

## “Palliation of Space Debris--A Need to Clean Environment”

Vivek Ratan Gadhavi

Student of LLM, Gujarat National Law University, Attalika Avenue, Knowledge Corridor, Koba, Gandhinagar,  
Gujarat, India

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**Abstract:** Space Debris is the waste or junk which have been left behind by human in space that no longer serves a useful purpose. It could be form of defunct satellites, discarded equipments, and rocket stages. It destroys satellite because due to its very high speed in orbit even relatively small pieces can damage or destroy satellites in a collision. For several decades, orbital debris has been identified as a serious concern. This debris is very dangerous in space especially for the future space mission. As there is the risk of high energy collisions with valuable space crafts. It have been understood that the current space debris environment poses a risk to space craft in earth orbit. As the population of debris continues to grow, the probability of collisions that could lead to potential damage will consequently increase. In addition, there is also the risk of damage on the ground if debris survives Earth's atmospheric re-entry. The prompt implementation if appropriate debris mitigation measures are therefore considered a prudent and necessary step towards preserving the outer space environment for future generations. The Present paper discusses about the Space Debris its threat to the environment and even to the future space missions. It also aims to create the principles of limiting the release of operational debris, preventing on-orbit break-ups, removing spent objects from useful orbit regions and off course collision avoidance. To cover all the elements and aspects of the topics the researcher has decided to keep the title of the project. **Palliation of Space Debris: The Need to clean Outer Space.**

**Keywords:** Debris, Environment, Palliation, Space Crafts, Space Mission.

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### I. Introduction

Space Debris is the waste or junk which have been left behind by human in space that no longer serves a useful purpose. It could be form of defunct satellites, discarded equipments, and rocket stages. It destroys satellite because due to its very high speed in orbit even relatively small pieces can damage or destroy satellites in a collision. For several decades, orbital debris has been identified as a serious concern. This debris is very dangerous in space especially for the future space mission. As there is the risk of high energy collisions with valuable space crafts. It have been understood that the current space debris environment poses a risk to space craft in earth orbit. As the population of debris continues to grow, the probability of collisions that could lead to potential damage will consequently increase. In addition, there is also the risk of damage on the ground if debris survives Earth's atmospheric re-entry. The prompt implementation if appropriate debris mitigation measures are therefore considered a prudent and necessary step towards preserving the outer space environment for future generations. This particular paper gives information about the types and kinds of Space Debris. It also gives information about the United Nations treaties on Outer Space, Astronauts and Space Debris. It talks about the Legal Frameworks and International initiative for Palliation of Space Debris, its future impact , Remedies and Conclusion.

### II. Headings

#### 1. Introduction

Space Debris is the waste or junk which have been left behind by human in space that no longer serves a useful purpose. It could be form of defunct satellites, discarded equipments, and rocket stages. It destroys satellite because due to its very high speed in orbit even relatively small pieces can damage or destroy satellites in a collision. For several decades, orbital debris has been identified as a serious concern. This debris is very dangerous in space especially for the future space mission. As there is the risk of high energy collisions with valuable space crafts. It have been understood that the current space debris environment poses a risk to space craft in earth orbit. As the population of debris continues to grow, the probability of collisions that could lead to potential damage will consequently increase. In addition, there is also the risk of damage on the ground if debris survives Earth's atmospheric re-entry. The prompt implementation if appropriate debris mitigation measures are therefore considered a prudent and necessary step towards preserving the outer space environment for future generations.

There have been various Convention, Agreements and Treaties have been made related to the space and in that they have discuss about the space debris and the space object. Article 1 (b) of the Registration Convention and Article 1(d) of the Liability Convention defines the space object as that “the term Space Object

includes component parts of a space object as well as its launch vehicle and parts thereof”<sup>1</sup>. These both conventions here are dealing with the term space object means those objects which are non-functional in space and they are harmful to the space missions as well as space shuttles and even to those satellite which are functioning in the space. However this definitions are very small and in concise way it have been presented but considerable debate exists about the true meaning of the term Space Object. There are various eminent authors who have talk about the Space debris. Although so far our experience is with debris in close-Earth orbits, debris mitigation is necessary to prevent problems for all astronauts everywhere. Debris may not constitute ‘harmful interference’ as such, but it is a potential menace. A punctured space-suit, spacecraft, capsule or Moon-base could spell disaster, raising question for ‘long range mission’. Suffice it here to note that collision avoidance manoeuvres are increasing in number for both manned and unmanned spacecraft.<sup>2</sup> Between 1967 and 1976 four space treaties have come into force, and in each case the consensus method was used by the legal Subcommittee of the UN Committee on the Peaceful Uses of Outer Space in formulating agreed texts and bringing about this body of space law. The treaty on Principles Governing the activities of states in Exploration and use of Outer Space, including the Moon and Other Celestial Bodies entered into force on October 10, 1967.<sup>3</sup> On December 3 1968 there was a entry into force of the Agreement on the Rescue of Astronauts, the Return of Astronauts and the force of Objects Launched into Outer Space.<sup>4</sup> The Convention on International Liability for Damages Caused by Space Objects of October 9, 1973<sup>5</sup> represents one of the most important international agreements whose detailed provisions are designed to avoid difficulties which could arise in connection with space activities.<sup>6</sup> Hence these are the definitions about the space debris given in the Conventions as well as agreement and various eminent author have given there views related to the topic but as it is said that there yet to be an acceptable legal definition of space debris. There have been proposal for defining space debris, but these definitions are couched, mostly in the context of legally binding treaties and liabilities and for space debris. Given the current geopolitical realities, the prospect of a legally binding space law treaty addressing space debris is slim and, therefore such definitions will not likely gain acceptance.<sup>7</sup> There are Committees have been develop which gives the information of the debris and with that they also maintain an international governmental forum for the worldwide co-ordinated activities related to the issue of man-made and natural debris in space. They also provides the definition of space debris such as the Space Debris are all man-made objects including fragments and elements thereof, in Earth orbit or re-entering the atmosphere, that are non functional.<sup>8</sup>

### **1.1 Types and kinds of Space debris**

History changed on October 4, 1957, when the Soviet Union successfully launched Sputnik I. The world's first artificial satellite was about the size of a beach ball (58 cm. or 22.8 inches in diameter), weighed only 83.6 kg. or 183.9 pounds, and took about 98 minutes to orbit the Earth on its elliptical path. That launch ushered in new political, military, technological, and scientific developments. While the Sputnik launch was a single event, it marked the start of the space age and the U.S.-U.S.S.R space race.<sup>9</sup> With this amazing incident many countries including America started the research to send their space shuttles as well as satellites in the space as we all know before when such operations related to space were done the concept of space debris where not there not even the measures was taken into consideration to avoid such damage to environment of space through such debris which have been created by such launches of space debris as well as satellites. Going to the satellites many Governments as well as cell phone, television and GPS receivers company, have launched hundreds of satellites a year since the beginning of the space race, these satellite along with rockets and other space objects sent up into space make up the majority of space junk.<sup>10</sup> Hence starting from 1957 till date there have been many space satellites and the space shuttles have been sent to the earth’s orbit and they have created

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<sup>1</sup> Convention on International Liability for Damage Caused by Space Objects 1972.

<sup>2</sup> Francis Lyall and Paul B. Larsen, “Space Law A Treatise”, Published by: Ashgate Publishing Limited, 2009, p.146,147.

<sup>3</sup> Treaty on Principles Governing the Activities of States in the Exploration and Uses of Outer Space, Including the Moon and Other Celestial Bodies, January 27, 1967, [1967] 18 U.S.T. 2410. T.I.A.S. No.6347. 610 U.N.T.S. 205 (effective Oct.10.1967).

<sup>4</sup> The Convention On the International Liability for Damages Caused by Space Objects, March 29,1972, [1973] 24 U.S.T.2389. T.I.A.S. No.7762(effective Oct. 9. 1973).

<sup>5</sup> The agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched into Outer Space, April 22, 1968, entered into force for the United States on December 3, 1968: [1968 19 U.S.T. 7570, T.I.A.S. No.6599. 672 U.N.T.S. 119.

<sup>6</sup> Francis Lyall and Paul B. Larsen, “THE LIBRARY OF ESSAY IN INTERNATIONAL LAW SPACE LAW” ASHGATE Publication, part 3, chapter 5 “CONSENSUS DECISIONMAKING BY THE UNITED NATIONS COMMITTE ON THE PEACEFUL USES OF OUTER SPACE” BY: Eilene Galloway.

<sup>7</sup> Michael Listner, “Addressing the Challenges of Space Debris, Part 1: defining space debris “, Published in (<http://www.thespacereview.com/article/2187/>) On Monday 12, 2012.

<sup>8</sup> <http://www.iadc-online.org/> International Agency-Space Debris Co-ordination Committee (IADC) an International Governmental forum for the world-wide co-ordination of activities related to the issue of man-made and natural debris in space.

<sup>9</sup> <http://www.nasa.gov/externalflash/SpaceAge/> 50<sup>th</sup> Anniversary of the space age 1957-2007.

<sup>10</sup> <http://science.howstuffworks.com/space-junk1.htm> John Fuller, “How Space Junk Works”.

and enormous amount space debris. As we talk about the types of space debris the first think comes to my mind is the debris which have been created by the Derelict space crafts what are they let's see. When space ships or parts of space ships no longer work they are left to float around space indefinitely, its usually expensive to retrieve these objects, so they are left there to circle the earth's orbit until they fall back down or collide with other space junk.<sup>11</sup>

Secondly we can talk about the debris which have been created by the Upper Stages of Launch Vehicles. Let's see what are they modern space shuttles are actually a collection of several rockets stacked on top of each other. When space shuttles are launch, it usually takes more than one rocket boost to get them high enough into space, and these rockets are fired off in stages. The Final stages are called upper stages because they are located near top of the entire shuttle and because they fire so late, any material expelled from the space craft can get trapped in the earth's orbit, they are among the largest kinds of space junk.<sup>12</sup> It's also One of the biggest problems facing spaceflight today is the accumulation of orbital debris because it threatens the successful operation and lifespan of existing satellites. The predominant cause of orbital debris is the jettisoning of launch vehicle upper stages after their usefulness is over once a rocket reaches orbit altitude. While their orbit slowly decays, these obsolete upper stages then share an orbit with valuable satellites presenting a danger to those satellites by either hitting them or hitting other rocket bodies and breaking into smaller pieces which can be just as dangerous but become much harder to track. These collisions potentially add an exponentially growing number of debris in orbit.<sup>13</sup>

As there has been debris created by the upper stages of the space shuttles there have been activities and views have been given on the reducing of space debris created from the launch vehicles. Not only all mission-related debris can be easily eliminated. Some mission-related debris may decay from orbit within a short period and not pest a long-term environmental hazard. Many objects which historically were released into orbit can be retained by the launch vehicle or space craft with the use of hinges, tethers, bolts, catchers, or new design. In the recent years the net growth of mission related debris in earth orbit has moderated and now accounts for only 11% of the catalogued objects. During the period 1957-1999 a total of 71 upper stages or their components fragmented in Earth Orbit, excluding re-entry break-ups, 80% of these fragmentations involved objects which had operated successfully but had been abandoned without passivation, historically, more than one-third of all known fragmentations in Earth Orbits have involved non passivated upper stages or their components 30% of all catalogued objects in orbit, in 2000 were debris created by non-passivated upper stages or their components, launch vehicles of many nations are organizations have been affected, fragmentations apparently have been caused by both cryogenic and non-cryogenic propellents, as well as by pressurised gases, upper stages fragmentations have occurred within hours of launch or as long as 25 years after launch.<sup>14</sup>

We have seen certain types and kinds of space debris which are harmful for the future missions due to the collision. We have seen Derelict space crafts they are such space ships which are no longer in work or function. So as the process to get them back to the earth's surface and to make them decompose by the Launching states its very expensive. So such objects have been left free to circle the earth's orbit until they fall back down or collide with other space junk or other space shuttles and even caused damage to the human being on earth, as well as we have discussed about the Upper stages of Launch vehicles which are the parts of the space shuttles launch, it usually takes more than one rocket boost to get them up in the space high enough and once the space shuttle goes to the space these stages have been removed and cause debris. They are among the largest kinds of space junk.

The Third type or kind of space debris is Solid rocket motor effluents they some space shuttles use solid rocket fuel for propulsion. After launches, some fuel can be left over and will float around in whatever container in which it flew up. This poses a great risk for collisions, because it only creates more space junk after an explosion. Other mission-related particles may be generated unintentionally, as in the release of slag during and after the burn of solid rocket motors. The precise nature of the amount and distribution of these slag ejecta are unclear, and the improvement of solid propellant and motor insulation to minimize the released solids is difficult.<sup>15</sup> Such Solid rocket motor effluents they have been used by space shuttle rocket fuel which is very

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<sup>11</sup> [http://www.nap.edu/catalog.php?record\\_id=13244](http://www.nap.edu/catalog.php?record_id=13244) THE NATIONAL ACADEMICS PRESS, “Limiting Future Collision Risk to Space craft: An Assessment of NASA's Meteoroid and Orbital Debris Programs (2011) by: Committee for the Assessment of NASA's Orbital Debris Program: Nation Research Programs.

<sup>12</sup> <http://science.howstuffworks.com/space-junk1.htm> John Fuller, “How space junk works”.

<sup>13</sup> [http://www.nasa.gov/spacetechnology/2013\\_nstrf\\_long.html#Ukfv2oZOGSA](http://www.nasa.gov/spacetechnology/2013_nstrf_long.html#Ukfv2oZOGSA) Alexandra Long, from Georgia Institute of Technology, “Deployable Drag Device for Launch Vehicle Upper Stage Deorbit”.

<sup>14</sup> [http://www.iadc-online.org/Documents/IADC\\_UN\\_Presentation\\_Feb01.pdf](http://www.iadc-online.org/Documents/IADC_UN_Presentation_Feb01.pdf) INTERNATIONAL SPACE DEBRIS CO-ORDINATION COMMITTEE (IADC) Activities and Views on Reducing Space Debris From Launch Vehicles, Presented To: 38<sup>th</sup> Session of Scientific and Technical Sub-committee Committee on The Peace Full Use Of Outer Space, United Nations.

<sup>15</sup> [http://www.spacefuture.com/archive/space\\_debris\\_and\\_its\\_mitigation.shtml](http://www.spacefuture.com/archive/space_debris_and_its_mitigation.shtml) Saurabh Kaushal, Nishant Arora, “Space Debris and its Mitigation”. Presented at ISEC Space Elevator Conference, August 2010. In this particular paper they discuss about how there have been an significant increase have been seen in space debris and how they have been threat to the future missions as well as environment and they have also suggested measures related to the mitigation to the space debris.

dangerous for the other satellites which are functioning in the space as well as the space shuttles which join the space for exploration and other future mission hence such solid rocket fuel can explode and time and create more space debris as well as damages to the space vehicles and functioning satellites. Some of this junk floats in space, while most of it orbits Earth at speeds of up to 36,000 km per hour. There are approximately 20,000 objects in orbit that are big enough for officials on the ground to track, and countries smaller ones. Earth's gravitational field pulls a lot of space debris into lower and lower orbits until it finally reaches Earth's atmosphere, most of the debris burns up when it enters earth's atmosphere, the higher the altitude at which it orbits the longer the space debris will remain in orbit, space debris moving in the orbit lower than 600 km normally falls back to earth within a few years, space debris orbiting at altitudes at altitudes higher than 1,000 km can continue circling earth for a century or more.<sup>16</sup>

Third smaller in size but hence more important space debris is Tiny flecks of paint, we can say that what damage can be done by little tiny flecks of paint to the satellites which are functioning in the outer space or what amount to damage it can do to the space shuttles in outer space or how they can affect the future space mission although it may be hard to believe, there are potentially millions of tiny pieces of paint floating around earth's orbit. Heat or impacts with other small particles usually chip off paint specks from space craft and turn them into space junk. Such small particles can cause damage on a large scale with this intention NASA frequently replaces space shuttles window which was damaged by orbiting flakes of paint! Because of the very great speeds at which debris travels, small pieces between 1 to 10 centimetres in size can penetrate and damage most space craft, a ten centimetres long piece of space junk can cause as much damage as twenty-five sticks of dynamites. The main problems with the space debris is the danger it poses to working satellite and manned space craft like the International Space Station (ISS). The (ISS) performs frequent collision avoidance manoeuvres to reduce the risk of this happening. The danger was highlighted when astronauts on ISS were forced to take shelter inside two Soyuz Capsules when debris comes within 1000 feet.

### **1.1.1 Other Sources of Space Debris**

There are other sources of space debris rather than the above like big bang in earth's orbit. The majority of space debris occurred because of explosions in higher orbits. Mission designers carry extra fuel on board in case it is unexpectedly needed. This extra fuel is stored in pressurized tanks once the rocket stage is discarded. When leaks occur sudden explosive release of pressure takes place due to each explosion thousands of small debris objects and about hundred tones of fragments are generated which are still in the orbit. This debris collides with other objects leading to creation of even more small space debris and also lost equipments as well as boosters such Debris is also caused during space-walks. For example Sunita Williams of STS-116 lost a camera during extra-vehicular activity(EVA) [2]. Lost equipments include garbage bag, gloves, tool kits etc. Lost equipment is one of the key sources of growing debris in space. We have to minimize this to as small as possible during the space walks. Lower stages, like the solid rocket boosters of the Space Shuttle, or like the Saturn IB stage of the Apollo program era, do not reach orbital velocities and do not add to the mass load in orbit. Upper stages, like the Inertial upper stage, start and end their productive lives in orbit. Boosters remain a serious debris problem and one of the major known impact events was due to an Ariane booster.<sup>17</sup>

Hence in such ways the Space Debris have been created and these were the definitions and types as well as kinds of the space debris and the process how these space junk of debris have been created and generated and how dangerous it could be to space shuttles and future space mission and as well as the satellites which are functioning in the outer space with also the danger to the International Space Station (ISS).

## **III. United Nations Treaties on Outer Space, Astronauts and Space Objects**

In the first Chapter we have discussed about the introductory part of the project scheme that was focusing on the definitions and the types and kinds of the space debris. In this particular chapter basically we are going to focus on various treaties, agreements and conventions related to the outer space. It also deals with outer space and its International frame work, legal status of Astronauts, legal status of space craft, satellite and space objects. To find for all above we should know that what is space law. Various Institutes have been discussing about the definition of space law. Space law is an area of law that encompasses national and International Law governing activities in Outer Space<sup>18</sup>. The term “Space Law” is most often associated with the rules, principles and standards of international law appearing in the five International treaties and five sets of principle governing

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<sup>16</sup> <http://tunza.eco-generation.org/m/view.jsp?board=ourActions&viewed=1355&searchType=&searchName=&pageNumber=3> an Article by: Neha Swaminathan, “SPACE LITTER SND SPACE TOURISM”.

<sup>17</sup> [http://www.spacefuture.com/archive/space\\_debris\\_and\\_its\\_mitigation.shtml](http://www.spacefuture.com/archive/space_debris_and_its_mitigation.shtml) Saurabh Kaushal, Nishant Arora, “Space Debris and its Mitigation”. Presented at ISEC Space Elevator Conference, August 2010. In this particular paper they discuss about how there have been a significant increase have been seen in space debris and how they have been threat to the future missions as well as environment and they have also suggested measures related to the mitigation to the space debris.

<sup>18</sup> <http://www.iislweb.org/> International Institute of Space Law Defining the principles governing outer space activities.

outer space which have been taken under the governance of United Nations Organisation. Hence space law also includes International agreements, treaties, conventions, rules and regulations of international organisations, national law, rules and regulations, executive and administrative orders, and judicial decisions.

There are some states which have national law and legislation governing space-related activities includes inter alia Argentina, Australia, Canada, Finland, France, Germany, Hungary, Indonesia, Japan, New-Zealand, Philippines, Republic of Korea, Russian Federation, Slovakia, Sweden, South Africa, Tunisia, Ukrain, the United Kingdom of Great Britain and Northern Ireland and the United States of America<sup>19</sup>. As we all know that Outer space is an exciting and highly important region because it is very much useful for the exploration to know new facts about the Outer space and to make it useful for the purpose of human kind. Hence as is very important at the same time it is very dangerous also. The main Goal of the Outer space is to have a rational as well as responsible approach to the exploration of the outer space for the benefit and the interest of all mankind. As we talk about the mankind several things could come to our mind that when we are using Outer space for the peaceful purpose as well as exploration for the benefit of the Human kind. Then the question comes to our mind that how it could be dangerous to the society as well as Humankind. Space law addresses a variety of diverse matters, such as military activities in outer space. As it is said under one of the convention's Preamble that, “Nothing the great importance of the treaty on Principles Governing the activities of states in the Exploration and use of Outer space, including the Moon and other celestial bodies, which calls for the rendering of all possible assistance to astronauts in the event of accident, distress or emergency landing, the prompt safe return of astronauts and the return of objects Launched into the outer space. Desiring to develop and give further concrete expression to these duties. Wishing to promote international co-operation in the peaceful exploration and use of outer space. Prompted by sentiments of humanity”<sup>20</sup>.

As we have seen the various treaties have been made to protect the outer space and all of them are saying about the peaceful use of outer space as well as for the purpose of the humankind, hence there is a country in the world which have been Planning the Militarization of the Outer Space and for which it have been criticized by many countries of the world and that is U.S. However the Bush Administration in the United States has long made it clear that the U.S wishes to expand its Military capabilities and have weapons in space and therefore also be dominant in this fourth military arena (the other being sea, land and air) Internal USAF documents reveal that seizing control of the 'final frontier' is deemed essential for modern warfare. Counterspace Operations reveals that destroying enemy satellites would improve the chance of victory. It states: 'Space superiority provides freedom to attack as well as freedom from attack. Space and air superiority are crucial first steps in any military operation'<sup>21</sup>. To what extent it is worth it that though we can understand that the U.S has suffered the one of its biggest Terrorist Attack of 9/11 in its entire history of America but it does not mean that they should try to do the militarization of the outer space does the conventions related to Outer Space gives permission to do that it would be wrong to treat questions of the law on military use of outer space as entirely separate and distinct from other international law on military matters. Outer Space Treaty Art. III provides that ‘States Parties... shall carry on activities in the exploration and use of Outer Space ... in accordance with international peace and security and promoting international cooperation and understanding’. Space cannot therefore be treated in isolation. Its military potential is part of the general law as to war.<sup>22</sup> The law of war has two aspects, the *ius ad bellum*—the circumstances under which it is law full to go to war – and the *ius in bello*—the law as to how war is conducted<sup>23</sup>. Hence we have seen how any unwanted step when taken by any country by forgetting the conventions of the Outer Space how they face the criticism. Let's go to the other conventions and see what they talk about the Outer Space.

## 1.1 Charter of United Nation

The Preamble to the UN Charter states inter alia that the people of the United Nations are determine to ‘save the succeeding generation from the scourge of war’.<sup>24</sup> To that end they agreed to unite their strength ‘to maintain international peace and security, and, to ensure, by the acceptance of these principles and the institution of methods, that armed force shall not be used, save in the common interest’. In Art. 1.1 the first listed Purpose of the UN is therefore ‘to maintain international peace and security, and to that end: to take

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<sup>19</sup> <http://www.oosa.unvienna.org/oosa/en/SpaceLaw/national/state-index.html> UNOOSA, United Nation Office of Outer Space Affairs, National Space Law Database.

<sup>20</sup> [http://www.unoosa.org/oosa/en/spacelaw/gares/html/gares22\\_2345.html](http://www.unoosa.org/oosa/en/spacelaw/gares/html/gares22_2345.html) 1968 AGREEMENT ON THE RESCUE OF ASTRONAUTS, THE RETURN OF ASTRONAUTS AND THE RETURN OD OBJECTS LAUNCHED INTO OUTER SPACE. Adopted in New York, the United States of America on 19 December 1967.

<sup>21</sup> <http://www.theguardian.com/science/2004/nov/07/spaceexploration.usnews>, Mark Townsend, “U.S ready to put weapons in space—Defence experts says America is likely to ignore treaty ban”, on Sunday 7 November 2004.

<sup>22</sup> Francis Lyall and Paul B. Larsen, “Space Law A Treaties”, published by: Ashgate, 2009.

<sup>23</sup> Y. Dinstein, (1) War, Aggression and self-defence, 4<sup>th</sup> ed. (Cambridge: Cambridge UP, 2005); (2) The Conduct of Hostilities under the International Law of Armed Conflict (Cambridge: Cambridge UP, 2004).

<sup>24</sup> Charter of the United Nations, 59 Stat, 1031.

effective collective measures for the prevention and removal of threats to the peace, and for the suppression of acts of aggression or other breaches of the peace, and to bring about by peaceful means, and in conformity with the principles of justice and international law, adjustment or settlement of international disputes or situations which might lead to a breach of the peace’.<sup>25</sup> As we see the history of the effectiveness of these provisions is mixed, and perhaps in recognition that this might be the case, they are followed by Art. 51 which provides: “Nothing in the present Charter shall impair the inherent right of individual or collective self-defence if an armed attack occurs against a Member of the United Nations, until the Security Council. Measures taken by Members in the exercise of this right of self-defence shall be immediately reported to the Security Council and shall not in any way affect the authority and responsibility of the Security Council under the present Charter to take at any time such action as it deems necessary in order to maintain or restore international peace and security.

## 1.2 Outer Space Treaty

Now let’s go through the another treaty related to the outer space is The Treaty on Principles Governing the Activities of States in the Exploration Use of Outer Space, including the Moon and Other Celestial Bodies (the Outer Space Treaty) was adopted for signature by the General Assembly of the United Nation on 19 December 1966, opened for signature on 27 January 1967, and entered into force on 10 October 1967.<sup>26</sup> It is important that space activities are the subject of rules. What these were needed to be agreed internationally? Whether claims to sovereignty in space could be made had to be clear, responsibility had to be established for supervision, for the ‘ownership’ of space activities at the state level and for liability in the case of damage or devastation. Astronauts should be rescued. Space objects should be ‘returned to sender’ or at least ‘returnable to sender’. Custom and practise would have taken too long to produce rules of sufficient detail to cope with such matters. Something closer to ‘legislation’ was required, and the UN Space Resolutions were not that.

The Outer Space Treaty certainly provides a solid foundation for the development of much of space law. It translates into treaty obligations the basic ideas expressed in the earlier Space Resolutions.<sup>27</sup> Another international instrument affording some guidance in the negotiation and drafting of the Outer Space Treaty was the Nuclear Test Ban Treaty of 1963,<sup>28</sup> which had entered into force just before the UN General Assembly adopted the 1963 Space Principle Resolution.<sup>29</sup> As its full title indicates, the Nuclear Test Ban Treaty bans nuclear weapon testing inter alia in space. Article I of that treaty speaks simply of the banning of nuclear weapons tests ‘in the atmosphere, beyond its limits, including outer space’, but lacks specificity as to where outer space might be. Nonetheless, it provide straw to help make the bricks of the Outer Space Treaty. Apart from such international agreements, many other materials were germane to the discussion. The US and USSR produced many suggestions and draft agreements.<sup>30</sup> We now move on to consider the remaining articles of the Outer Space Treaty. Article IV obliges states not to put nuclear weapons of mass destruction into space, whether in orbit or otherwise stationed in space, or on the Moon or other celestial bodies. The Moon and other Celestial bodies are to be used exclusively for peaceful purpose. Military bases, exercise or the testing of weapons are forbidden. Notwithstanding military equipment for scientific purposes is permitted.<sup>31</sup> Such generalities require further elaboration – as in the Moon Agreement of 1979, albeit that Agreement has not been success.<sup>32</sup> Article V of the Outer Space Treaty, repeating the terms of paragraph nine of the 1963 Declaration of Principles, holds astronauts as envoys of mankind, who are to be given assistance in emergencies and are to be returned to the states are to inform the UN Secretary General of any phenomena found in space that may endanger astronauts. As with Article IV these points have been filled out by later agreement, in this case the Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, generally known as ARRA, which was adopted one year after the Outer Space Treaty.<sup>33</sup> Article VI and VII are partially

<sup>25</sup> L.B.Sohn, “The Definition of Aggression” (1959) page: 697—701; D.W.Bowett, *Self-defence in International Law* (Manchester: Manchester UP, 1958) Law Book Exchange, 2009. ‘Aggression’ was defined by UNGA Res. 3314 (XXIX) 14 December 1974. The first use of armed force is prima facie evidence of aggression though the Security Council may decide otherwise in a given instance (Art.2).

<sup>26</sup> Treaty on Principle Governing the Activities of States in the Exploration and Use of Outer Space Including the Moon and Other Celestial Bodies, London, Moscow and Washington, 27 January 1967.

<sup>27</sup> ‘International Cooperation in the Peaceful Uses of Outer Space’, 20 December 1961. ‘Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space’ (1964)

<sup>28</sup> Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space, and Under Water, Moscow, 5 August 1963, in force 10 October 1963.

<sup>29</sup> Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space.

<sup>30</sup> P.G. Dembling and D.M. Arons – 1. ‘The Evolution of the Outer Space Treaty’ (1957) 33 J Air L. And Comm. 432-56, P.G. Dembling ‘Principles Governing the Activities of States in the Exploration Use of Outer Space, including the Moon and Other Celestial Bodies’, I Manual 1-51; -2. Their ‘Space Law and United Nations Celestial Bodies Convention’ (1966).

<sup>31</sup> The discussion of the Moon Agreement in the Report, Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, Committee on Commerce, Science, and Transportation (US) 96<sup>th</sup> congress, 2<sup>nd</sup> session (Committee Print 1980).

<sup>32</sup> Agreement Governing the Activities of States on the Moon and other Celestial Bodies, 5 December 1979.

<sup>33</sup> Agreement on the Rescue of Astronauts, the Return on Astronauts and the Return of the Objects Launched into Outer space, 22 April 1969.

innovative and go together.<sup>34</sup> With this conventions and the agreements we come to know about the Space Law why it was needed and we also discussed about the articles which give us information about the danger of the outer space and its way of working.

With regards to the Outer Space treaty here we would to Summarize the Outer Space Treaty that the main intention of the treaty is the peaceful exploration of the outer space, it have been desiring that there should be international co operation and as well as mutual understanding between the countries, what they believe is that the outer space is a belong to realm of human kind and irrespective economic and scientific development and even while doing this there should be international co-operation and Multiple Understanding between the nations and at the last what should be inspired by is the fact that outer space should be common heritage of all mankind. As we speak about the aspect of the Outer Space Treaty, there should be interest of all the countries to do scientific investigation without any discrimination between the nations who are doing it. There should be use of the outer space with an occupation of the scientific investigation and for the purpose of the mankind but at the same time there should be not the claim of sovereignty for the outer space. As we talk about the International Law there should be peace and security and all the operations regarding the outer space should be done with the co-operation and mutual understanding. At the same time it also prohibits to carry the objects like weapons to the outer space or to create the military bases on moon ore any celestial body, or any installations and fortifications, the testing or any type of weapons and the conduct of military Manoeuvres which includes equipments or facility necessary of the exploration of the Outer Space. We can also say that this Astronauts Convention is deriving from this parent treaty of Outer Space Treaties because they say that Astronauts are agents of human kind and any accidents, distress or emergency landing is there then at that time the country which come to know about it first should provide all possible assistance to the Launching state in any phenomena as the Astronauts are said to be the agent of humankind. The Outer Space Treaty also talks about the Governmental or by Non-Governmental entities or any International Organisation if something happens then all of them are responsible because as we talk about the Governmental Organisation here we means that national space agencies and Non-Governmental Organisation we says for example:- Virgin Galactic and with the reference to the International Organization are those National Space agencies which come together and create the International Space Agency like European Space Agency, if any act done by them which should be not done then in such cases all of them are held responsible.

It also talks about the technicalities about the Launches or Procures the Launching with the addition of territory of Facility makes to the Internationally Liable for damages. It says about State and its Launching, State and its Procures and State as to provide facility. Regarding to State and its Launching it says that the state will construct its own launching vehicle and it will launch from its own territory, it say about the state procure that the nation will produce its launching vehicle but it will launch it from any other nations territory, and the other state as to launch it will provide facility to the launching state but if something goes wrong the there should be Internationally Liable for damages. Once again this Outer Space treaty is the base for the Liability convention which we are going to discuss further with the Astronauts Convention as well.

### **1.3 Astronauts Convention**

While discussing all the above conventions and agreements its important to take under consideration about the study about the Space Debris which have been created by the Space Shuttles and unfunctional space objects in the space these all convention talks about the peaceful exploration of the Outer Space and should be done with the International Co-operation as well. But are there any conventions related to any accident or damage which have been caused to the astronauts and the space shuttles which can provide liability to such damage which can provide remedies to such, because the danger posed by debris is only a part of the larger problem of environmental pollution, but it certainly is a major contributor, all the more so because the amount of debris in outer space is rapidly increasing, the importance of debris tracking activities cannot be overstressed, the damages caused by debris falling down to the earth, or by colliding in outer space with other space objects; and by interfering with telecommunications and remote sensing, debris may put both human life and active payloads at risk.<sup>35</sup> Examples of damage caused on the surface of the Earth are provided by Skylab which came down over Australia in July 1979, and the Cosmos 974 satellite which disintegrated over Australia in July 1978.<sup>36</sup> A collision case occurred when the Space Shuttle Challenger was hit by a tiny piece of paint, originating from a Delta rocket and measuring only 0.2 mm. in diameter.<sup>37</sup> As we have seen that the Astronauts are the

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<sup>34</sup> B. Cheng, ‘Article VI of the 1967 Space Treaty Revisited: “International Responsibility”, “National Activities”, and “The Appropriate State” (1998).

<sup>35</sup> I.H.Ph. Diederiks – Verschoor and V. Kopal, “AN INTRODUCTION TO SPACE LAW”, THIRD REVISED EDITION, Published by: Kluwer Law International BV, The Netherland, 2008.

<sup>36</sup> I.H.Ph. Diederiks – Verschoor, “Similarities with and differences between air and space law primarily in the field of private international law”, *Recueil des Cours*, Vol. 172, pp.349-350.

<sup>37</sup> He Qizhi, “Space and the Environment, in *Space Law—development and scope* (N. Jasentuliyana, ed), 1992, pp.159-174.

agents of the mankind and hence there should be certain steps must taken to save them therefore there have been a Convention has created related to the Astronauts.

Never before in the history of the United Nations has a request of the General Assembly to one of its Sub-Committee to prepare the text of a multipartite treaty been implemented with such alacrity as in the case of the 1968 Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space.<sup>38</sup> The Agreement was open for signature to ‘all states’ on 22 April 1968, simultaneously in London, Moscow, and Washington, and came into force on 3 December 1968, upon ratification by three depositary states.<sup>39</sup> As we look at the Preamble of the Astronauts agreement it say that Nothing the great importance of the treaty on Principles Governing the activities or states in the Exploration and Use of Outer Space, including the moon and other Celestial bodies, which calls for the rendering of all possible assistance to astronauts and the return of objects or emergence landing, the prompt and safe return of astronauts and the return of objects launched into the Outer Space, what this particular convention is Desiring is to develop and give further concrete expression to these duties. As well as it wishes to promote international co-operation in the peaceful exploration and use of outer space, and last but not the least it talks about the sentiments of humanity.<sup>40</sup> let’s look at this particular convention in an another way, it talks about if in case there is an Emergency landing or distress or any accident happens then in such case there should be International Co-operation between the states, when it talks about the International Co-operation there should be Concrete expression to astronauts conventions, all possible assistance to the astronauts should be given because as the astronauts are the agents of the human kind there should be the sentiments of humankind. That all possible assistance when we talk is that when any country comes to know about the accident have happened then it’s the responsibility of that country to Notify it, after Notification that country have to make Public announcement that such accident have been happen in its territory if then also none of the country comes forward the they will inform to the General Secretary on the United Nations.

### **2.3.1 Obligation of Contraction Parties**

As stated in the Convention regarding the Space Objects. The Obligations of contracting Parties in regard to objects launched into space are similar to, but less exacting than, those relating to astronauts. It also talks about Rescuing them and Launching authority and secretary general there should be co operation with the consultation and Direct and Control should be there. The definition of the Launching authority under Article 6 defines the launching authority as ‘the State responsible for Launching, or, where an intergovernmental organization is responsible for launching, that organisation, provide that that organisation declares its acceptance of the rights and obligations provided for in this agreement and a majority of the states members of that organisation are Contracting Parties to this Agreement’ and to the 1967 Space Treaty. What happens if the shuttle land in No-man’s land of High sea, then it’s the duty of the nation to know about the accident first that is Rescue state. Both Launching State and Rescue State should have Consultation that how they can give better rescue to the Astronauts. Then this Convention speaks about the Personnel of Space craft, within it comes search of rescue operation and with the launching authority and secretary general and regarding steps should be taken. When it comes to the receiving of the space object or space shuttle then there should be safely and promptly measures should be taken by the rescue states to return the objects to the launching state with regards to the accident and distress and emergency but within the jurisdiction. The rescue state should Identify the space object that whose it is and space object when fall will no jurisdiction the neighbour nation will take rescue having the jurisdiction no problem but when the identification data return should be registration state that is same as launching state. Lastly regarding to this Convention if something has fallen that is Hazardous material in the rescue nation so as nation what you will do you will take steps to notify and then suddenly steps should be taken to remove the Hazardous substance then at the last the final step should be taken is that that the rescue state should inform the secretary general and the public announcement and what every expenses have been occurred it should be recover from the Launching State.

## **1.4 Liability Convention**

The Final and the most important document regarding to United Nations Treaties on Outer Space, Astronauts and Space Object is the Liability Conventions which throws light on the term ‘space object’. It took the United Nations Committee on the Peaceful Uses of Outer Space nine years from 1962 to 1971 to produce an agreement on international liability for damage caused by the launching of objects into space. The text of the

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<sup>38</sup> Bin Cheng, “STUDIES IN INTERNATIONAL SPACE LAW”, Clarendon Press Oxford 1997, reprinted 2004.

<sup>39</sup> Resolution 2345 (XXII) adopted by 115 votes to none, with no abstentions, 47 States signed it that day. Signature not binding without retification.

<sup>40</sup> [http://www.unoosa.org/oosa/en/spacelaw/gares/html/gares22\\_2345.html](http://www.unoosa.org/oosa/en/spacelaw/gares/html/gares22_2345.html) 1968 AGREEMENT ON THE RESCUE OF ASTRONAUTS, THE RETURN OF ASTRONAUTS AND THE RETURN OD OBJECTS LAUNCHED INTO OUTER SPACE. Adopted in New York, the United States of America on 19 December 1967.



draft convention elaborated by its Legal Sub-Committee and transmitted by it to the General Assembly of the United Nations was in due course endorsed by the latter in its resolution 2777 (XXIV) on 29 November 1971, and opened for signature at London, Moscow, and Washington on 29 March 1972. Some States have acted upon this interpretation and made declarations accepting in advance the decision of the Claim Commission under the Convention as binding.<sup>41</sup>

Let's look at this particular convention as regarding to all Conventions this particular Convention of International Liability for Damages Caused by space object 1972, talks about the Common Interest of mankind it also give information of the precautionary measures as well as rules and procedures and its effectiveness and the prompt payment with there is also an international co-operation between the nations. This Convention speaks about the Absolute liability which can be categorized under fault or third state absolute liability and with the fault there is compensation to the fault. Lets us make it clear with an “Example: State I is the Launching State of the Space Object and has caused damage to the State II here the nature of damage either on earth's surface or the second part of damage is its done elsewhere on the earth's surface. If its on earth's surface its nature of absolute liability that means you have to pay compensation. When it is done elsewhere to earth's surface the launching state will be liable to any extent of fault regarding maintaining the object. If Launching state I + Launching state I (A) makes damages to the third party then there will be share for compensation between the Launching states. It also talks about the Claims for Indemnification, Financial Obligation and Participant means when two state make joint Venture to the Launching state and then they make some damage to third party then one party will pay the compensation to the damage state then that one party will ask for sharing the compensation to the another party at that time the claim for indemnification comes into existence, and financial obligation means to claim one who is the participant of the launching state.

It can come to our mind what could be done if the state who have been held liable for the paying of the compensation and if that particular state want to get rid of it then that state will blame the launching state, saying that due to their gross negligence the accident happened. What is Gross Negligence, when there is Gross Negligence at that time what happens and it could be No exoneration of the Launching state and with Not in Conformity let see. When the party who want to compensate, want to get free from paying the compensation then the party can say that its the gross negligence from the other party. There is some act or omission that the part of the party which have caused the loss they are responsible to response on the act. If it is prove then the compensate party should not pay the compensation. Once it is proved that there are act or omission its not my responsibility to pay you the compensation. When we talk about the term not in conformity at that time, ‘when to launch the satellite the launching state will not inform to the United Nation. Those nation launch there Space craft that launching is not in confirmative to United Nation and International Law.

When Convention shall not apply to nationals and foreign national means participating states in Launching? When there are two launching states they launch space craft and with the launching to state one state two suffers then this convention does not apply the state two to take the compensation under the Liability Convention but it can claim its compensation by going to the Government of the state one for the compensation. If foreign state will go to either to the Liability convention or to its Launching state tribunal court here the foreign national means participating states in launching states. When the claimant state fails to get the compensation the last option is to go to the Claim Commission.

Under this particular Convention who can claim for the compensation either state for its state nationality, State for its territory or State for its Permanent residents towards the Launching State even individually states can go for compensation or jointly go for the compensation to the Launching state. Even to claim the compensation what is the procedure, the procedure is that first it should go with the diplomatic relations means Ambassadors, the Ambassadors of the particular countries will take to each other of respective state. Second step is that if diplomatic relations are not there then you can go to those states which have diplomatic relations are there with the Launching state. Third thing they can do is that when there is no scope to have the compensation then at last you can go to the Secretary General.

When there have been made claim for compensation then within one year and not later than that there claim should be settled. But the question comes to our mind that from when there should be count of one year when the state does not know about the accident. Then in such case the date of occurrence should be taken into consideration when it is identified of the launching state. And when it could get the full extent of damages when claimant states revise the claim. If the claimant state does not prove the facts then at that time the claim for the compensation come to expiration. But how the claim has been decided? It could be decided by the International Scientific experts who are there to Judge the damages. There is no longer process for claim damage through local remedies you can go directly to the claim commission. Longer process here means claiming state go to the Launching state and it's going through local tribunals and courts they can directly go to the claim commission. When it comes to the International Law there are certain Principles of Justice and equity regarding these Justice and equity when a state asks for compensation and if the launching state is agree to pay the compensation then

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<sup>41</sup> Bin Cheng, “STUDIES IN INTERNATIONAL SPACE LAW”, Clarendon Press Oxford 1997, reprinted 2004.

that launching state should pay the compensation in the Currency of the Claimant State. If the claim is not settled then there is the responsibility of the Claim Commission to settle the dispute within one year.

How the Claim Commission is generated. The Claimant will appoint a Arbitrator and the other party means the launching state will appoint its Arbitrator they will appoint the Chairman of the Claim Commission. Once parties have given the case to claim commission then they will have the responsibility to solve the problem they will have six months to solve the problem if not then two more months are provided and if still there is no conclusion then they will ask the Secretary General for more two months, but the Claim Commission should come with the conclusion with the year. The day when the documentation is filed then the process will get started by the claim commission. If the condition arise that there are two launching states and there are more two claimant state then in such case two or more state they will decide one arbitrator they will decide the Chairman.

Is there any Single member Claim Commission. When claiming state have appointed one member arbitrator but the launching state had not appointed then that arbitrator will go to the secretary general and they will appoint a chairman of the claim commission then that chairman will go to the claimant state and then will go to the launching state for the settlement of the claim. What happens when is there any vacancy. When there will be such vacancy about means arbitrator quit of chairman quit there will be appointed a new chairman or the arbitrator and he will means new chair person and that new chairperson will start from where the old had stopped. Procedure to settle the claim is done when the appointment is done then what claim commission will procedure about argues, such will be decided by the claim commission. The time comes to decide that where should the process of settlement of claim should be done means place, it should be decided about where should be the place to pursue the claim. How the decision comes out, by majority of votes but the final decision will be of the Chairman. Hence when the judgement has been decided by the Chairperson, the compensation is made on the merit of claim and amount has been decided. There should be reasoned decision and that would be final and binding and recommendatory. Promptly no later the one year the decision should be made and if there should be an extension. The decision or the public award should be made general and even the secretary general of the United Nation should be known. All the expenses should be done by the parties.

At the end this Liability Convention, we would summarize as, when any danger or damage is happen to human kind then such convention plays a vital role, with also rendering appropriate and rapid assistance with rights and obligations. The last Obligation of the Liability Convention is the interlinks as International, Intergovernmental organisation, acceptance of the rights and obligations to states members of the organisation are states parties with all appropriate steps to held them liable and to get the damages whether it could be Jointly or Severally claim for compensation presented to the organisation with the Liability of the members.

## **1.5 Registration Convention**

The fifth Convention related to the Outer Space is the Registration Convention. Registration of space objects is largely catered for by the Convention on the Registration of Objects Launched into Outer Space of 1975.<sup>42</sup> When an object is launched into space, it should be registered on at least two of three registers. It should be entered on a register maintained by the state of launching as defined in the Registration Convention (Article I). In addition it should be entered on one of two register maintain by the UN Office for Outer Space Affairs (OOSA), the one a listing of launches provided to COPUOS under UN registration No. 1721 (XVI) 1961, and the other maintained in terms of the Registration Convention itself.<sup>43</sup> Internationally this last is the most important, allowing the identification of at least one of the entry is important for grounding responsibility, for ‘ownership’, for the exercise of control and in the worst case, for liability.<sup>44</sup> As we go through the Preamble of the Convention it say about the Common Interest International responsibility, registration of the space object, identifying data prior with international rules and procedure with also national registration, central register of objects. When we talk about the central register of object it gives the means and procedures and also makes aware about the mandatory system of registering objects. There should be a central register office means you have to register your object within your central registry. With this the register there should be give and take of the information of joint launching if done and with the content and conditions. Once the Registration have done then have to inform Secretary General of United Nations Joint Launching will provide the information and every possible detail have to submitted to the Secretary General on United Nation.

The basic information which has to be sent to the UN registry comprises (a) the name of the launching state or states; (b) an appropriate designator of the space object or its registration number; (c) the date and territory or location of the launch; (d) the basic orbital parameters including (1) the nodal period,<sup>45</sup> (2) the inclination,<sup>46</sup> (3)

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<sup>42</sup> Convention on the Registration of Objects Launched into Outer Space, 14 January 1975. C.M. Dalfen, “ Toward and International Convention on the Registration of Space Objects: The Gestation Process” (1971).

<sup>43</sup> Practice of States and International Organisation in Registering Space Objects: Background paper by the Secretariat (COPUOS) 2005.

<sup>44</sup> Francis Lyall and Paul B. Larsen, “Space Law A Treatise”, Published by: Ashgate Publishing Limited, 2009.

<sup>45</sup> How long the object takes to complete one orbit.

<sup>46</sup> The angle between the plane of the orbit and the plane of the ecliptic stated in degree, 90 degree being a polar orbit.

the apogee,<sup>47</sup> (4) the perigee<sup>48</sup> of the orbit; and (e) the general function of the space object. In addition, since a major purpose of the Registration Convention is the identification of a space object, Article V provides that, when a space object launched into Earth orbit or beyond is marked with a designator or registration number or both, the state of registry is to notify this datum to the Secretary General when submitting the basic information required under Article IV.I.<sup>49</sup>

Further to the Registration Convention it says that there should be full and access information should be provided by the nation who is doing registration of their object or their invention after they had done to their nation they are supposed to with the United Nations. As we have discussed above the information regarding the name of the launching party its registration number date and territory within the orbital parameter and general functions. Even Additional information should be given to the UN as well as the other nation because they are obliged to all of them because once they had sent the satellite and till what date it will function for that the regarding information should be given because if they do not give such information then such satellite when stop functioning can cause the damage to other space object which are functioning there by creating the debris, they have to give previously transmitted information that their satellite is no longer in the earth's orbit and shall record this notification to the UN, State Parties and Scientific Community as well.

When a contracting party receives information or discovers that a space object or its component parts has returned to Earth in its territory it is to notify the launching authority and the UN Secretary General (Article 5.1). The same applies if the returned object is discovered on the high seas or any other place not under the jurisdiction of a state. In the normal case if the object is in territory under its jurisdiction and at the request of the launching authority a contracting party is required to take such steps as it finds practicable to recover the object or parts (Article 5.2). There is no obligation to recover an object if the launching state does not so request, and what is practicable is for the finding state to determine. In a recovery operation the territorial state has discretion to ask for the assistance of the launching authority, but the launching authority has no power to intervene other than to make the request for the recovery (Article 5.2). Object found beyond the territorial limits of the launching authority are to be returned to or held at the disposal of the representatives of the launching authority (Article 5.3). If asked, the launching authority is required to provide identifying data prior to the return of the object or parts concerned. The expenses of recovery and return are to be borne by the launching authority (Article 5.5). Extraordinarily, the object or its component parts may be found to have hazardous or deleterious elements. In this instance the contracting party 'to eliminate possible danger or harm' (Article 5.4).<sup>50</sup>

At the end if we conclude the Registration Convention there should be Rights and Obligation of International Organisation it means different Nations who are the members of this convention, it is the duty of each and every State member to follow all appropriate steps regarding their rights and obligation regarding the duties of member states. There should be not like the Two Super Powers in the World like U.S and Russia, that U.S is always trying to prove that damages were caused to a U.S space object which have been registered on a register it maintain and also with the UN registry. It try to establish that Russia is the "Launching State" of the space object that caused the damage and therefore has ownership and control over the space debris. U.S is always in a run to prove that the damage was caused by the fault of Russia or the fault of private operator for whom Russia is responsible. So that should not be done.<sup>51</sup>

#### **IV. Legal Frameworks and International Initiative for Palliation of Space Debris**

This particular chapter focuses on the legal frameworks which have been created on the International level in Palliation of Space Debris. Protection of the Earth and Space Environment from Space Debris there have been certain Status Quo of International Legal Frameworks. In the principle, states are under the obligation to ensure that activities within their jurisdiction and control do not cause damage and they should respect the environment of the other state or of area control do not cause damage and should respect the environment of other states or of areas beyond their jurisdiction control. There must applicability towards the outer space with due regards principle and duty to avoid harmful contamination, Article IX of the Outer Space Treaty. Global public/community interest in Outer Space under Article II OST. Interrelation with General international law by

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<sup>47</sup> The high point of the orbit.

<sup>48</sup> The low point of the orbit.

<sup>49</sup> Article 6 of the 1959 "Project of an International Convention on Space Law" Article 6 would have required clear nationality markings on spacecraft.

<sup>50</sup> Prior to discovery of the debris to the Cosmos 954 incident, the Canadian authorities inquired of the USSR about the fuel the satellite carried. When notifying the USSR of the discovery of the debris on its territory Canada did refer to the Agreement of Rescue and Return of Astronauts. In due formal claim for compensation was made in terms of the Liability Convention. The USSR was not asked in terms of Article 5.5 of ARRA to take effective steps to eliminate the danger, perhaps because Canada and the US hoped to learn much from the debris.

<sup>51</sup> JOANNE WHEELER, "Space Debris-Legal Framework and Issues Arising", Royal Aeronautical Society, Space traffic Control, on 2, July 2013.

operation of Article III OST. Absolute minimum state obligation to prevent and minimize risks related to space debris.<sup>52</sup>

Orbital Space Debris represents a growing threat to the Operation of man-made objects in space.<sup>53</sup> According to Nick Johnson, the National Aeronautical and Space Administration's (NASA) chief scientist for orbital debris, “the current orbital debris environment poses a real, albeit low level, threat to operation of space craft” in both Low earth orbit (LEO) and Geosynchronous orbit (GEO).<sup>54</sup> Due to lack of concrete binding rules reflecting the “appropriate means” in the exercise of due diligence during the conduct of space activities. Space Debris as complex multi-dimensional problem (safety, security, economics/financial burden and liabilities as well as ethics) need for operational framework. There have been various Committees and subcommittees have been prepared which gives Guidelines related to the Mitigation of Space debris such as in the year 1993 there was a formal establishment of the (IADC) i.e. Inter Agency Space Debris Co-ordination Committee. As 1994 came the term space debris as formal agenda for Scientific and Technical Subcommittee (STSC). As the issues became more crucial related to space debris a Technical Report on Space Debris was submitted by STSC as (Rex Report) in 1999. In the year 2002 IADC Space Debris Mitigation Guidelines were submitted and which were further updated in 2007. In 2004 STSC starts developing own set of mitigation guidelines based inter alia upon with the use of technical content of and not be more technically stringent than IADC guidelines, which would be not be legally binding under international law, voluntary implementation, national mechanism, and a living document that could be updated regularly and that reference IADC.

### **3.1 U.S Guidelines for Definition of Space Debris**

Let's look at the content of US Guidelines (annex to UN doc. A/62/20), which goes with the definition of space debris as “as all man-made objects, including fragments and elements thereof, in Earth orbit of re-entering the atmosphere, that are non-functional”. The US Guidelines also talk about the mission planning and the operation of newly designed space craft and orbital stages and, if possible to existing ones. The scope of the UN Guidelines do not “outlaw” a certain type of space activities, it also provides guidance on how to conduct space activities in principle in order to prevent or at least to minimize harmful by-products of space activities. It does not address Remediation, space Traffic Management Awareness. As the part of to take the steps to mitigate the space debris which are released during normal operations. They certain measures so that space debris could be minimized as space systems should be designed not to release debris during normal operations to prevent the production of space debris even when undertaking space activities that are perfectly legal in general. If this is not feasible, the effect of any release of debris on the outer environment should be minimized if release cannot be prevented in its entirety the effects are to be minimized.

It also talks about to minimize the potential for break-ups during operational phases especially passivation. Limit the probability of accident 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 space craft and launch vehicle orbital stages in the low-Earth orbit (LEO) region after the end of their mission. Limit the long-term interference on space craft and launch vehicle orbital stages with geosynchronous earth orbit (GEO) region after the end of their mission.

### **3.2 United Nation Guidelines for mitigation of Space Debris**

There is also Legal Status of the UN Guidelines, such as Non-binding the implementation of space debris mitigation measures is recommended, with the member states and international organizations should voluntarily take measures, the UN Guidelines are not legally binding under international law. With the technical aspects of UN Guidelines there should be development within STSC, reference to IADC guidelines and based on the technical content to be updated in the light of new findings and research. A proposed Model Law on National Space Legislation, it speaks under Article 7 that there should be Protection of Environment as, Space activities shall not cause environmental damage to the earth and outer space of parts of it, directly or indirectly. An Environmental impact assessment is required before the beginning of a space activity, and details of the environmental impact assessment shall be laid down in an implementing decree/regulation. With this under Article 8 it talks about the Mitigation of space debris that any space activity shall avoid the production of space debris, with the obligation it includes the obligation to limit debris released during normal operations, to minimize the potential for on-orbit break-ups, to prepare for post mission disposal and to prevent on-orbit collisions in accordance with international space debris mitigation standards.

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<sup>52</sup> UNITED NATION TREATY AND PRINCIPLE on Outer Space. Text of treaties and principles governing the activities of states in exploration and use of outer space, adopted by the United Nation General Assembly.

<sup>53</sup> NASA defines orbital as “artificial objects, including derelict spacecraft and spent launch vehicle orbital stages, left in orbit which no longer serve a useful purpose”. (NASA) Handbook 8719. 14, 2008.

<sup>54</sup> <http://www.spacenews.com/article/nicholas-johnson-nasas-chief-scientist-orbital-debris> Debra Werner, “Profile-Nicholas Johnson, NASA's Chief Scientist for Orbital Debris”, May 10, 2010.

Inter Agency Space Debris Co-ordination Committee (IADC) is a committee which is giving guidelines related to the Space Debris Mitigation. According to its Preamble it talks about the exchange of information on space debris research activities between member space Agencies. So that they can facilitate opportunities for co-operation in research of space debris and to review progress of ongoing co-operative activities, and to identify debris mitigation options. Out of four IADC working groups, two are dedicated to exploring new and more effective mitigation technique. Their main three aspects which comprises within the mitigation of space debris is (i) Prevention of space debris (ii) Protection of space system against space debris (iii) Removal of space debris. With it they also speak about the current space debris environment is very risky for space mission. Without doing palliation of it future space operations will face an increasingly unfriendly environment. Its main and only objective is to reduce the space debris population for the benefit and the safety of human and earth orbital mission.

This Committee also talks about the Passivation of Space Object, here passivation means to reduce the chemical reactivity of a surface by applying a coating. This committee also give the theory of Passivation of space craft and launch vehicle upper stages requires the elimination of all forms of stored energy including residual propellants, including both main propulsion system and attitude control system or by residual pressurants, electrical energy kinetic energy and range safety exploration should be also disabled. They gives ways to prevent space debris they says that the main sources of space debris are space craft and rocket stages fragmentation to reduce it they says for passivation of space crafts and rockets stages at end of mission and also to avoid of international breakups debris in long-lived orbits. They adds approximately 12% of catalogued space debris are mission related objects for there prevention they talks to improve design of space crafts and rocket stages separation and stabilization devices. Worn and broken down space craft rockets stages is pose collision and debris are generated although unlikely, collisions may occurs between newly launched objects and resident space object.

They also gives measures to have protection from space debris, such as small space debris particles (<1 mm in diameter) which generates the risk to space craft sensors electrical cables, and fluid lines and space debris particles with the size of (1mm-1cm in diameter) may penetrate space craft walls and cause severe damage. For such possibility they suggest to nations who prepare space shuttles to locate sensors away from direction of highest space debris flux and place shields around them and to run electrical cables and fluid lines inside space craft walls or to place in conduits on exterior of space wall. The removal of space debris reduces the growth of the space debris population by orbit space craft and rocket stages at and of mission by propulsion systems or other means, orbital lifetime reduction by transfer to lower orbit, by use of natural perturbations (sun and moon) or by drag augmentation device, active removal by space vehicles, accelerate orbital decay for small as well as large space debris using advance technologies.

An (IADC) summary with their mitigation theory as mitigation of the earth space debris population is essential to keep hazardous for space operation within tolerable limits. In the future, however compliance with the full range of mitigation measures will be needed in order to avoid as uncontrolled growth of the debris population. The IADC promotes continued research into space debris mitigation options. But there have been various difficulties which are there inbuilt in the Regulation of space debris such as there have been no such specific definition have been given related to the object and space debris such as (satellite, screwdriver, particular fragments, or coke bottle?). Even there have been establishing causality of damage which is difficult as the origin of uncatalogued or particulate space debris is difficult to determine.

As we talk to the International Legal requirement to indentify the ownership of space debris who is responsible of the space debris, the launching of the object need to be registered, the object should be continuously tracked. And as when Proving fault of the responsibility of the launching state, there should be detected the fault liability presumes that a standard of care exists against which actions can be judged, but no mandatory international standard to establish standard of care against which fault can be assessed. There should be mandatory measures lead to an increase in the cost of space activities with the international solution only achieved after harmonised regulations to avoid unfair competition. Hence International solution must be based on “level playing field”.<sup>55</sup>

Let us summaries Palliation Measures which have been provided by the Current Guidelines. There must be legal certainty which have been required to the binding of International Law and a level playing field. What could be the next best solution for this guidelines which have been accepted by international community. As discussed from (IADC) the Inter Agency Space Debris Co-ordination Committee. They comes with the three main principle with drafts space debris mitigation guidelines, (1) Prevention of orbital breakups (2) the removal of end of mission space craft and orbital stages (3) limitation of objects released during normal space operations. According to the UN Scientific and Technical Committee-working on the space debris says, as space debris Mitigation Guidelines of the Scientific and technical subcommittee of the Committee on the Peaceful use of Outer space, they gives such voluntary measures applicable to mission planning and the operation of newly

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<sup>55</sup> JOANNE WHEELER, “Space debris-Legal Framework and Issues Arising”, Royal Aeronautical Society, Space traffic Control, 2 ,July 2013.

designed spacecraft, with that they also discuss to be implemented by UN Member states through their own mechanisms.

With the Network of Centres Space Debris Co-ordination Group. The European Code of conduct for space debris mitigation, they speaks on policy statement containing general guidelines and voluntary measures and intended to be used practically by range of industry players. The Handbook of European space Agency, space debris mitigations says about Non-binding documents providing technical information in support of European debris mitigation standards. The International Organization for Standardization (ISO), talks about the Responsibility for transformation of debris mitigation guidelines such as (IADC, UN, ITU) into high level debris mitigation requirements, methods and processes and lower level implementation standards to ensure incorporation into engineering practice. The ISO 24113 on space debris systems, space debris mitigation requirements, it talks about primary space debris mitigation requirements applicable to technical requirements covering avoiding intention release of space debris, avoiding breakups in Earth Orbit, and removing space craft from protected regions after end of missions.

There have been legal Issues related to the active debris removal have been raised. New Space craft Launched to remove defunct satellite and other debris from orbit. As we talk about the Main issues Article VIII of the Outer Space Treaty, “Ownership of objects Launched into Outer Space.... or of their components parts, is not affected by their presence in outer space”.<sup>56</sup> A space object or space debris remains owned by its launching states, another state or private entity would require consent before touching the interfering with removing the space debris. Ownership would need to be identified and provide consent. Other legal and regulatory issues such as Mechanisms require detailed technical information to allow docking and removal impact on IP, Patents, Confidentially, and export control and ITAR issues concerns over surveillance activities, liabilities issues originally launching state remains liable for damages caused during deorbit, and agreements required between the “remover” and the original launching state.

## **V. Future Impact and Remedies**

As a result of 50 years of space flight, the useful orbits around earth are littered with derelict satellite, burnt out rocket stages, discarded trash and other debris. This particular chapter talks about the future impact, remedies and conclusion related to space debris and in suggestions some elements which need to be more focused on while enacting new ways to mitigation of space debris also to make familiar to the future impact if the initiative steps have not taken to remove such space debris.

“A burgeoning blizzard of space debris is going to have a major impact on the future economics of space flight”. That was the prediction made by Hugh Lewis of the University of Southampton, UK, at the European Air and Space Conference, in Manchester.<sup>57</sup> This kind of projection can indicate that the numbers of close encounters between the space objects in the space will be double in the next decade and four times more in 2059. He also added in his saying in his report that, if the counter measures have been taken then it will add greatly to the cost of future mission. The orbit of the earth have been used as a Space dump yard as satellites operations have been done and dumping of the space craft’s have also been increased in orbit since the Soviet Union Launched Sputnik 1 in 1957. When the space agencies started getting heavy exposes to the cost of their space craft having collision with the space debris or having the feel of danger, from there these space agencies have tried not to add to the junk mountain, but there have been some cases came out that these space agencies have created space debris. In 2007, the Chinese army used a missile to destroy a defunct weather satellite<sup>58</sup>, it was just 6 feet long object and it was there in the space for last seven years, and earlier in year 2009 an Iridium communications satellite collides with a derelict Russian vehicle<sup>59</sup> in this case the there was a collision between U.S. and Russian Communication satellites, it happen over 800 kilometre over the Siberia, one communication satellite was a derelict space craft from Russia and another was a working satellite from U.S. Both events added many thousands of debris remains to near Earth orbit.

There was an incident which horrifies the earth and its people, when there were six astronauts were awoken early and scrambled into escape capsule. NASA ground control had spotted a piece of space debris hurtling towards their temporary home aboard the International Space Station 244 miles (390 KM) above the Earth. The Fastest moving Junk was spotted just one day before its potential impact, making it too late to manoeuvre the station to a safer orbit. The only course of action for the three Russian, two Americans and one Dutch astronauts crew to take shelter and prepare to evacuate it required. In the event, the debris, a chunk of defunct military communications satellite, missed by the ISS by approximately 7.5 miles (12Km). The Incident, in March, 2012

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<sup>56</sup> <http://www.unoosa.org/pdf/publications/STSPACE11E.pdf> United Nation Treaties and Principle on Outer Space.

<sup>57</sup> [www.newscientist.com/article/dn18050-space-debris-threat-to-future-launches.html#U1V2EVA3DJY](http://www.newscientist.com/article/dn18050-space-debris-threat-to-future-launches.html#U1V2EVA3DJY) PAUL MARKS, “Space debris threat to future Launches”, 27 October 2009.

<sup>58</sup> Carl Hoffman, “China’s Space Threat: How Missiles could Target U.S. Satellites”.  
<http://www.popularmechanics.com/technology/military/satellites/4218443>

<sup>59</sup> Douglas Brich and Vladimir Isachenkov, Associated Press Writers, “Crash of U.S., Russian satellites a threat in space”.

was the latest close shave for the space station. Six other crew members had to take shelter in June last year, when another piece of junk whistled just 1,000 feet (335 meters) past the station. Again it was precautionary measures; however NASA estimate that anything larger than a baseball poses a potentially catastrophic threat to the ISS. It's a problem that is getting rapidly worse, US Air Force Space Command is tracking around 22,000 piece of man-made space debris, mostly bigger than 10 cm across, and there are estimated to be hundreds of thousands more smaller bits.<sup>60</sup>

Summary of legal Issues Raised by recent examples (1) Collision of Pegasus with particular debris from Soviet rocket Particulate debris is normally harder to identify as certain the owner of and therefore to establish the fault of launching states.<sup>61</sup> (2) The re-entry of NASA's UARS satellite and Germany's ROSAT satellite, in relation to damage caused to the surface of the Earth by space debris, the Liability of the Launching state is absolute and such state must pay compensation for damage caused by the space debris (Liability Convention, Article II), any space debris found on the earth, outside the jurisdiction of the state on whose registry the object is carried, is to be returned to that state (Outer Space Treaty, Article VIII).<sup>62</sup> (3) The destruction of an orbiting weather satellite by china. Unlikely that China can be said to be conducting its activities with due regard to the corresponding interests of other states. "Fault" may be easier to establish long term in relation to at least the larger piece of debris caused by this intentional destruction.<sup>63</sup> (4) ERS-1 and Envisat, and their possible removal from orbit. The ERS-1 and Envisat satellites can be tracked but cannot be controlled. Therefore, no action can be taken to manoeuvre them off a possible collision course. These satellites are the subjects of discussion as to their active removal.<sup>64</sup> (5) The Collision of two intact space craft: the US Iridium 33 and Cosmos 2251, a decommissioned Russian Satellite, Cosmos 2251 was non-maneuvrable space debris, no clear guidance as to whether.<sup>65</sup>

Russian was responsible for not deorbiting the satellite or moving into a graveyard orbit, the US were liable for not tracking Cosmos 2251 and Manoeuvring Iridium 33 to avoid collision. Under International law, Russian did not have the express obligation to dispose of Cosmos 2251 after the end of its operational life and the US did not have the express obligation to take actions to avoid the collision. Now we can say that everyone wants to use the outer space and with related to all the conventions that there should be a peaceful settlement of dispute and so on, but still what can assume? Whether the defaulter is US or Russia liable for all the damages caused by the space debris which have been created by the Collision. We can say that both the nations should be held liable for such negligence and both should be given warning that such things should not happen next time.

In September 2012, the US, Space Surveillance network tracked about 23,000 orbiting objects larger than 2-4 inches (5-10 centimetres), by extrapolation it is estimated that there could be a total of 7,50,000 orbiting objects larger than 0.4 inch (1 cm)<sup>66</sup>, the majority of catalogued objects (65 percent) result from a Chinese anti Satellite test in 2007, and the accidental collision of two satellites in 2009, when objects in different orbits intersect, the collision takes place at a speed of thousands of miles per hour, there have been some recent proposal plans have been promoted over the years for various means of removing debris around the earth, (1) DARPA's (Defence Advance Research Project Agency) Phoenix—A robotic servicer space craft would chase down derelict satellites and harvest still usable hardware, such as a dish antenna. The servicer attaches a module that allows the salvaged part to be used for a new mission Phoenix is a project of the United States defence Advanced Research Projects Agency.<sup>67</sup> (2) Clean Space One— A robotic janitor space craft is launched into orbit from an airplane. The janitor chases down a target satellite, grapples it, and then plunges back into the earth's atmosphere, destroying itself along with the derelict satellite Clean Space One is a project of the Swiss Ecole Polytechnique Federale de Lausanne (EPFL)<sup>68</sup> Swiss Federal Institute of Technology Lausanne, Switzerland, it will launch in 2018 using a three stage process involving a A300 jetliner. (3) Earth based Lasers<sup>69</sup>— A ground-

<sup>60</sup> [www.bbc.com/future/story/2012051-danger-space-junk-alert](http://www.bbc.com/future/story/2012051-danger-space-junk-alert) SHARON WEINBERGER, "Space Junk: why it is time to clean up the skies", 18 may 2012.

<sup>61</sup> <http://www.satellitetoday.com/publications/st/curated/2013/05/23/ecuadors-first-satellite-crashes-with-russian-rocket-debris/> VERONICA MAGAN, "Ecuador's first Satellite crashes with Russian Rocket debris", May 23, 2013, Curated content, Government.

<sup>62</sup> <http://www.thespacereview.com/article/1948/1> MICHAEL LISTNER, "Revisiting the Liability Convention: reflections on ROSAT orbital space debris, and the future of space law", October 17,2011.

<sup>63</sup> <http://defensetech.org/2013/10/03/chinese-satellite-grabs-another-in-orbit/> BRENDAN MCGARRY, "Chinese Satellite Grabs Another in Orbit", October 3, 2013.

<sup>64</sup> <http://www.bbc.co.uk/news/science-environment-22299403> JONATHAN AMOS, "Urgent Need' to remove space debris", Science correspondence, BBC News, April 25, 2013.

<sup>65</sup> [http://archive.org/stream/Wolfgang\\_Rathgeber\\_Kai-Uwe\\_Schrogl\\_Ray\\_A.\\_Williamson\\_The\\_Fair\\_and\\_Responsible](http://archive.org/stream/Wolfgang_Rathgeber_Kai-Uwe_Schrogl_Ray_A._Williamson_The_Fair_and_Responsible) WOLFGANG RATHGEBER, KAI-UWE SCHROGL, RAY A. WILLIAMSON, "The Fair and Responsible use of Space". 2010 Springer-Verlog Avien, printed in Germany.

<sup>66</sup> RSSPUMP NEWS, "Space Junk Explained: How orbital debris Threatens Future of Space Flight". <http://larger-than-four-inches.rsspump.com/?key=2013100221346d.space-junk-explained-orbital-debris>

<sup>67</sup> Graham Warwick, "DARPA's Phoenix Would Harvest Dead Satellite", Aviation Week, February 1, 2013. [www.aviationweek.com](http://www.aviationweek.com)

<sup>68</sup> Ellie Zolfagharifard, "The 'hoover' on a mission to clear up space: Clean Space One will sweep up 370,000 pieces of junk orbiting the planet. <http://www.dailymail.co.uk/sciencetech/article-2429933>

<sup>69</sup> Charles Q. Choi, SPACE.com Contributor, "Earth-based Lasers Could Zap Space Junk Clear from Satellites", March 17, 2011. <http://www.space.com/11157-nasa-lasers-shooting-space-junk.html>

based laser could de-orbit space debris by robbing it of a bit of the momentum it needs to continue orbiting the earth light exerts pressure, so to de-orbit an object such as the discarded ASTRO-E Satellite Lens cap- 31 inches (80 centimetres) wide and 11 pounds (5 kilo grams) in mass a laser beam of about 5 to 10 kilo watts would be shined upon it for about two hours.<sup>70</sup>

#### **4.1 European Space Agency**

As we look at the European Space Agency have accelerates space debris research and development they talk about the Satellite operators worldwide, including those flying telecom, weather, navigation, broadcast and climate-monitoring missions, are now focusing their efforts on controlling space debris, the climate goal is to prevent a cascade of self-sustaining collision from setting in over the next few decades, ESA as a space technology and operations agency, has identify the development of active removal technologies as a strategic goal, a number of Long-standing space debris-related research activities are being reinforced our understanding of the debris environment and its evolution using novel, sensitive measurements and improved modelling of debris sources, the new clean space initiative includes maturing technology to approach, capture and de-orbit targets a mission is already under study, Clean space will also develop techniques to mitigate the problem, such as passive and active clear orbiting devices and the means to passivate retrying satellites.<sup>71</sup>

#### **4.2 American Space Agency (NASA)**

NASA talks differently on removing the space junk from the space. Space is filling up with trash, and its time to clean it up, NASA experts warn. A Growing amount of human-made debris from rocket stages and obsolete satellite to blown off hatches and insulation is circling the earth, Scientists say that orbital debris, better known as space junk, poses an increasing threat to space activities, including Robotic Mission and human space flight, “This is a growing environmental problem”, said by Nicholas Johnson, the chief Scientist and program manager for orbital debris at NASA in Houston, Texas. Johnson and his team have devised a computer model capable of simulating past and future amounts to space junk, the model predicts that even without future rocket or satellite launches, the amount of debris in Low orbit around Earth will remain steady through 2055, after which it will increase, while current efforts have focused on limiting future space junk, the scientists say removing large piece of old junk will soon be necessary.<sup>72</sup>

### **VI. Conclusion**

As we have seen space debris has become the crucial topic in the recent years as well as a topic of great concern. It could be understood that the space debris creation cannot be stopped completely but by adopting various measures could be taken to minimize space debris. As we have gone through many methods of space debris mitigation have been proposed earlier by many space experts, but some of them have limitation in them, but with some modification to those plans or measures it can be proved beneficial in the process of space debris mitigation, some new methods we have proposed including (1)DARPA’s Phoenix is Defence Advance Research Project Agency of United States defence department, which is only looking at the reduction of cost and risk of Launching communication satellites into earth’s orbit by instead removing and revising antennas from retired spacecrafts from the space, but the question comes to our mind is that what about the other parts of the space craft? (2)Clean Space One is the concept which is think is the one of the recommended way to remove the space debris for the Outer space of the Earth, as this particular satellite will throw debris into Earth’s atmosphere to burns up on re-entry, ok it could be thought that this could be happen when this so called Clean Space One will be Launched in 2018 using a three stage process involving a A300 jetliner, but is there a possibility that once the debris are thrown in the earth’s orbit will burn? (3)Earth based Lasers have been suggested by those scientist who work in NASA they talk about the Lasers which could be installed on the ground and it could be used to push debris in orbit, which could help move dangerous space junk away from satellites and space crafts, could you think this could be the solution?

We have already polluted our planet Earth, we should take care and ensure that the space should be kept least polluted for our safe exploration of outer space and with the same interest for our coming Generations also. And not for the aliens from the other plants because they does not exist.

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<sup>70</sup> [www.space.com](http://www.space.com) KARL TALE, “Space Junk Explained: How orbital Debris Threatens Future of space fight”, Infographics Artist.

<sup>71</sup> [www.esa.in](http://www.esa.in) Space Debris, “Global Expert Agree action needed on space debris”, European Space Agency, April 25, 2013.

<sup>72</sup> [www.nationalgeographic.co.in](http://www.nationalgeographic.co.in) STEFAN LOVGREN, “Space Junk Cleanup Needed, NASA Expert Warn”, for National Geographic News, January 19, 2006.



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