomous landing of a Reusable Launch Vehicle Autonomous Landing Mission (RLV LEX) at the Aeronautical Test Range (ATR) in Chitradurga, Karnataka.
[35] "Space Junk is a problem but don't blame it on ISRO," Sanchita Sharma, Hindustan Times, (2017), New Delhi.

INDIAN JOURNAL OF LEGAL REVIEW

(P) Volume I and Issue I of 2023

ISBN - 978-81-961097-8-3

Published by

Institute of Legal Education

https://iledu.in

International Space Law on space debris. The existing space law is related to the use of space and does not address issue of controlling and limiting the proliferation of space debris. The International legal regime direly needs to be proposed with new laws which would encourage sustainable use of space for all. The paucity or outright absence of law regarding certain key subjects such as liability and dispute resolution is causing concerns for the future.

Today, any country or corporation can launch a rocket and place it into orbit without permit. The only requirement being to record the launching as stipulated under the Registration Convention. Furthermore, nothing in international space law can prevent a nation from destroying one of its own satellites and creating space debris resulting from it.

The existing treaties and conventions were drafted in time of political and military pressure when the USA and the former Soviet Union were engaged in space race. It is now important to achieve a broader consensus with respect to commercial development and rapid growth of outer space applications and, more importantly to address the issue of inadequate coverage of the space debris problem in the present outer space regime.

References

1. V. Balakista Reddy, Rahul J. Nikam, "Space Law and Contemporary Issues: Perspectives on Asia-Paacific Region, Centre for Air and Space Law (CASL), NALSAR University of Law, Hyderabad, 2012.
2. V. Gopalkrishnan, Rajeev Lochan, ISRO – IISL Space Law Conference 2005: "Bringing Space Benefits to the Asian Region," Allied Publishers Pvt. Ltd., Bangalore, 2006.
3. ISRO - Indian Space Research Organization, Department of Space, Government of India, https://www.isro.gov.in.
4. B. Sandeepa Bhat, "Space Law: The Emerging Trends," Eastern Law House, New Delhi, 2018.
5. Bin Cheng, "Studies in International Space Law," Clarendon Press Oxford, New York, 1997.
6. Dr. Sandeepa Bhat B., "Space Law: In the Era of Commercialization," Eastern Book Company (EBC), Lucknow, 2010.
7. Damodar Wadegaonkar, "The Orbit of Space Law," Stevens & Sons Ltd, London, 1984.