



## POLLUTION IN OUTER SPACE: INTERNATIONAL LEGAL REGIME\*

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### Introduction

The great technological advances of the mid-twentieth century have enabled man, for the first time in history, to leave our planet and venture into outer space. The significance for mankind of this event which has opened up new horizons of an unprecedented scope may not be measured in its full potential for some time to come. For the second time in our generation we are witnessing the unfolding of a great scientific evolution which, in the scope of its boundless aspirations, infinite promises and challenge ridden perspectives, represents a panoramic face with hardly a parallel in our history.

The gigantic rockets that lifted the artificial moons, the boldest creation of human inventiveness, did much more than place instrument bearing satellites in orbit around the Earth. They lifted man's imaginations out of his captive environment and gave a new impetus to, and a realistic expectation of, the fulfillment of his age-old dream: the conquest of space. This outstanding victory of science over the mighty forces of nature seems to have put mankind on the very threshold of space.

Scientists tell us that space travel is no longer outside the realm of possibility. A lunar voyage is feasible by applying the basic scientific and technological know-how available to us today. While many technical problems remain to be solved, voyages to Mars and outer planets seem sure to follow in the not too distant future. Such explorations are not only expected to shed light on many hitherto unexplained phenomena in space but will, no doubt, inaugurate new principles of communication and new dimensions of travel.

The man's penetration into the limitless regions of space holds out another and more frightful challenge. Military and other experts tell us that whoever has the capability to control space will likewise possess the power to exert control over the surface of the Earth<sup>1</sup>. From space, the masters of the undifferentiated continuum will have the capability to change the weather to cause drought and flood; they will be able to control the tides and the levels of the sea, to alter the course of the Gulf Stream and change temperate climates to frigid. Whoever gains that position also gains control over the world for purposes of tyranny or for the service of freedom.

It is important to note that risks that pollution pose to the space environment have become both grave and imminent today as a result of sudden and massive addition of space debris to the space environment since 1957 when first man-made object i.e. Soviet Sputnik 1 was launched to the pristine environment of the cosmos.

Since then many more satellites have been launched by many countries in the outer space which despoil its environment. According to United States Surveillance Report, as on today, nearly 10000 objects are being tracked in orbit in the outer space. Considering the progressive increase in launches, this figure is bound to increase rapidly. Besides the satellites, there are other causes for escalating number of objects in the outer space. First, multi-stage rockets shed off their parts like motors, fuel tanks, fairings and fastening material till positioned in planned orbit. Secondly, motors and fuel tanks detached do not exhaust completely of fuel and tend to explode creating splinters, big and small. Thirdly, controlled blasting of rogue satellites or secret mission vehicles or for technological experiment are also on increase thus littering the outer space. With cumulated clutter mounting in the outer space, vehicle safety, collision risks and economic viability of operations is bound to be adversely affected by higher attrition factor. Further accumulations and continued deterioration of space environment may even boomerang to the Earth. The threat is valid and risks foreseeable.

However the dawn of cosmic age in the challenging shadow of the extinction or survival of human aspirations under freedom, justice and law, not only taxes the wisdom of the best brains in the fields of science and technology but it also puts a supreme premium on the efforts of our social engineers, legal technicians and policy makers to adjust man's own behavior to his newly unfolding spatial environment. At this most critical moment in human history, faced with such common accusations that modern science has once again 'far outstripped' the law and that technological progress poses a serious threat if the respective legal problems are not settled before hand, what excuse does the space lawyer of the mid-twentieth century have for not having invented a magic panacea to solve the pressing problems created by the advent of space communication. Indeed, there seems to be no special body of domestic or international law to cope with the multitude of

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\*Dr. Rajinder Verma, Landsberg, 'Geophysical Research', 8 AIR Univ. Q. Rev. (1953) 73.



questions in regard to already existing or future situations which are likely to arise with man's venture into space. As stated earlier, until Russia's Sputnik 1 soared into the sky, the juridical problems of space were largely theoretical and somewhat remote to deserve the devoted attention of lawyers and policy makers<sup>2</sup>. Today, when several satellites have already made innumerable trips around the fringes of outer space, there is a strong conviction entertained by many legal authorities that it would right time to establish a comprehensive system of law to govern relationships in space with the purpose to protect the pristine environment of outer space.

Whatever view one may take, it would seem that legal developments are greatly influenced by scientific innovations and discoveries<sup>3</sup>. Technological progress is an inexhaustible source of new demands, identifications and expectations presenting the law with an ever-changing pattern and a variety of situations which it must attempt to tackle if it is to avert instability and chaos. The problem of formulating a body of law governing cosmic space is no longer purely theoretical. The miraculous, almost daily achievements of science are making it increasingly practical. Apart from the broader questions of whether the establishment of the new structure of law will or should take the form of an international convention or whether the law of the universe will or should grow like common law from custom and practice or by analogy to what is already settled, a closer analysis and clarification of some of the problems raised by man's debut in interplanetary space may be helpful, even if it does not claim to offer ready-made solutions.

### Concept of Outer Space

Space exploration no longer remains a mere fantasy now. It has come true with the subsequent successful launching of artificial satellites, space rockets, manned space flights and moon landings. With the opening of space era it is desirable to discuss briefly, certain terms. Space is a term which is difficult to define with exactitude for all purposes because it has never been considered as a commercial property which could be individualized. It is not an object in the strict legal terminology. Space is neither finite nor defined as an object. The term 'space' ordinarily means the distance extending without limit in all directions: that which is thought of as a boundless, continuous expanse extending in all directions or in three dimensions, with in which all material things are contained<sup>4</sup>. Space may be defined as the entire universe beyond the atmospheric envelop of the earth, the near vacuum in which solar system, stars, galaxies exist<sup>5</sup>.

In the denomination of legal material dealing with the space exploration and nearly the entire space law, the term 'outer space' is commonly used. But this term has not been defined to date with precision despite many attempts undertaken by jurists, international non-governmental and the United Nations bodies. The difference between space and the outer space is generally not recognized. But the former term is wider than the later and means the whole universe including the earth while outer space means all spaces other than the earth. In fact, outer space begins where the earth's atmosphere ends and extends in all directions infinitely. The upper limit of air space constitutes the lowest limit of outer space. The outer space in a broader sense also consists of the entire space beyond celestial bodies and their atmosphere except earth<sup>6</sup>. Therefore, air space is excluded from outer space. The difference between space and outer space is insignificant in so far as the exploration and use of such domain is concerned.

### Pollution and Outer Space

The term 'pollution' has been in the centre of attention of people everywhere, particularly during recent years. Many definitions of this term have been advanced including statutory and judicial definitions, as well as definitions by administrators, scientists and many other people. Obviously, many of these definitions vary in terms of content, and the purpose which they intend to accomplish. In a sense no definition is full proof, and in most cases this is realized, since a definition usually purports to apply only in a given context. With a foregoing preliminary observation in mind, and in most general terms, pollution may be defined as a human alteration of the environment by the introduction of undesirable elements or by the undesirable use of elements.

Generally speaking, one may distinguish two broad categories of pollution in relation to outer space. The first category covers those situations in which the pollution or contamination takes place through the introduction of undesirable elements into outer space by some form of human intervention, commonly called forward contamination<sup>7</sup>. The second category

1. Hogan, 'Space Law Bibliography', 23 J. AIR L and Com. (1956)317-322.

2. Wright, 'Inferences of Science and Technology in International Law', 4 J. Pub. L. (1955) 358.

3. Webster's New Twentieth Century Dictionary (Unabridged, 2<sup>nd</sup> Ed. 1969) 1736.

4. F. Gayer, *Aerospace Dictionary* (New York, 1960) 215.

5. J. Kish, 'The Law of International Spaces', (Leyden, Sijthoft 1973) 4.

6. Horowitz, Sharp and Davis 'Planetary Contamination I: The Problem and The Agreements', 155 Science (1967) 1501.



encompasses those situations in which the pollution arises as a result of the introduction of undesirable extraterrestrial matter into the environment of the earth or undesirable use of such matter by similar human intervention. This is known as back contamination<sup>8</sup>.

Among the types of situations which may arise under the category of 'forward contamination' may be, for instance, biological, chemical or radiological contamination. Such contamination could result from the introduction of leaving terrestrial organisms into outer space, including celestial bodies<sup>9</sup>. It has been reported, for instance that the introduction of blue-green algae into the upper atmosphere of Venus would be sufficient to reduce the high carbon-dioxide content of the atmosphere of Venus which may lower the temperature perhaps by as much as hundreds of degrees. In addition to biological and organic contamination, there might also be other ecological disturbances through the artificial dissemination of terrestrial life<sup>10</sup>. Another form of possible contamination arising out of space activities would be nuclear explosions in space and accidents involving nuclear propelled space craft. At present, under the Nuclear Test Ban Treaty, 1963, such tests are prohibited in outer space. However, it should be noted that the ban does not relate wartime uses of atomic energy and also on states which are not parties to the agreement. Another form of pollution may also arise through electromagnetic interference. It is common knowledge that only a certain, limited radio spectra can be used for space communication, and one of the major causes of electromagnetic pollution is the increasingly intensive competition for the use of available radio frequencies. Many derelict space objects add to this problem by their continued emission of signals. Sometime illegal amateur radio operators also interfere with allocated frequencies and create problems of electronic pollution<sup>11</sup>. More recently it was reported that large scale operation of supersonic jets could possibly inject sufficient water vapors into the stratosphere to cause increased winter cloudiness in Polar Regions. Furthermore, the jet's fuel could possibly raise the temperature of the stratosphere by as much as 7° centigrade<sup>12</sup>.

Still another form of contamination may be caused by the indiscriminate use of outer space for the disposition of space debris and radioactive waste. According to report space debris present in outer space, are of different size ranging from more than 1cm diameter to 10cm or above. Out of tracked above 10cm diameter over twenty one thousand man-made objects orbiting earth, only fewer than five percent are operational satellites and the rest are debris. But what is more worrisome is the presence of over three lakh objects, with a diameter larger than 1cm orbiting the earth. Even worse several million space objects that are smaller are orbiting in space, and large majority of these are man-made garbage in space. Further, according to an estimate, out of more than six lakh pieces of space objects larger than one centimeter, only 5% have been tracked down and categorized, the rest are undetected<sup>13</sup>.

#### **Effort to control pollution in outer space**

With the increase of man's activities in outer space, came the realization by many people that effective measures must be taken to prevent pollution in and from outer space if man is to continue his exploration and exploitation of the cosmos without major adverse effects. International regime could have provided a legal framework to tackle the outer space pollution but it deals with it at best only by inference. In this context Outer Space Treaty, 1967 created, for the first time, certain specific international obligations pertaining to the prevention of contamination of outer space from earth.

#### **i. International Treaties and Conventions:**

Outer Space Treaty, 1977 known as the 'magna carta' for space activities<sup>14</sup>, which constitutes the foundation of the international legal order in outer space are worth mentioning in regard to protect the outer space environment. The treaty proclaims that being global commons and province of mankind and accordingly immune from appropriation by a state, outer space is free for the exploration and use for all states, but the exploration and use of outer space has to be exercised on the basis of equality and in accordance with international law<sup>15</sup>. This treaty also requires the space faring nations to make the space environment pollution free to enable other states to have an unhindered access to outer space, including the moon and outer celestial bodies and explore and use the same for their own benefit and in the interest of all countries. The treaty also

7. McLane King, et al, 'Lunar Receiving Laboratory', 155 *Science*, (1967) 525.

8. *Supra* note 7 at 1501.

9. A. Haley, *Space Law and Government* (19 63) 281-286.

10. *Time*, October 26, 1970, 96.

11. *New York Times*, August 5, 1970, 70.

13. Vladimir Radyuhin, 'Space Junks Spinning Out of Control, warns Russia', *The Hindu, New Delhi*, 16<sup>th</sup> March, 2013.

14. Eilene Galloway, 'Expanding Space Law into 21<sup>st</sup> Century', as cited in J. Imburgia, 'Space Debris and its Threat to National Security: A Proposal, for a Binding International Agreement to Clean the Junk', *Vanderbilt Journal of International Law*, Vol. 44 (2011) p.614.

15. *Outer Space Treaty, 1967, Articles I and II*.



allows a state party to launch space objects into the outer space and to retain jurisdiction and control over objects launched<sup>16</sup>. But what is most pertinent to the present discussion on space pollution is Article IX of the Outer Space Treaty, 1967 which stipulates that the exploration of outer space shall be conducted in such manner as to avoid its harmful contamination and requires the signatories to adopt appropriate measures for this purpose when doing so becomes necessary. But the treaty does not define what ‘harmful contamination’ for the purpose of Article IX is. Scholars differ in their views on whether or not space debris falls within the purview of harmful contamination, since the space debris is the main pollutant of outer space environment<sup>17</sup>. According to one view the expression ‘harmful contamination’ refers only to astronauts and space crafts and accordingly does not include space debris<sup>18</sup>. Another argument based on plain language reading of the provision, however, suggests that harmful contamination refers only to contamination resulting from the introduction of extra terrestrial matter, but it in a way includes space debris created from fragmented earth objects. Be that as it may, defining space pollution and space debris will be of crucial importance of any space pollution treaty in near future.

If Article IX of Outer Space Treaty, 1967 is carefully analyzed, it reveals the limited scope of the provision. In the first place the obligation of state parties to avoid harmful contamination is related to outer space, while the obligation to avoid adverse changes in the environment only refers to effects on earth’s environment resulting from the introduction of extra terrestrial matter. Secondly, it provides for preservation of the outer space environment through state consultation but such consultation is not mandatory<sup>19</sup>. Thirdly, as already noted the phrase ‘harmful contamination’ is open to interpretation and it has been argued that, ‘in the context of treaty, it appears to mean harmful to humans rather than harmful to environment’<sup>20</sup>. Again it is possible to argue that Article IX states that ‘potentially harmful interference with activities, with the peaceful exploration and use of outer space’ strongly suggests that as with rest of the treaty, this phrase is more concerned with protecting activities rather than environment<sup>21</sup>.

In the context of present discussion the most troublesome part is the lack of any definition of space debris in any of the space treaties. It is true that Article III of the Outer Space Treaty, 1967 mentions the concept of ‘space object’ in the context of liability of a launching state for the damage caused by its space object or its component parts. But since the Outer Space Treaty does not clarify what a space object is or what are component parts of such an object, it will perhaps be not convincing to argue that space debris could be considered as a space object. Groove tries to impress upon us that the drafters of Outer Space Treaty used space object to mean operational objects and regarded only component parts and not all parts of a space object as being subject to the constraints of the Outer Space Treaty<sup>22</sup>. On this construction while component parts like rocket boosters could be regarded as space objects, debris fragments should not be considered a space object. Scholars are, therefore, correct when they assert that the term ‘Space Debris’ is not adequately covered by current space law.

Liability Convention, 1972 further reinforced the earlier proclaimed liability of the launching state for damage that space objects may cause. It is true that this treaty attributes a relatively broader meaning to space objects by including within its purview component parts of a space object as well its launch vehicle and parts thereof<sup>23</sup>, what a component part of a space object actually is or whether the term space object also includes space debris remain unaddressed even in this otherwise it is considered very important space treaty. Another major space pollution related drawback to the Liability Convention, 1972 is the lack of any specific mechanism under it for establishing the identity of space object launched into outer space and pollution that might be created<sup>24</sup>. The Liability Convention is based on the assumption that the launching state of any space object will be easily identified. In consequence the Liability Convention was to be considered applicable to space pollution, liability for damage caused by space debris remains<sup>25</sup>. It would be difficult to establish in view of difficulty involved in determining the specific source of a piece of debris.

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16. *Ibid*, Article VI.

17. Mark Williamson, ‘A Pragmatic Approach to the Harmful Contamination in Article IX of Outer Space Treaty, 1967’, *Proceedings of The International Institute of Space Law (2010): Concept of Harmful Contamination be expanded in the context of Space Environment*, p. 666-673.

18. Williams, ‘Space: The Cluttered Frontier’, *J. Air L & Com. No. 60 (1995) p. 1156*.

19. Michael Meheiro, ‘Principles of Peaceful Purposes and the Obligation to Undertake Appropriate International Consultations under Article IX of the Outer Space Treaty, 1967’, *Proceedings of the International Institute of Space Law (2010) p. 674-686*.

20. *Supra* note 17, p. 667.

21. *Ibid*

22. Stephen Groove, ‘Toward a Classification of the Term Space Object: An International Legal and Policy Imperative’, *Journal of Space Law, No.21 (1993), p. 11*.

23. *Liability Convention, 1972 Article II*.

24. N. Jesntuliyana, *A Survey of Space Law as Developed by the United Nations in Perspective on International Law (1995) p. 313*.

25. *Ibid*.



Registration Convention, 1975 is another major treaty that may have some bearing on the problem of space pollution in view of its requirement that a launching state should not only get any space object launched by it into space registered by means of an entry in an appropriate registry to be maintained by it<sup>26</sup>. But it must also inform the UN Secretary General of the establishment of such registry<sup>27</sup>. The Registration Convention also stipulates that after each space launch the UN Secretary General must be notified about it as soon as practicable without setting length of time which shall be deemed practical for the purposes of such notification<sup>28</sup>. Indeed, a lack of time bound for UN registration is a major lacuna in this Convention. When the Registration Convention is considered from the perspective of the mitigation and removal of space pollution following short comings in the Convention are discernible. First, non-registration of many military related launches is a recurrent phenomenon. Secondly, non-registration of satellite makes subsequent identification of any piece of space pollutant or space debris or caused by that satellite a stupendous task. Thirdly, the Registration Convention does not require a launching state to provide appropriate identification marking for its spacecraft and its component parts. Fourthly, it is unclear whether only active satellites are required to be registered or whether additional information on such things as inactive satellites, failed missions and space object break up might also be required. It is the later which could add up new space pollutant in the form of space debris in outer space. Since Registration Convention only covers space object and not space debris, there appears to be no affirmative duty on the part of nations to register the space debris that they create.

Despite the short comings mentioned, the Registration Convention hailed for creating a data sharing duty of the launching state as it would be helpful in the tracking of space objects<sup>29</sup>. But this duty is not absolute and is perhaps inapplicable to space pollution, particularly to space debris. Thus Article IV of the Registration Convention provides that in the event of space object being found to be of hazardous or deleterious nature on the territory of a state party, which can contaminate the earth's environment, other state parties shall respond to the greatest extent feasible to a request by that state party, or transmitted through the Secretary General on its behalf for assistance under equitable and reasonable conditions in the identification of the object. As is evident from foregoing discussion, the Registration Convention is not a useful tool to deal with the space pollution specially, space debris problem. At the same time it also needs to be acknowledged that it is associated with identification of space object or its components and is also concerned with general safety of the space environment.

In the other major space treaties, prohibition contained in the Partial Nuclear Test Ban Treaty, 1963 aims to prevent the wide ranging distribution of radioactive pollutants and it seems to apply to all tests carried out in the atmosphere and beyond its limits, including outer space<sup>30</sup>. The Agreement on the Rescue of astronauts etc, 1968 obligates the launching state to take effective measures in order to avoid the possible danger of inflicting harm on another state, if a space object discovered on other's territory is harmful. The measures by launching states have to be taken under direction and control of the contracting party on whose territory such space object or its component parts have been found. Under the Environmental Modification Convention, 1977, each state party to it undertake under Article I, paragraph I, not to engage in military or other hostile use of environmental modification techniques having widespread, long lasting or severe effects on the means of destruction, damage or injury to any other state party. For the purpose of this provision the term 'environmental modification techniques' refer to any technique for changing through the deliberate manipulation of natural processes such as the dynamics, composition or structure of the earth, including its biota, lithosphere, hydrosphere and atmosphere, or of outer space. Article II goes on further and makes it clear that 'environmental modification techniques' includes changes in weather or climate patterns, ocean currents, the state of the ozone layer or ionosphere, or upsetting the ecological balance of the region. As focus of this Convention is on the earth environment as opposed to space environment, it may not be helpful in addressing the space pollution caused due to space debris. The fact that the obligations that this Convention establish, apply only to state parties and not to all parties and moreover it does not prohibit the use of environmental modification techniques for peaceful purposes diminish its utility in respect of the present discussion. The Moon Treaty, 1979 under Article VII established the environmental obligations of state parties by stating that in exploring and using the moon, state parties shall take measures to prevent the disruption of the existing balance of its environment whether by introducing adverse changes in that environment, by its harmful contamination through the introduction of extra environmental matter or otherwise.

## ii. Emerging Soft International Law

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26. *Registration Convention, 1972, Article II (1)*

27. *Ibid.*

28. *Ibid, Article IV.*

29. *Supra note 24, p. 144.*

30. *Article I of the Treaty Banning Nuclear Weapon Test in the Atmosphere, in Outer Space and under Water, 1063.*



There are two possible ways to address the space pollution and space debris problem i.e. mitigation and removal. Since the space debris is the main component of space pollution, so space faring nations favour the adoption and implementation of space debris mitigation guidelines. A group of scientists emphasize the urgency of the situation in view of the likelihood of the cascading effect of the growing space debris population if they go uncontrolled just now and its disastrous consequences for the space safety and the space environment. For this reason plead for removal of space pollutant i.e. debris without any further delay.

Turning to space debris mitigation guidelines the Inter Agency Debris Coordination Committee (IADC), a non-governmental organization after several years of information exchange, adopted a set of guidelines to mitigate space debris and space pollution in 2002. According to IADC guidelines space pollution could be reduced in the following ways<sup>31</sup>;

- a. To limit the debris released during the normal operations
- b. To minimize the potential for an orbit breakups by release of stored energy after mission and performance analysis during operations and avoidance of internal destruction.
- c. Removal of spacecrafts and launch vehicle stages for useful orbits and
- d. Prevention of on-orbit collisions.

The IADC guidelines are not legally binding however some space faring nations have implemented them as mandatory requirements into their space programs. Code of Conduct adopted by states and international organizations also follow IADC guidelines<sup>32</sup>.

UN General Assembly through resolution in 1993 called upon the Scientific and Technical Sub-Committee (STS) of Committee on Peaceful Uses of Outer Space (COPUOS) to engage with this problem by formally including space debris in its agenda. The STS drafted guidelines for space debris mitigation went through the review process which took several years to complete. Finally, in 2007 COPUOS provided non-binding guidelines for space debris mitigation to the UN General Assembly for consideration and potential implementation<sup>33</sup>. It is noteworthy that COPUOS guidelines closely followed the IADC guidelines which may be stated that; (a) to limit debris released during normal operations, (b) to minimize the potential for breakups during operational phases, (c) to limit the probability of accidental collision in orbit, (d) to avoid intentional destruction and other harmful activities, (e) to minimize potential for post-mission breakups from stored energy, (f) to limit the long term presence of space crafts and launch vehicles, orbital stages with the Geosynchronous Earth Orbit (GEO) after the end of their mission. In addition to stressing the importance of the immediate implementation of the above mentioned measures COPUOS not only described these measures as a prudent and necessary step towards preserving the outer space environment for future generations but also offered a definition of space debris.

Thus, in 2008 the UN General Assembly not only adopted the aforesaid guidelines but also called upon member states to pay more attention to the problem of space pollution specially space debris and give continued attention to national and international resources including research and development for both tracking and removal of space pollution. The problem with IADC and UN General Assembly guidelines is that they are not binding. Arguably these guidelines may in due course crystallize into binding rules of international customary law. But since custom formation is a slow law making process and the crisis space debris presents is to be addressed immediately wisdom warrant negotiations for a binding convention.

### Concluding Observations

The problems that space pollution pose are real and need to be addressed on priority bases if the exploration of outer space for peaceful use and purposes and for the benefit of humankind is to be ensured on a sustainable basis. The provisions of the various international treaties relating to outer space specially, the Outer Space Treaty, 1967 constitute and important initial step toward preventing adverse changes in the environment of outer space including celestial bodies. At the same time, this brief scrutiny seems to indicate that further steps will have to be taken by the international community as men's exploration of outer space assumes more significant proportions. But, while the quoted provisions have been a response to mankind's concern about the dangers of pollution and contamination, the treaties have not yet provided any detailed code of conduct for the space powers to prevent the chances of pollution in outer space.

Inter Agency Debris Coordination Committee (IADC) guidelines and UN General Assembly on space debris mitigation represents both positive and desirable steps towards remediation of the space pollution. But experts are of the views that not

31. UN Doc. A/AC. 105/C.1/L 260, 29<sup>th</sup> November, 2002.

32. Martha Mejia Kaiser, 'International Regulation in the Field of Space Debris Mitigation', *Air and Space Law*, XXXIV (2009) p. 23-25.

33. Report of the Committee of the Peaceful Uses of Outer Space, Official Records of the General Assembly, 42<sup>nd</sup> Session, Supplement No. 20 (A/A/62/20), paragraph 117-128.



only guidelines are not binding, they also fail to address the immediate problem of space debris. While acknowledging the importance of mitigation guidelines they very strongly advocate the adoption of removal measures to prevent the cascade effect of space debris. J.C. Lion and Nicholas Johnson, for example, argue that only the removal of existing space debris can prevent future problem for research in and commercialization of space<sup>34</sup>.

The exiting legal framework does not address the issues of outer space environment. So it is suggested that the formulation of an international code of conduct regarding pollution of outer space is essential. The need of a binding international convention has been strongly felt by some scholars. Further any active space pollution removal program not only needs a cost effective method technology but also requires huge funds for this purpose. For this reason some states may oppose it on the grounds of financial constraints. But this problem can be overcome by creating international fund and requiring all space faring nations to contribute to this fund. Suppose sooner or later space faring nations and other states decide to remove space pollution and to facilitate this enter into negotiations regarding a new convention, it is humbly submitted that the proposed convention should cover certain aspects such as mitigation provisions, liability of launching state to pay compensation for damage caused by the space pollution it creates, joint and several liability of two or more steps to take appropriate steps to remove any space pollutant created, obligation of the subscribing states to share immediate information on provisions to prevent and minimize the possibility of accidents, collisions or other forms of harmful interference caused by space pollution, cooperation in sharing space situational awareness<sup>35</sup>.

Further no treaty howsoever well drafted it may be, will serve the intended purposes unless it contains a provision on peaceful settlement of disputes and provides for creation of a special mechanism to look after its implementation. The proposed treaty should therefore establish an international tribunal for this purpose. It is suggested that priority should be given to the agenda of space debris removal irrespective of the fact that whether or not such removal is currently technically and economically feasible. It is observed that space pollution specially orbital's debris poses a threat to the sustainability of space activities and presents a danger to space operations. To overcome this problem international community should develop a legal regime for mitigation and removal of space pollution.

In the light of increasing commercialization of space activities it is necessary that states enact national legislation requiring state agencies and commercial operators to take appropriate measures for space pollution remediation. Since the present space pollution has mainly arisen from the contribution of various space faring nations, there responsibility for space pollution remediation should be proportional to the level of space activities. In other words, equity in the form of common differentiated responsibilities should be the overarching principles around which a new regime on space pollution mitigation and removal should be built up. It is hoped that members of the United Nations and International Agencies will rise to the occasion and take appropriate steps to complement international conventions, particularly, those dealing with the liability of space activities as well as state jurisdiction and control over space objects so that the conduct of active space pollutants and debris removal and on orbit satellite servicing may be facilitated.

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34. J.C. Lion & N. Johnson, 'Risks in Space from Orbiting Debris', *Science*, 20<sup>th</sup> January, 2006, p. 341.

35. Joseph Imburgia, 'Space Debris and its Threat to National Security: A Proposal for a Binding International Agreement to Clean the Junk', *Vanderbilt Journal of International Law* Vol. 44 (2011) p.636-641.