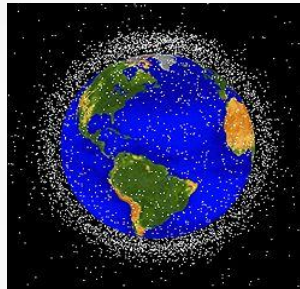


**THE IV AFRICAN LEADERSHIP CONFERENCE ON SPACE SCIENCE AND  
TECHNOLOGY FOR SUSTAINABLE DEVELOPMENT (ALC)**  
*Mombasa, KENYA*

**Session 10: Space Technology and Space Law**  
*28th September, 2011*



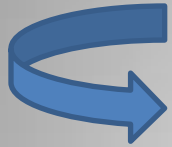
**SPACE DEBRIS MITIGATION AND SPACE LAW**

***Sergio Marchisio***

University Sapienza of Rome  
European Center for Space Law (ECSL) -Chairman

## DEFINITION AND SOURCES OF SPACE DEBRIS

**Space debris: all man-made objects, including fragments and elements thereof, in Earth orbit or re-entering the atmosphere, that are non functional (IADC Guidelines, 2002).**

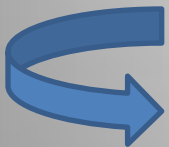


- ❖ COLLISION/FRAGMENTATION IN SPACE
- ❖ RE-ENTRY TO THE EARTH'S ATMOSPHERE
- ❖ DELIBERATE DESTRUCTION OF SATELLITES

### *Estimations*

- ✓ Over 22,000 objects larger than 10 cm in outer space.
- ✓ Only about 1,000 of these represent operational spacecraft; the rest are orbital debris.
- ✓ particles smaller than 1 cm probably exceeds tens of millions

### ➤ IMPACT, RISKS AND THREATS POSES BY SPACE DEBRIS



- ❖ DAMAGES IN OUTER SPACE AND LOSS OF SPACE OBJECTS.
- ❖ DAMAGES TO HUMANS ON THE SURFACE OF THE EARTH AND ENVIRONMENTAL POLLUTION.
- ❖ SIDE COLLATERAL EFFECTS.

## SOME CASES OF PRACTICE

- ❖ **07/24/1996: CERISE.** Disintegration of French micro-Satellite;
- ❖ **02/10/2009:** collision in low - Earth orbit between an inactive Russian Cosmos – 2251 satellite and an active US commercial Iridium - 33 satellite;
- ❖ **07/13/2011:** fragments of space debris perilously close to colliding with the ISS, prompting its crew to seek temporary refuge in Russian craft.
- ❖ **09/23/2011:** re-entry of the Upper Atmosphere Research Satellite (UARS) from orbit. UARS entered in orbit on September 15, 1991 with the mission to collect data on Earth's atmosphere and its interactions with the Sun; the Satellite ceased operations on December 14, 2005.

## SPACE DEBRIS MITIGATION MEASURES CATEGORIES

**MITIGATION:** Reduction of the rate at which new pieces of space debris are generated during the conduct of space activities.

- **NEAR TERM MEASURES TO CURTAIL THE GENERATION OF POTENTIALLY HARMFUL SPACE DEBRIS**
  - **Curtailment of the production of mission-related space debris;**
  - **Avoidance of break-ups;**
  
- **LONG TERM MEASURES TO LIMIT THE GENERATION OF SPACE DEBRIS:**
  - **Removal of non functional space object;**
  - **Removal of launch vehicle stages from regions populated by operational spacecraft.**

## SPACE DEBRIS: LEGAL ASPECTS

- ❖ *Is a legal definition of space debris needed?*
  - **Description *vr.* definition**
- ❖ *Are space debris “space objects” in the meaning of the UN Treaties?*
  - **1972 LIAB Convention, art. 1, lett. d; 1975 REG Convention, art. 1, lett. b.**
- ❖ *Or of the technical rules?*
  - **IADC Space Debris Mitigation Guidelines, 2002 (updated 2007);**
  - **European Code of Conduct for Space Debris Mitigation (2007);**
  - **COPUOS: Space Debris Mitigation Guidelines (2007) endorsed by UNGA Resolution 62/217 of 21 December 2007.**

*“For the purpose of this document, space debris is defined as all man-made objects, including fragments and elements thereof, in Earth orbit or re-entering the atmosphere, that are non functional”.*

# SPACE DEBRIS AND UN OUTER SPACE TREATIES

## ➤ 1967 UN OUTER SPACE TREATY:

Space Debris are against the fundamental principles of the OST.

### Article I

- *Outer Space as Res communis omnium;*
- *Freedom of exploration and use;*
- *Right of free access to all parts of outer space and celestial bodies.*

### Article IX

- *Principles of ‘cooperation’ and ‘mutual assistance’; ‘due regard’; ‘corresponding interests’.*
- *The protection of outer space environment*
  - *No harmful contamination of outer space*

## ➤ **Inter-relation with international environmental law**

- *Duty of preventive action and due diligence in outer space.*
- **Principle 2 of the 1992 Rio Declaration on Environment and Development (outer space is an area beyond national jurisdiction).**

**Advisory opinion of the ICJ (1996) on the Legality of the Threat or Use of Nuclear Weapons:**

*‘the existence of a general obligation of States to ensure that activities within their jurisdiction and control respect the environment of other States or of areas beyond national jurisdiction is now part of the corpus of international law relating to the environment.’*

➤ **ARRA CONVENTION (1968):**

Article 5: *Return of space objects.*

➤ **LIAB Convention (1972):** *Damages in the meaning of the Convention can be produced by space debris.*

➤ **REG Convention (1975):** *inclusion in the UN Register information on the space objects; tracking space debris.*



<http://www.orbitaldebris.jsc.nasa.gov/photogallery/beehives.html#leo>

Article 4, para. 3: *Notification of space objects.*



**Best practices:** on 29 April 2003 the Italian BeppoSax minisatellite crashed harmlessly into the Pacific Ocean, following a procedure of impact assessment and voluntary notification to potentially affected States.

Article 6: *Identification of objects that caused damage to a State Party or its nationals or juridical persons or which may be of a hazardous or deleterious nature.*

## TECHNICAL STANDARDS AND RULES/SOFT LAW

- European Space Debris Safety and Mitigation Standard issued by ESA (2002);
- IADC Space Debris Mitigation Guidelines (2002);
- European Code of Conduct for Space Debris Mitigation adopted by ASI, BNSC, CNES and ESA (2007);



### Fundamental Mitigation and Safety Measures:

- *Management Measures;*
  - *Design Measures;*
  - *Operational Measures.*
- Space Debris Mitigation Guidelines (UNGA Res. 62/217 of 21 December 2007).



### 7 Guidelines:

- *Limit debris released during normal operations;*
- *Minimize potential for break-ups during operational phases;*
- *Limit the probability of accidental collision in orbit;*
- *Avoid international destruction and other harmful activities;*
- *Minimize potential for post-mission break-ups resulting from stored energy;*
- *Limit the long-term presence of spacecraft and launch vehicle orbital stages in LEO after the end of their mission;*
- *Limit the long-term interference of spacecraft and launch vehicle orbital stages with GEO region after the end of their mission.*



## SPACE NATIONAL LEGISLATION

- **UK Outer Space Act (1986), Article 5: Authorization of Space Activities conditioned**
  - ❖ to prevent the contamination of outer space or adverse changes in the environment of the earth; to avoid interference with the activities of others in the peaceful exploration and use of outer space.

## NATIONAL PRACTICES ON SPACE DEBRIS

- **Policy to Limit Orbital Debris Generation, NASA Program Directives (1997);**
- **US Government Orbital Debris Mitigation Standard Practices (December 2000);**
- **Policy Directives for Limiting Orbital Debris generation- US Space Debris Environment and Policy Updates (2005).**
- **Russia: Space Technology Items General Requirements for Mitigation of Space Debris Population (Federal Space Agency Standard, 2000);**
- **National Standard on Space Debris Mitigation;**

## OPEN LEGAL ISSUES

- **The access to database on space debris for all countries without discrimination;**
- **The responsibility and liability for accidents involving space debris, in case the ownership of the space debris is established to a particular launching state;**
- **The responsibility for the damages to the victims in case the ownership of the debris involved cannot be explicitly established. Some authors proposed setting-up of a “Compensation Fund”.**

## **FURTHER STEPS**

- **Since 2008, is in the agenda of the LSC COPUOS a new item concerning international cooperation and information sharing (Exchange of information on national regulatory measures to mitigate space debris and voluntary implementation of the COPUOS Guidelines).**
- **Active Space debris remediation and development of related technologies (Ground-Based Lasers, Solar sail arrays, and so on).**
- **Safety of critical assets in outer space (SSA).**
- **Draft Code of Conduct for Outer Space Activities proposed by the EU.**
- **A new legal instruments on space debris, set of principles, convention, protocol?**

## FOR FURTHER INFORMATION

- <http://www.oosa.unvienna.org/>
- <http://www.esa.int/SPECIALS/ECSL/>
- <http://www.iislweb.org/>
- <http://www.isgi.cnr.it>