

# MANAGEMENT ISSUES CONCERNING SPACE DEBRIS

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## ABSTRACT

The time has not yet come to propose a full legal treatment of space debris. Some issues, however, can be tackled at present with a view to alleviate risks posed by the growing amount of space debris:

(a) Definition of space debris.

After ten years of discussing space debris in the United Nations we still have no legal definition of space debris.

(b) Registration of space debris

Active objects should be registered and kept on the registries even after they terminated their activities.

(c) Protection of space debris by space law.

Provisions in space law protect space debris thus making their de-orbiting by third parties difficult. Consequently, research on removing debris from orbit is discouraged.

## 1. INTRODUCTION

Space debris is a phenomenon which existed from the beginning of the space era but its significance for space activities, in particular the risk of close encounters or collisions with active satellites, has been realized much later. At first, the expanse of outer space was considered sufficient to make the probability of an encounter negligible.

Space debris have not escaped the attention of individual researchers but the general recognition of the problem came with authoritative studies, such as the report by the European Space Agency (ESA SP-1109, 1988), or the Report on Orbital Debris by the Interagency Group (Report 1989), or the

background paper Orbiting Debris (1990) by the United States Congress. At that time it was too late for space debris to be included into one of the treaties.

Space Law developed rapidly in the 1960s with a high speed in the beginning but markedly slowing down with time. The first and most important, the Outer Space Treaty entered into force in 1967 and by 2004 had 125 ratifications or signatures by states. It was followed by the Agreement on the Rescue and Return of Astronauts of 1968 with 112 state parties, by the Liability Convention in 1972 with 106 parties, by the Registration Convention in 1975 with 48 parties and finally by the Moon Treaty in 1979 with 14 state parties. No space law treaty has been adopted since 1979. Instead, the UN Committee on the Peaceful Uses of Outer Space (COPUOS) turned to adopting principles on several topics, such as on direct TV broadcasting in 1982, on remote sensing in 1986, on nuclear power sources on board spacecraft in 1992, and on international cooperation in 1996. The principles are not obligations but recommendations. Their voluntary adoption and implementation by all users of space is, however, expected.

A still weaker "instrument", if it can be so called, was for the COPUOS to express its agreed opinion on a subject matter without declaring it as a recommendation. As an example, at its session in 2001 (A/56/20), the committee expressed as its agreed opinion the statement that the Geostationary Orbit, characterized by its special properties, is part of outer space. This was supposed to end a disagreement which adversely affected discussions on the GEO since about 1976.

Expecting that a comprehensive treaty on space debris would be adopted any time soon is overly optimistic after ten years of discussions of space debris in the

Scientific and Technical Subcommittee and still no consensus on starting discussions in the Legal Subcommittee. Moreover, the trend in COPUOS instruments has to be taken in account, too. More modest solutions, such as an adoption of recommended guidelines or of an agreed opinion are, let us hope, within possibilities. These possibilities are examined below.

## **2. DEFINITION OF SPACE DEBRIS**

Definition of space debris is not a trivial problem. The launching state has, according to the Outer Space Treaty, control and jurisdiction over objects it launched. This implies that only the launching state is entitled to determine the functional status of the object. A casual observer may come to the conclusion that an object is inactive but the launching state may know better. The object may exhibit no activities at a certain time because it is in reserve for future activities, or because it is part of a specific scientific program, or because it is of value or interest to its launching state. It may, e.g., carry technical or military classified information which the launching state has no intention of divulging.

The distinction between active and inactive space objects is not quite appropriate. It would be preferable to distinguish between objects which are valuable assets to the launching state and those which have no value or interest to the launching state, or, for that matter, to its subsequent owner or operator.

The purely technical definition of space debris as inactive objects with no hope of restoring activities is correct but not sufficient without stating how and by whom the functional status is made known. A legal formulation of these facts has to be left in the hands of lawyers. If no agreement on a legal instrument can be reached, possibly a statement of an agreed opinion of the COPUOS could serve the purpose.

## **3. REGISTRATION OF SPACE DEBRIS**

There is a way, how the launching state can make the functional status of its space objects known. It can use the practice of registering launchings in its national register and in the UN Registry of Objects Launched into Outer Space. It is the Registration Convention which imposes these obligations on all

states which are parties to that treaty. At present, 48 states are parties to that treaty, among them practically all states which launched space objects. The Convention provides the possibility to launching states to make additional announcements on their space objects whenever they deem it necessary. It would be sufficient, without the necessity to conclude a new international treaty, if leading launching states informally agreed that they would voluntarily provide to the UN the information that an object became space debris at a certain date, and that from that date onwards the launching state has no interest in that object while, of course, retaining the liability for possible damages.

There is a precedent for such practice. Eleven leading space agencies established several years ago an Inter-Agency Space Debris Coordinating Committee (IADC) for elaborating guidelines for restricting the generation of new debris during the launching and operational phase. These guidelines are now before the Scientific and Technical Subcommittee of the UN. It can be expected that the guidelines will be universally adopted and would thus be a substitute, for practical purposes, for an obligatory international treaty.

The IADC, or a similar committee of representatives of space agencies, could take up the question of announcing the functional status of space objects to the UN and develop guidelines for that practice. Now is a convenient time because the UN Legal Subcommittee has on its agenda an item on improving the practice of registering space objects.

Practices of registering contain quite a few scientific and technical aspects and the Legal Subcommittee will need in this respect extensive support. Let us hope that the success of the IADC will be emulated and an inter-agency committee with representatives of leading national space agencies will be established. It could be named the Inter-Agency Coordinating Committee for Registration Practices, IARP, and its mandate could be extended beyond space debris, to dealing with all rational registration practices.

There are other problems connected with the registration of space debris. Large objects, such as payloads which terminated their activities, or rocket bodies and stages which were active during the launch phase only, have to be treated and catalogued individually. They have masses up to several tons. It would be convenient to keep these large objects in the national registers as well as in the UN register. On the other hand, small objects have to be treated summarily because of their large number. Moreover, objects

below the limit of detection are unknown, yet dangerous at close encounters. One of the tasks of the IARP, if and when it is established, would be to set a limit between large and small debris, introducing specific terms. Small debris could be called for instance fragments, because mostly they are the results of explosions and breakups. Trackable fragments can be identified, and tracked to their origin, by their orbital elements. Their lists should not make the national and the UN registers unwieldy. More convenient for that purpose would be publications containing updated orbital elements and their changes with time, such as the NASA Two-Line Elements.

The IARP conclusions could be considered by the COPUOS and/or its Subcommittees and adopted as recommended guidelines in anticipation that these will be followed by space agencies represented in the IARP and with the hope that their adoption will become universal.

#### **4. PROTECTION OF SPACE DEBRIS BY SPACE LAW**

Unless a definition of space debris has been adopted, the question remains whether or not space debris are space objects in the sense of space law. Some authorities are of the opinion that space debris are space objects in the legal sense because they are just space objects or parts of space objects which are no longer considered as valuable assets, mostly because they are not in a state to perform their intended activities. Other, equally prominent authorities are of an opposite opinion. They maintain that space objects are launched in order to perform certain tasks. If they stopped performing activities they are no longer space objects because nobody has the intention to launch space debris.

In this context it is of interest to recall the incident of Cosmos 954 when it disintegrated over northern Canada on 24 January 1978. The subsequent agreement between Canada and the Soviet Union showed that the liability for damage extends to fragments of a spacecraft, i.e. to space debris, and not only to the spacecraft itself.

If, indeed, space debris are considered to be space objects, they are under control and jurisdiction of the launching state. For everybody else they are foreign property and have to be handled as such, i.e. only with the permission of the owner. In fact,

space law protects debris from any intrusive action by non-owners. If a debris is in a collision course with the International Space Station, any action on the debris is legal only with permission. Will there always be time for requesting and granting permission?

There is an additional reason for exempting space debris from the (possible) protection by space law. The total mass of artificial objects in space is approaching 5000 tons. It doubled in the last 18 years and is still growing. In the future it may threaten space activities. Already in 2003, a group of authors came to the conclusion that *the only reliable long-term strategy to stabilize the orbital debris environment will be removal of mass from the densely populated altitude bands in LEO, in the GEO ring and possibly in the region of the semi-synchronous 12h navigation orbits* (Klinkrad et al. 2003).

Consequently, it is imperative to find and test methods for removing inactive objects from Earth orbit. Manned missions cannot be used for chasing space debris but possibly unmanned spacecraft could do the task. Or a tether between a spacecraft and large piece of debris could be used to put the debris into a fast decaying orbit while putting the “sweeper” on a higher orbit with a longer lifetime. Or small debris could be irradiated by an energetic laser and the reactive force from mass evaporating from the debris would speed up the decay of the debris. All these methods are expensive, technically difficult and none of them has been verified in practice. Extensive and costly research has to be devoted to these methods, or to entirely new inventions, in the future. The scientific community does not seem to be too enthusiastic about studying or verifying these methods in spite of the fact that difficult tasks as a rule instigate curiosity and challenges are willingly taken up. It is quite possible that scientists and technicians hesitate to devote their time, and organizations are not willing to mark their finances, for tasks which, even if successfully solved, would lead to illegal activities. Removing legal obstacles to scientific research in this particular field could be a way how to – in the end – stabilize the debris environment.

An agreed opinion of the COPUOS, whether space debris are space objects or not, would be helpful. The worst possible option is keeping the uncertainty.

#### **5. CONCLUSION**

We have been lucky that the risk posed by space debris has been known, but for a few exceptions, rather from theory than from experience. An enormous amount of

facts about space debris and about the risk they pose and will pose in the future has been already collected and analyzed in the past years thanks to the four ESA conferences as well as to the COSPAR Scientific Assemblies and to the yearly International Astronautical Congresses.

The good news is that on the management side in the international area, we have the IADC Mitigation Guidelines which, if implemented, will significantly restrict the generation of new debris. The bad news is that practically no progress has been achieved in dealing with debris which already are in orbit and have no means of maneuvering or speeding up their decay. Solar activity is helping but not fast enough.

On the legal side we have international treaties which solved problems of the early space era but have no provisions for cleaning near Earth outer space. The international community does not seem to be inclined to adopt new obligatory rules but at the same time favors voluntary measures, as explained in the text. These voluntary measures can be discussed and eventually introduced only if the scientific and technical community formulates facts which are important from the point of good management and if it initiates the discussions in the United Nations.

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