# SPACE DEBRIS: AN EMERGING PROBLEM FOR GLOBAL REGULATION

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## I

ABSTRACT. The purpose of this analysis is to inquire into the adoption of a regulatory system to be shared by the world community in taking timely measures to prevent, eliminate, or minimize the space debris occurring in outer space, with special emphasis upon orbiting debris. The primary concern is with the threat that is imminent with regard to space activities, and the additional threat that natural objects treated here as debris affords objects on earth. Regulation is therefore perceived in terms of all forms of debris.

Debris is a threat to legitimate space activity. The threat is global and serious in nature. A collective effort is called to oppose it, and this must operate through a regulatory regime, with high participation and cooperation among states.

In going about the task of regulating - in our own interests and in the interest of the environment that we share - we cannot rely upon scientific frameworks or scientific efforts at definition or delimiting space debris for this purpose. These matters of definition are but means to the larger end of securing public order itself. They are the means, in short, to establishing a constitutive order, or more directly, a constitution - at first loosely constructed, and then given the precision and certainty of practice. We presuppose at least minimal order to talk clearly about state responsibilities and obligations.

In a cooperative regime that is human-oriented, the effectiveness of the regime is directly determined by the decisions and policy to prevent harm before it occurs. The guidelines are the community standards. The overriding policies are those assimilated in and adopted by the community as its perspectives. In view of our vision of achieving optimal results, we presuppose that it will be a regime operating as a community institution or United Nations

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organ. And we consciously presuppose the adoption of strategies and perspectives that strengthen the prospects of attaining these results.

Because states disagree about the framework and operation of decisions, the regulatory scheme must be designed to provide alternative dispute settlement mechanisms to deal with disagreements among the parties.[1] The more familiar dispute settlement procedures, found in tribunals for example, depend upon resolution or assimilation raised in adversarial confrontations. But these devices for overcoming disagreement at all levels of intensity, when compared to a cooperative regime let alone joint enterprises among states, have a far lesser claim on optimal operation. Cooperative regimes of the kind proposed here have at the minimal level of operation a framework of common objectives among the participating - i.e., space active - states. They have law prescribing, law making, and law enforcing and applying impacts even where they are designed to provide only advisory opinions.

Problems define the primary settings for analysis and for productive efforts at control. Accordingly, problems denying the use of space or causing harm to those that use it, when those problems are created by space debris, call upon us for an effective on-going program combining both the joint enterprise of states, their dispute settlement institutions, and a regulatory or law prescribing and law enforcing regime. These problems by their very nature can be optimally formulated so that we can choose among the optimal options only if formulated in the context of the program to deal with such problems.

This combination of decision-linked control mechanisms can be expected to reduce or even prevent the damage or harm that may be caused by the debris already resulting from on going human activities. But such controls have further ramifications reaching into controls upon affirmative mechanisms, such as the joint enterprise that might be adopted among states to check a common danger such as a collision with an asteroid. As such they would be designed to draw upon joint efforts and actions by the space community to reduce the impending harm or the impending interference with legitimate human activities in space or on earth that is likely to be caused, by natural phenomena.

The latest technical study about space debris carried out in the United States, but including experts from abroad, summarizes the significance of the debris problem, but it largely stresses the technical problems to be faced in reducing the dangerous debris in the orbiting channels. This is primarily a problem of increased costs, threats of harm and damage, and burdens to be assumed as one of the state responsibilities of space states when undertaking space activities. The key and opening phrase points out: "space activities in Earth orbit are increasingly indispensable to our

civilization."[2] But the study stresses the technical aspects, while the considerations of jurists must be directed instead to reaching the human sources of the debris problem. Hence an effective, cooperative regime in tune with our overall objectives for the space environment must be aimed at controls on decisions designed to reach those objectives.

Because we cannot rely entirely upon each municipal legal order acting alone to provide adequate control over space debris, we must turn to treaties and international agreements that can bridge the gap left in our efforts to impose unilateral as opposed to multi-state controls of this kind: For this purpose we can look to the past, and to precedents and the lessons learned in the international controls over human activities adopted in a variety of action arenas. Our vision must incorporate a continuous refinement of dispute adjustments and alternatives for cooperative action.

## I

Problems relating to space debris manifest themselves in a number of ways: debris is at once a waste product especially if we cannot reclaim useful outcomes from recycling or refining it, and it is also a natural phenomenon, a global threat calling for more effective, globally concerted regulation of activities in outer space and the natural outcome in terms of the physical waste of the efforts of mankind to conquer and exploit space.[3]

State practice will determine content and meaning for a more specific definition and legal controls. In the meantime, we may need to regulate on the basis of general principles, intended to operate as criteria or standards to be applied by an appropriate institution, to ensure that we fulfill common objectives in the use and exploitation of space.

Several questions, and associated problems, are raised by this threat. The first the physical control of the debris, and involves problems that concern the technology and cost of acquiring the technology to eliminate the threat.[4] The problem of cost is in part related to the tolerances of the space community: we can eliminate debris at relatively low cost if we are willing to tolerate accumulations of amounts that are sufficiently small or innocuous but pose no serious hazards.

A separate problem facing the construction of a system of regulation under law shows up in the difficulties in formulating the problem. We adopt for simplistic purposes the perception that the "solution" to space debris must be captured by a global order decision process, even though we do not know how to ensure the satisfactory performance of this process among states at least as long as states maintain their relations on the basis of self-applied and self-interpreted global compact operating in competitive arenas in which the competition is over power and the bases of power.[5] As the trade wars over the export of automobiles have shown, the social compact

among independent, sovereign states is posed in opposition to a global order, replete with appropriate institutions, eventually approximating those of government itself.

The seriousness of the threat of space debris needs closer analysis. For here we raise a question that concerns out tolerance to the threat environment - tolerances that must range from minor to serious threats, and tolerance problems that call for the formulation, refinement and application of community-oriented distinctions between the serious and minor threats. This question concerns our tolerances to lesser threats, because our willingness and ability to contain those threats will reduce the costs of the cleansing technologies, and also concerns our ability and willingness to create a regulatory body that can if need be deal with newly emerging threats on a case by case basis.

We will have to identify the tolerated threat level, or the standard for distinguishing between serious threats and tolerable threats. And we must do this through community processes - such as community institutions or community supported regulatory bodies. We must be willing to work with this problem on an international basis so that we can economize on the technology and resource costs as well as regulatory costs.

The overall approach raises a further feature: states, unquestionably, must meet the problems and hazards of space debris unilaterally, and by way of the responsibilities and in a more precise sense, the accountability assumed in their own or joint ventures, as well as by a global initiative. The fundamental trend with regard to the duties with regard to the protection against harm is that in which even before the venture, activity or program is carried out, those in charge must determine as far as reasonably possible the likelihood that harm or serious perceived threats of harm will occur. With perceptions such as these they must design the safety factors to prevent harm, or take, promptly, the measures to overcome harm that is caused.

Part of this problem is met by self-help: space-using states must find the economical and technologically effective means, and share them. These means will include their efforts to harden their satellites, deflect on-coming debris, introduce methods to fragment large pieces of debris, construct facilities to monitor larger hazards - such as asteroids, large objects containing natural materials, electrical interference, and so on. The space using nations will need to rethink the use of nuclear, x-ray, or laser directed energy to destroy asteroids or comets that may pose a very serious threat to the earth. Overriding this problem is that of state responsibility, accountability and liability. Hence, the problem is related to the familiar and traditional normative and legal problems involving state responsibility, accountability and willingness to assume liability or adopt corrective relief when found to

have engaged in conduct that would cause harm, damage, or impermissible interference with the legitimate activities of others.

II

The hazardous nature of debris is set forth in the report of the United States Office of Technological Assessment:[6]

> Man-made debris, now circulating in a multitude of orbits about Earth as the result of the exploration and use of the space environment, provides a growing hazard to future space operations. The 6,000 or so debris objects large enough to be catalogued by the U.S. Space Surveillance Network are only a small percentage of the total debris capable of damaging space craft. Unless nations reduce the amount of orbit debris they produce, future space activities could suffer loss of capability, destruction of space-craft, and perhaps even loss of life as a result of collisions between spacecraft and debris [Emphasis added].

The OTA Report examines the future problems of debris for "future directions for reducing orbital debris." Necessarily implied is the overriding need for a shared approach and cooperation: these two principles must operate effectively in the controls that are instituted among states to counter threats in general, i.e., at controls to deter or prevent the deposit of debris in space. The general public must be fully informed because one of our objectives is to increase participation in decisions - a step that is proposed by the Space Debris Study Group of the Japan Society for Aeronautical and Space Science.[7]

> Most breakups which created [up to the present] a large amount of debris took place in LEO [low earth orbit] ...Investigations of the dynamic relationship between the creation and cleaning of debris have demonstrated the existence of a critical density, above which collision chain reactions increase the amount of debris even with no further launches taking place.

The urgency of the crisis from debris is stressed in the Japanese report:

> Debris in higher orbits has long lasting effects. Therefore, if action to avoid ramifications is to be taken it must be done before the hazard becomes real. Reliable information on debris size,

> shape and rotational motion will be needed to formulate ideas on how to prevent collision damage and establish mitigation methods.

Further policy positions are suggested in the Department of Defense statements pointing out that space launching states must assume responsibility and meet the overriding principle of the utmost due care. But up to the present time, there is no implementation or program for managing the problem of debris, either within states or among them. We have as fall back only the general principles under review at the International Law Commission aimed at working through state responsibility.[8] Additionally, as the Japanese Report indicates, we are compelled to pursue measures of self-help even though such measures are certain to fall short of global needs unless standards are agreed upon and made part of a global community effort.

The position taken by the United States Department of Defense is however of interest for the attempt to regulate the problem of debris by a policy statement, i.e., by issuing normative standards operable and presumably obligatory within the Department to reduce debris, to wit:

> DOD will seek to minimize the impact of space debris on its military operations. Design and operations of DOD space tests, experiments and systems will strive to minimize or reduce accumulation of space debris consistent with mission requirements.

Yet this approach is only hortatory lacking the teeth of enforcement and unable to sustain an extraterritorial reach of the needed jurisdiction and control over space activities. Even the policy within the United States falls short of a directive that is enforceable: there are insufficient criteria and guidelines to enable the space-faring activity to know exactly what is expected.[9]

To establish a regime of effective, enforceable decisions states must adopt a regulatory regime - perhaps in the initial stages falling short of decision making authority - but able to single out the problem and presence of debris, ultimately to identify who is responsible. We must provide the options and recommendations and fact finding panels for states to reach the problem and regulate it through the diplomatic exchange. Accordingly, we would expect strengthening the decision-impacting processes of diplomatic exchange even beyond the earlier models such as those found in the Standing Consultative Committee of the Anti-Ballistic Missile Treaty [See Article XIII]. The problem of minimizing or eliminating the threat of harm from space debris tends to expand with the expanding perspectives of harm and interference. As they expand, we are faced also with the need to test, engage in research and maintain observation of situations in which harm is taking place or about to take place. The regulatory regime

mentioned above therefore should be in a position to make recommendations or reach findings of a technical, technological and scientific nature as well as of the nature of the sources of harm to the community or members of the community.

The creation of a regulatory regime with authority and control over the activities of states in outer space comes up against the traditional opposition that is part of present relationships among states. Current practice, and trends indicating what we may expect of practice in the future, suggest that most states insist upon and claim their rights of sovereignty. They do not willingly accept decision making, or even decision affecting, mechanisms in which they are denied final control that can decide upon their actions, pass in judgment on their behavior, and so on. Short of this authority, it is a matter of dispute whether the regulatory approach can be adopted, unless we are willing to drop the decision making and enforcing regulatory program and rely, at least at this stage in the relations among states, uplon an administrativbe device. We may have an opportunity to move closer to the regulatory regime however because space offers hazards, costs, and technological challenges unlike those we have had to face on the high seas in its exploitation, and these are challenges with greater strategic impact as well.

States are free to adopt principles or normative declarations relating to their undertakings in their treaties or other international agreements and instruments. These instruments are not readily enforceable and fall short of a regulatory program needed here. States, as the incident involving COSMOS 954 has shown, do not willingly accept liability or responsibility, or even make ex gratia payments nor do they expect amongst themselves a willingness to pay compensation or grant other forms of relief to those hurt by their negligence or by accidents involving their activities. It will be recalled that COSMOS 954 did raise the possibility of the application of the outer space claims convention, but this application was blocked when the Soviet Union insisted that it had not been afforded its rights established under the liability convention to investigate or assist in providing relief with regard to the damage that had occurred.

The establishment of a regulatory regime faces another obstacle. There are tendencies to view a sufficient solution to problems such as space debris as a problem manageable under commitments or undertakings, often with substantial moral overtones, as a means of "regulation." Under treaties of this kind states act as their own interpreters of the treaties and decide upon how the treaties will be applied, notwithstanding clauses that might be added for dispute settlement. As has been shown elsewhere, we must now view outer space ventures as ventures of a cooperative nature, and formulate at the very beginnings the provisions

that will make cooperative action, with respect to interpretation, application and resolution of disputes, a joint, mutual or cooperative endeavor. Secondly, with regard to the United States, to escape the continuing scrutiny of the legislative branch, the treaties must, like the GATT, contain provisions enabling executive action to modify or implement the agreement without continuing review by the Congress and its committees.

A further problem reaches beyond space debris, or specified pollution, and extends to the environment of outer space in general. This means that environmental laws for outer space, or the establishment of a regulatory regime for space environments, or the expansion of principles aimed at protecting the environment in the outer space treaties might be tapped for regulating the problem of space debris. This would mean reaching the responsible states, finding them accountable and responsible, and, at least through international public opinion encouraging them to grant relief and engage in corrective practices.

Disputes may arise in this arena, so that we should adopt among the undertakings of states connected with the launching of space objects provisions evidencing their willingness to pursue the principle of cooperation and mutual tolerance in resolving disputes and disagreements of any kind. This approach designed as part of their enterprise is to be preferred over the adversarial process - usually favored by lawyers - adopting the use of adjudication or arbitration. It is to be preferred also over conciliation or mediation.[10]

Space debris created by armed conflict or by arms testing as part of a program of national security or to establish effective arms control need special consideration. Debris may be the natural outcome of such defense or security oriented activities. The problem of debris associated with military activities aimed at security or defense is aggravated by the traditional practice of states: the activities of states in wartime are regulated by the law of war. The activities under arms control are controlled not by the constitutive treaties aimed at protecting outer space, but under an agreement of a contractual nature among states.

Yet a further problem concerns the content of the agreements to control space debris. These may be problems alling for us to give attention to specific provisions with regard to the controls, how they are to be operated, what they are to apply to, and so on. Past experience with the treaties relating to the law of war and the law of the sea indicates that we might be in danger of adopting an agreement of inordinate length - too difficult to press through the treaty ratification processes of states like the United States, and, in practice too difficult to enforce, or to ensure effectiveness of the numerous provisions. Codifications and instruments

of this kind lead to continuing problems of interpretation and these, in turn, to the possibilities of dispute and difficulties of dispute management.

The matter of minimizing or eliminating hazardous space debris is therefore largely a social order problem, but one that is both a large problem of the social order, and also a problem that can be fragmented and partially resolved by initial steps at regulation - by global licensing of space launches and providing funds through licenses to cover damages, costs of research for economical space debris disposal, by the adoption of fact-finding panels, coupled with panels for scientific and technological assessment and review, and eventually by inducing states to permit on-site monitoring of their activities. This is the perennial legal-political problem of how far we can encourage the participation, or exercise of the will, of the members of the global community to enter into regulations and control over a common hazard and how far we can progress jointly through democratic processes into the carefully guided technologies of debris control and reduction[11].

1. Law making regimes are at times placed in three bery broad categories: adversary dispute settling institutions or mechanisms; cooperative activities and enterprise for joint efforts at establishing law, including treaty negotiation; and, reciprocal arrangements where the participants involved act and react in a process in which their tolerated levels of prescription or law are reached.

2. See ORBITAL DEBRIS: A TECHNICAL ASSESSMENT, Comm. on Space Debris, et al, National Academy Press: Washington, 1995. This book is primarily designed as the first draft relating to reducing and cleaning up debris, but has no discussion of legal regulation. The authors recommend continuous study, and follow-on texts. The issues include the preservation of space for useful, peaceful activities, the maintenance of the environmental balance, and a deliberate effort to couple design of space activities to promote these goals. These objectives reappear, stated in differing language in the text, with special emphasis in the recommendations in Ch. 9, p.175 et seq. The technical findings, supporting these recommendations, provide jurists with the substance or content that must be the focus of their regulatory scheme. The study further insists that great importance is owed to a multilateral approach, primarily in view of the impact of space activities on the environment.

3. S. Gorove in his paper on "Space Debris and International Space Law," focuses on the "scientific" problem and at his conclusion proposes an "interdisciplinary" panel of experts to solve the problem, presumably leaving the drafting of the agreement to the lawyers once the other work is done. The approach taken in this paper is to consider the foremost element to be that of the regulatory regime, often driven not by scientific, but by political considerations. Such a regime must be able to expand to accommodate new physical or other phenomena and able to make regulatory controls that can be effective, even enforced. The regulatory approach as my paper indicates can also accommodate to damage, harm and interference from space phenomena, of which manmade space debris is a subset. The use of experts on an interdisciplinary panel is unlikely to work in any event because it is too difficult to frame issues for all the disparate members, and because the experts tend to favor the agendas and priorities of their own disciplines.

4. According to Green:

> At the risk of some oversimplification, "technology assessment" can be defined as a process for examination of the benefits, costs, and risks of a technology or technological development in a rigorous and intensive manner to determine what, if any, governmental action may be necessary or desirable to direct the development or use (or the nondevelopment or nonuse) of the technology along lines that will achieve an optimal benefit-cost or benefit-risk ratio. In performing this examination, technology assessors endeavor

> to consider not only the immediate effects but also second, third, and higher order effects. They also endeavor to sort out and quantify anticipated effects as to whether they are desirable, undesirable, or uncertain. The assessors also may consider the effects of various alternative governmental actions with respect to the technology.

Harold Green, "The Limitations of Technology Assessment," in Thomas, ed., SCIENCE AND LAW: AN ESSENTIAL ALLIANCE, Westview: Boulder, 1983, p. 134.

5. See for a comprehensive survey and map about shaping and ordering processes relating to law and peace, in the article entitled "Law and Peace," by Myres S. McDougal, in Thompson et al., ed., APPROACHES TO PEACE, U.S.I.P., Washington, 1991, 131.

6. The report of the Office of Technological Assessment, an Office under the control of the United States Congress, dated, Washington, 1990, is entitled "Orbiting Space Debris." The paper is referred to in my paper as the "OTA Report." Other reports available at the time of preparing my paper cover much of the same ground, and several are referred to in the paper. The OTA Report points out at p.1:

> Unless nations reduce the amount of orbital debris they produce each year, future space activities could suffer loss of capability, loss of income, and even loss of life as a result of collisions between spacecraft and debris.

Cf. Green, op.cit., p.133. He mentions Congressman Daddario who proposed in 1968 "a new institution of government with the function of assessing the benefits, costs, and risks of technology." But then notes:

> In 1972 Congress finally created an Office of Technology Assessment (OTA), but most authorities agree that OTA is a mere and ineffectual shadow of the institution originally proposed by Daddario. In more recent years, the term "technology assessment" seems to have receded in favor of "cost-benefit" or "risk-benefit" assessment. p.135.

7. Report of the Japan Society, p.3. The Japnese study group uses the following "definition:" "Orbital objects consist of operational satellites, satellites which are no longer functioning, rocket bodies and various fragments. Among the different types of orbital objects, the largest humber is that of fragment debris created by explosions.

8. See on the matter of principles of law Roscoe Pound, AN INTRODUCTION TO THE PHILOSPHY OF LAW, Yale U.P.: New Haven, 1922, Ch.4, pp. 48-71. Pound points out that law does not depend upon the adoption of definitions. But it requires a process of continuing clarification of substance and of the operational concepts, precepts, principles, standards and so on because it is

factually-oriented - and the facts are forever changing. Law evolves when general principles are applied in law-shaping situations to events, persons, and so on.

9. The Japan Report, for example refers to the adoption of "appropriate international laws to facilitate and enforce technical methods or criteria for debris minimization." [p.53]. Clearly, the social control mechanisms must be designed in part to regulate the activities of private parties as well as states and political entities, and this means that the regulatory regime must be established, or at least implemented, through domestic legislation working in harmony with the international directives.

10. The matter of dispute settlement mechanisms such as mediation, conciliation, arbitration and adjudication is a familiar formulation among jurists, but the limitations on these mechanisms are rarely examined. Article 33 of the United Nations Charter, the claims convention for outer space and for disputes involving the high seas, are all familiar examples. An English scholar after indicating the fragility of such mechanisms. After noting that law especially today is, in terms of effectiveness, closely linked to the official enforcement agencies and presence of governmental authority in the social order. He notes:

> Several aspects of this familiar picture require emphasis for the present purpose. The first is that important elements of the legal system are directly linked to and dependent upon the particular form of governmental organization established in this society. Part, at least, of the special authority enjoyed by legal rules must be attributable to the ascendancy which parliament, the main rule-making body has acquired. This authority must also be linked to the availability of enforcement agencies to secure compliance with them, itself a feature of the centralized state - as is the presence of a hierarchy of appointed specialists with authority to adjudicate in disputes.
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> Another characteristic feature is the apparently differentiated character of 'the law' as a discrete sub-system, rather cut off from the rest or society. All this is exemplified in the specialized nature of legal rules and of the courts, the latter being remote places we only visit in the event of a dispute, presided over by specialists who conduct their business against a background of unfamiliar ritual. [S. Roberts, ORDER AND DISPUTE, St. Martin's Press: New York, 1979, pp. 21-22].

I have discussed this problem elsewhere proposing that we now look to dispute settlement in the larger context of the venture that is involved, the states as participants in such ventures, and their perspectives and strategies, and the extent to which we can adopt cooperative frames of reference <u>when the agreement for a joint venture in space</u> or elsewhere is at issue. States must negotiate between themselves the matter of conflict resolution and dispute

settlement. Simon points out that arbitration like adjudication is adversarial rather than cooperative in nature. These further expect a high degree of maturity through tradition and experience: but states perceive themselves as law-makers, not as entities that are to be the subject of the imposition of law. One of the problems of regulatory regimes is that states are not yet ready to surrender their decision-making authority to independent bodies, outside their control or veto. Hence regulation must be proposed in moderation, and best assumes the application when it has a checks and balancing mechanism assuring that the controls or decision support recommendations are not excessive.

11. See McDougal, op.cit., p. 132, observing the interaction of claims based on demands for power among states operating largely by way of a social compact, rather than achieving their joint efforts through the cooperative efforts of a constitutive order comparable to those of the states at large:

> A most important component in this larger community process is an ongoing, all-pervasive process of effective power, totally global or earth space in reach, in which decisions are in fact taken and enforced by severe deprivations or high indulgence, oftentimes irrespective of the wishes of any particular participant. For some centuries nation-states have been, and remain, through the resources and people within their boundaries, the principal institutions by which people wield effective power and have engaged in a continuous balancing of such power. [footnotes of author deleted].

Green, op.cit., insists that technology assessment cannot accurately point a policy decision of the Congress, nor assist in choosing among even major alternatives, or in focusing on more direclty related alternatives. The push for technology assessments seems to be of a scientific community concerned with making public policy decisions more rational. [p.140]. Technology assessment is at best an integral, but only, a part of the "political function." But the results must be made "readily available and comprehensible to the public."

> Technology assessment should be based on the premise that it is more important in a democracy that the public have the decisions it wants, rationally or irrationally, right of wrong, rather than that "correct" decisions be made. Technology assessment is a useful tool for public policy decision-making only if it is not taken too seriously. (p.143).