

Summary of Replies
to the questionnaire which included
issues concerning space debris

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At the meeting of the Scientific-Legal Liaison Committee held in Montreal, 1991, a questionnaire including a tentative list of legal problems relating to space debris was extended amongst the members of the Committee in order to facilitate further discussions on these problems. A number of replies have been received. They are summarized in this report which, of course, cannot reflect all details of these replies. The report was compiled by V. Kopal.

Question 1. Does the generation of space debris cause a pollution of outer space? Consequently, should the problem of space debris be treated as one of the problems of protection of the space environment, or is it a problem of its own?

All replies presented to this question are affirmative suggesting that space debris should be treated as one of the problems of protection of the space environment.

According to S. Gorove, "the problem of space debris is certainly part of a much broader problem of the protection of the space environment. At the same time, space debris in the earth-space environment is emerging as a serious issue which deserves early and careful international attention on its own right. The space debris problem should not be diffused or derailed by similar attention to other problems relating to the general protection of the space environment which is a much broader issue with many additional ramifications."

L. Perek emphasizes that "space debris have been introduced into outer space by man's activities, consequently their presence in outer space has changed the natural environment. Space debris present a hazard to space activities which, at least in the case of peaceful uses of outer space, are carried out for the benefit of mankind. Therefore, space debris constitute a pollution of outer space."

C. Christol suggests that our study might be enlarged, "to look at problems of pollution and contamination." According to him, "it is increasingly evident that the fuels used by the rockets for space objects are detrimental to the environment, including the ozone layer."

Question 2. What measures should be taken against the generation of space debris?

- (a) Preventive measures (such as changes in design and operation of space objects);
- (b) Removal of non-functional space objects from orbit (into the atmosphere, into a disposal orbit, out of Earth's influence);
- (c) Return to Earth by means of reusable space vehicles;
- (d) Other methods.

While not all answers offer a comprehensive reply to this question, the opinion seems to prevail according to which all of the identified measures and conceivably others may be taken against the further generation of space debris or for the purpose of reducing its numbers, as this has been demonstrated to some extent, in practice to date. (S. Gorove)

As to the methods mentioned under (a), according to L. Perek, "preventive measures minimizing the amount of debris generated in operational activities can be taken already in the design stage of a spacecraft. There has to be, however, some incentive for the designer not to use the simplest and least expensive ways..."

I. Diederiks-Verschoor believes that "preventive measures should be taken not only in changes in design and operation of space objects but also by better registration and tracking of debris".

E. Finch recommends that "preventive measures as to space debris currently in writing and unofficially in effect by US and USSR should be circulated to the Presidents or Executive Chiefs of Staff, of all other countries currently using the outer space environment."

As to methods mentioned under (b) and (c), some skeptical views concerning their applicability were expressed.

I. Diederiks-Vershoor, while agreeing that removal of non-functional space objects in the atmosphere or into a disposal orbit, would be desirable, fears that they would be very expensive.

C. Christol warns that "the greatest harm produced by a collision of space objects would be at the geostationary orbital altitude. The resulting debris would undoubtedly damage or destroy many of the satellites in the orbit/spectrum position." According to him "there should be on-board jets allowing for a repositioning of the satellites which is no longer engaged in transmissions." However, he puts in this connection, the following question: "Some now think that over time such parked space objects would descend once again into the area occupied by broadcast satellites. Can this be supported by the scientists, or is it merely speculations?"

In the view of E. Finch, "compulsory removal of non-functional space objects to disposal orbit or atmosphere must await Treaty amendment or modification of four Treaties or a new Treaty on Space Debris."

As to other methods mentioned under (d), L. Perek recalls that "in principle, existing orbital debris can be removed by remote action and some methods have been already proposed but not yet tested. One of the obstacles is the legal situation of debris." He also reminds that "since large numbers of debris are generated in breakups and explosions of satellites, measures to avert explosions should be adopted. In the case of international explosions, if they are at all considered unavoidable for

technology tests, the altitude and strength or direction of the explosion should be selected with a view to minimize the lifetimes of fragments."

It should be noticed that the draft of the IAA Position Paper on Orbital Debris, which was finalized by the IAA Space Debris Ad Hoc Group consisting of scientists and engineers on 12 May 1992, describes in greater detail possible methods to initiate selected options of controlling the growing orbital debris population and makes recommendations in this respect. As stated in this paper, "several of these techniques are already practiced by space users at this time. The utilization of some debris minimization techniques already bodes well for the future, but it is not clear at this time which of the methods are most effective, and how to measure the cost-benefit tradeoffs for each."

Question 3. Should such measures become subject of:

- (a) Voluntary policies of space-faring nations?
- (b) Agreed standards and recommended practices?
- (c) Principles spelled out in a UN General Assembly resolution?
- (d) A legally binding instrument (treaty or a supplement to one of the existing treaties)?
- (e) Other methods?

A full set of replies to all these questions are suggested by S. Gorove. In his opinion, "certain preventive measures based on voluntary policies have already been undertaken... While such measures may constitute a modest beginning, it seems clear that if they are left entirely to the discretion of the space-faring nations - with the result that they may be undertaken by some of the space-faring nations and not the others and that they may be very limited in scope - they cannot be expected to achieve a satisfactory result."

As to the agreed standards and recommended practices, S. Gorove raises the question "in what form and by whom have the standards been agreed upon or the practices recommended by. If the standards are agreed upon or recommended by all the space-faring nations, this is certainly a step forward and in such a case, there appears little reason why the agreed-upon standards or recommendations should not be included in an international treaty (protocol) or a UN resolution, respectively."

"In view of the current opposition of some of the space-faring nations to placing the space debris issue on the agenda of COPUOS, it appears that a major thrust of the effort should be directed toward overcoming this initial hurdle and having the item of space debris placed on the agenda with a view to developing a set of principles, standards and guidelines to be incorporated, if not in a treaty (protocol), at least in an appropriate UN resolution."... "If the space debris problem is dealt with as a whole it would appear best to include such measures in a separate treaty. If however, a particular issue requiring urgent attention is addressed (e.g. Should space debris enjoy the protection provided by Art. VIII of the 1967 Outer Space Treaty?), a supplement (protocol) to an existing treaty may provide a much needed short-cut, particularly when a more comprehensive treatment of the subject matter is likely to result in long delays."

Finally, S. Gorove recommends that non-governmental international and national organizations (e.g. COSPAR, IAF, ILA, AIAA) should be involved in assisting in the formulation of appropriate standards and recommended practices.

From among the replies of E. Finch, two specific suggestions must be recalled:

1. New measures and new policies, and agreed standards and recommended practices should now be prepared by a new UN working Group on Space Debris in the UN Outer Space Affairs Division; and

2. The IAA/IISL Scientific-Legal Liaison Committee should start to work on drafting an amendment to the 1974 Outer Space Registration Convention for more prompt reporting of both nuclear and non-nuclear launches and for reporting promptly and fully the launch purpose, to the UN Secretary-General.

In a brief reply to this point, I, Diederiks-Verschoor simply prefers the establishment of agreed standards and recommended practices to other possible measures.

Question 4. How to define "space debris"?

In his reply, L. Perek recalls that originally the term "space debris" suggested the meaning of "fragments", but later, all inactive objects from burnt out rocket stages down to sub-millimeter particles were included under "space debris".

Furthermore, L. Perek quotes a definition formulated at the meeting of The IAA Space Debris Ad Hoc Group at the Congress in Montreal 1991, according to which "'space debris", or briefly "debris" are all man-made objects launched into space and fragments thereof which will not now or in the future serve a useful purpose. The term includes all such objects surviving the passage through the Earth atmosphere. The term "space debris" does not include natural objects such as meteoroids."

In the above-mentioned draft of the IAA Position Paper on Orbital Debris published on 12 May 1992, "orbital debris", which is considered as a category of space debris, is defined as "all man-made Earth orbiting objects which do not now, nor will in the foreseeable future, serve a useful purpose. Orbital debris includes non-operational spacecraft, spent rocket bodies, material released during planned space operations, and fragments generated by satellite and upper stage break up due to explosions and collisions."

Question 5. Is any piece of space debris to be considered as "space object" in the sense of the UN space treaties? If not, where is the limit between space object and space debris?

In the opinion of S. Gorove, "under the above-mentioned definition, every bit of space debris is a space object or a part of the space object but every space object is not necessarily a space debris. Where "any piece of space debris" can be considered a "space object" depends on what we regard as a "part". Pieces, fragments and other substances of a space object would normally be regarded as parts of that object."

According to I. Diederiks-Verschoor, "a space object will be registered, a debris in itself not. Sometimes, it will be very difficult to trace the origin of the debris. The size of the debris will be a crucial point."

V. Kopal doubts whether there should be indeed an equal approach to "debris" as to "non-functional objects". While "debris" raises rather a picture of irreparable and useless fragments, a "non-functional object" is still a whole and may be reparable thus becoming reusable. Even if not reparable, such an object and its parts, when recovered, may have a certain significance for exploring the causes of their non-functionality, the effects of their stay in outer space, etc. In his opinion, "space debris" must sooner or later become subject of a special legal definition or definitions that would differentiate the smaller, insignificant fragments of space objects from the entire non-functional space objects and the component parts thereof.

Question 6. Does the principle of responsibility for national activities in outer space under Article VI of the 1967 Outer space Treaty and the principle of liability for damage under Article VII of the same treaty and the 1972 Liability Convention apply to space debris of any kind and any size?

According to S. Gorove, "the provisions referred to, which are currently in effect, do not appear to place any limitation on their applicability arising out of the kind and size of a space object, whether controlled or uncontrolled." Also in the opinion of I. Diederiks-Verschoor, the space treaties of 1967 and 1972 will be applicable but she "would link in future the application to the definition of debris with one exception. This exception could be made in the case when the debris not covered by the definition is causing damage if it is clear from which engine the debris is originated..."

Question 7 Should any space debris enjoy the protection provided in Article VIII of the 1967 Outer Space Treaty with regard to "an object launched into outer space" (jurisdiction and control by the State of registration, and unaffected ownership)?

According to S. Gorove, "de lege ferenda the international community should address the all-important question of the extent and conditions of applicability to space debris of the protection provided in Art. VIII of the 1967 Outer Space Treaty to "an object launched into outer space"."

According to L. Perek, "if debris are of no use and no value to the launching state, they should not enjoy the protection by the Outer Space Treaty. Another question is: Do they enjoy the protection under existing law?"

In the opinion of I. Diederiks-Verschoor, "in the case that space debris enjoy protection of the State of registration, the State should be also liable if the debris cause damage."

Question 8. Should any State or international organization be entitled to remove a non-functional space object or space debris, which might threaten its own functional space object and/or its space activities?

According to S. Gorove, "at present, there is no right to remove non-functional (uncontrolled) space objects without permission, unless legally justified under the rules of international law governing self defense. It is doubtful that a potential (not actual) threat to one's own functional space object or one's space activities, would be considered as sufficient justification for such a removal."

I. Diederiks-Verschoor would prefer to leave the removing of a non-functional space object by an international organization, but she does not indicate by which one. In her opinion, however "in case of immediate danger there could be removal because of self-defense of the State."

L. Perek replies positively to the above question, but he is not sure whether it is permitted by existing law.

Question 9. Should a captured non-functional space object or space debris be returned to its owner under Article III of the 1967 Outer space treaty, or to the launching authority under Article 5 of the 1968 Rescue Agreement?

S. Gorove believes that "the answer to this question would appear to be in the affirmative, if the non-functional (uncontrolled) object is a space object or its component part and if identifying data are furnished upon request prior to the object's return." However, "as a practical matter, it is highly unlikely that the State of registry or launching authority would request the return of worthless fragments of a space object, particularly since such a party would have to bear the expenses associated with the recovery and return. At the same time, it is quite conceivable that a request would be made for the return of a valuable component part."

In the view of I. Diederiks-Verschoor, in this case prior consultations would be desirable.

Question 10. Should the problems relating to space debris and measures of protecting against them be:

- (a) Left for further studies at national levels?
- (b) Dealt with in an international group of experts established by an existing international organization?
- (c) Included in the agenda of an international intergovernmental organization (or organizations) concerned?
- (d) Treated in another manner?

In his comprehensive reply to this question, S. Gorove expressed the following views:

(a) National studies can make significant contributions to the understanding of the problem and there appears no reason to discontinue them. At the same time, it should be made clear that such studies themselves are insufficient to deal with the problem.

(b) The space debris problem is a multidisciplinary problem where scientific, economic and legal considerations dominate. It should be dealt with accordingly by an international group of experts. The existing UN framework of COPUOS and its two Subcommittees could provide a convenient avenue, if acceptable to its members. Such a body could utilize input by appropriate national and international bodies, both governmental and non-governmental.

(c) If possible, the space debris issue should be included in the agenda of the COPUOS and its two Subcommittees.

(d) Irrespective of the foregoing, the matter should continue to be studied nationally and internationally.

According to L. Perek, the problem of space debris "should be included in the agenda of the COPUOS which has a tradition of dealing with space problems of a general nature. It cannot be solved in a smaller than global scale because it concerns all users of outer space applications and benefits." However, the COPUOS may "relegate the discussion of space debris to an international group of experts, if it

so decides." At the same time, "space debris will continue to be studied at national level to provide a better understanding of the scientific and technical side of the problem."

Also, I. Diederiks-Verschoor shares the view that the problem should be "dealt with by a group of experts and included in the agenda of international intergovernmental organizations".

Question 11. Should the IAF/IAA/IISL elaborate a position paper including all aspects of the problem in order to bring it to the attention of the world community?

In his reply S. Gorove emphasizes that "elaboration of an IAF, IAA, IISL position paper may be a minimal but essential first step which could be instrumental in paving the way for the acceptance of the space debris issue as an agenda item for discussion by COPUOS and its two Subcommittees. Such a position paper may also include an appropriate draft of a set of principles or a draft of a convention on space debris."

I. Diederiks-Verschoor also gives an affirmative reply to this question.

L. Perek reminds that an IAA position paper on space debris is already under preparation but as stated at the meeting of the Scientific-Legal Liaison Committee in Montreal, the legal point of view should be adequately reflected in the paper.