DEFINITIONAL ISSUES PERTAINING TO "SPACE OBJECT" +

Prof. Stephen Gorove*
Vice President
International Institute of Space Law (IAF)

Abstract

The purpose of this presentation is to focus solely on some significant issues and related policy considerations pertaining to the notion of "space object" and associated with the five U.N.-drafted space treaties. The term "space object" is central to the international law of outer space and the policies and laws relevant to its application will become more crucial with the anticipated expansion of space activities in connection with the building of the US/International Space Station and the contemplated moon and Mars missions in the next century. Following a brief introduction, the presentation deals with the use of the term "space object" as well as related "terms other than space objects" in the space treaties and issues of their interpretation. The conclusion provides a single text indicating many possible alternatives, the variations being reflected by additions or omissions of words in square brackets and parentheses.

* Director of Space Law and Policy Studies and Chairman, Ed. Bd. JOURNAL OF SPACE LAW, University, Mississippi; Member, IAA; Chairman, Space Law Committee, International Law Association (ILA), American Branch; IAF and ILA representative to the U.N. Committee on the Peaceful Uses of Outer Space; Chairman, Space Law Interest Group, Am. Soc'y of Int'l Law. Associate Fellow, AIAA. Honorary member, Japanese Society for the Study of Law and Policy on Space Utilization; Author, editor: SPACE LAW: ITS CHALLENGES AND PROSPECTS (1977), THE SPACE SHUTTLE AND THE LAW (1981); THE TEACHING OF SPACE LAW AROUND THE WORLD (1986), DEVELOPMENTS IN SPACE LAW: ISSUES AND POLICIES (1991); UNITED STATES SPACE LAW - NATIONAL AND INTERNATIONAL REGULATION (1981-94).

+ The topic of "definitional issues of space law" has first been discussed at the Montreal Colloquium in 1991. This was followed up by a decision of the IISL Board at its 1992 meeting in Washington, D.C. to establish a Working Group, consisting of Professors S. Gorove (chair), K.-H. Böckstiegel, and V.S. Vereshchetin, for consideration and development of the subject matter. While this paper deals with the notion of "space object," it also touches upon issues of "space debris" as well as "launching." At the same time, Böckstiegel's papers (IISL-94-IISL.2. 828a and b) address the concepts of "appropriate State" and "launching State," whereas the contributions prepared by Dr. E. Kamenetskaya (IISL-94-IISL.2 826) and Dr. E. Zhukova (IISL-94-IISL.2 827) in cooperation with Vereshchetin focus on the terms "astronaut," "personnel," "crew," "passenger," and "space debris."

The present paper, the first version of which has already appeared in print in the JOURNAL OF SPACE LAW [vol. 21 (1993), pp. 11-26], is a slight variation of the first version in that it takes into account the exchange of views in the collaborative effort among members of the Working Group.

A. Introduction

Notwithstanding the remarkable achievements of the U.N. Committee on the Peaceful Uses of Outer Space (COPUOS), as reflected in the drafting of five main space treaties, commonly known as the Outer Space Treaty,[1] the Rescue Agreement,[2] the Liability[3] and Registration Conventions[4] and the Moon Agreement,[5] a number of crucial concepts and terms like "space object," "outer space," and "launch" remain only partially clarified while many others, including "space debris," "astronauts," "personnel" and "procurement" remain undefined.

There can be little doubt that a clarification of concepts and phrases used in major space agreements and other international instruments constitutes an important aspect of legal development which will have to be addressed by lawyers and policy makers in order to allay legal uncertainty, a serious potential impediment to the prudent involvement of private enterprise in space activities.

The purpose of this presentation is to focus solely on some significant issues and related policy considerations pertaining to the notion of "space object" and associated with the aforementioned five space treaties. The term "space object" is central to the international

law of outer space and the policies and laws relevant to its application will become more crucial with the anticipated expansion of space activities associated with the building of the US/International Space Station and the contemplated moon and Mars missions in the next century. Individuals and organizations, both public and private, engaged in space activities will have to know what their rights and responsibilities are when dealing with objects in outer space. They will have to know whether to regard a particular object in a given set of circumstances as a space object because significant legal consequences, particularly with respect to liability for damage, follow from such determination.[6]

B. Use of the Term "Space Object" in the Space Treaties

While the major space law treaties frequently use the phrase "space object," unfortunately, only a partial definition may be found in the Liability and Registration conventions, both of which state that the term "space object" includes "component" parts of a space object as well its "launch vehicle" and "parts" thereof.[7]

The fact that the partial definition of "space object" refers back to itself when speaking of "component parts" of a "space object" and "its" launch vehicle leaves the fundamental issue of what is or is not a space object or under what circumstances an object becomes or ceases to be a "space object" and the question of the applicability of the relevant space treaty provisions unanswered, thereby necessitating a systematic analysis of the various scenarios in which the issues may arise.

Issues of Interpretation

Before embarking on such a detailed review of the notion of "space object," it may be appropriate to address ourselves, first of all, to two initial issues raised by the partial definition, namely: (a) the question of its applicability to all of the main space treaties and (b) the question of the meaning of "component parts" and "parts" with special attention to the issue of what constitutes "space debris."

(a) Applicability of the Partial Definition of "Space Object" to all of the Space Treaties

The first question that comes to mind in connection with the Liability and Registration conventions' partial definition -- that a space object includes its component parts as well as the launch vehicle and parts thereof -- is whether such a definition is also applicable to the other space treaties. The answer to this query is likely to be in the affirmative. For one thing, there is no indication in the Outer Space Treaty and the Rescue and Moon agreements or in their *travaux préparatoires* that the launch vehicle and parts thereof or the component parts of a space object would not be regarded as space objects. For another, it may be pointed out that the Outer Space Treaty speaks of liability for damage caused by a space object or its "component parts,"[8] thereby implying the inclusion of such parts in the notion of space object in the particular context. Also, the Rescue Agreement refers to component parts[9] and it would appear untenable, for instance, for a state party to argue that the launch vehicle is not a space object and deny its return in a given situation on that ground.

(b) Meaning of "Component Part" and "Part" with Special Attention to Space Debris

It is the authoritative choice by policy makers that determines in what situations damage caused by space objects will entail international liability and the scope and extent of such liability. Thus a determination of whether to regard an object in a given set of circumstances as a space object or a part of it and impose liability for damage caused by it reflects an antecedent policy choice which should be kept in mind throughout the ensuing discussion.

Reducing the policy considerations to a textual legal analysis, since a space object under the partial definition includes its "component parts" as well as the "launch vehicle and parts thereof," it appears necessary to determine what can be regarded as a component part and a part. Pieces, fragments and other substances of a space object, would normally be regarded as parts of that object.

Thus the basic issue arising from the partial definition of a space object is whether the phrase "component part" is to be equated with the term "part." Can any part of a space object be regarded as a component part, or, to put it differently, are all parts of a space object necessarily component parts?

Admittedly, the term "component part" has a distinct meaning and it may be legitimately argued that the drafters of the Liability Convention by their definition regarded only "component parts" and not all "parts" of a space object as being subject to the constraints of the Convention. However forceful this argument may be at first sight, the fact remains that the quoted definition itself speaks not only of component parts but also of parts when it makes reference to the launch vehicle and "parts" thereof. It would appear unsound and unworkable within the context of the Liability Convention to regard any "part" of the launch vehicle as a space object and, at the same time, to assert that only a "component" part and not just any "part" of a spacecraft is to be taken as a "space object."[10] There is no indication that the drafters ever intended to make such distinction when they formulated the partial definition of a space object. This conclusion is also reinforced by state practice to date. To the knowledge of this writer, whenever there was a question of liability arising from the fall of space debris on earth, the issue of whether the debris was a component part or just a part of a space object with the idea of possibly denying liability in the latter case has never been given consideration.

Of course, 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 of such fragments. At the same time, it is quite conceivable that a request would be made for the return of a valuable component part.

The Liability and Registration conventions' provisions that the space object includes its component parts has also brought to the fore an important question in connection with the US/International Space Station. The issue that policy makers faced was whether such a station should be conceived of as a single space object, with the various elements being regarded as the object's component parts, or whether it should be taken to constitute a cluster of different space objects requiring separate registration. The latter had notable relevance in connection with the exercise of jurisdiction and control. This matter was settled in the US/International Space Station Agreement which provides for separate registration of each of the flight elements supplied by the partners.[11]

An issue closely associated with component parts and parts is whether debris, which may result from the break-up, deterioration, loss or abandonment of a space object, is a space object. If space debris is regarded to be a space object or a component part of such an object or happens to be its launch vehicle or a part of it, under the Liability Convention the launching state's international liability would be absolute in case damage was caused by it on earth and would be based upon fault if damage occurred in space.[12]

To date, there has been no general agreement in the scholarly literature on the issue whether space debris is to be regarded as a space object. Some notable space law writers maintain that space debris is not to be considered a space object or a part of it.[13] This would mean that a space object which malfunctions or cannot be controlled any more, like a broken part, would no longer be regarded as a space object or a part of it and, as a result, any damage caused by such debris would not fall under the provisions of the Liability Convention. Such a position appears to run counter to the intention of the drafters of the Liability Convention and can hardly be supported by rational arguments. As Bin Cheng quite correctly observes, fragments of a space object are treated as space objects both in the Liability Convention and the Rescue Agreement.[14]

While it is difficult and somewhat risky to attempt to provide a workable definition of space debris, the latter may be looked upon as a no longer functioning, no longer controlled, non-useful or abandoned space object or a part of such an object, when no change can reasonably be expected in these conditions for the foreseeable future.[15] Under such a definition, every bit of space debris is a space

object or a part of a space object but every space object is not necessarily space debris. However, as with any definition, here also care should be exercised in its application. For instance, should a space object be branded immediately as "space debris" -- with whatever legal consequences may follow from such determination -- when a loss of radio contact and control occurs? Most likely not. Also, it should be noted that the space treaty provisions which are currently applicable to space objects do not appear to place any limitation arising out of the kind and size of such an object, whether controlled or uncontrolled.

The issue of the nature of space debris is also significant because, under the Outer Space Treaty, ownership of objects launched into outer space is not affected by their presence in outer space.[16] Currently, there is no right to remove no longer functioning (uncontrolled) and even useless 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 functioning space object or one's space activities, would be considered as sufficient justification for such a removal. However, if space debris is not a part of an object launched into outer space, including objects landed or constructed on a celestial body, the ownership provisions of the Outer Space Treaty would not be applicable to it, though conceivably ownership rights could still be asserted, albeit with less legalistic justification.

The conclusion that emerges from the foregoing discussion is that the Liability Convention is clearly applicable to damage caused by space debris and that *de lege ferenda*, the international community should address the all-important issue to determine in what situations and under what conditions could space debris be lawfully removed from outer space, bearing especially in mind the Outer Space Treaty's stipulation that, in the absence of contrary agreement, the state of registry retains jurisdiction and control over an object launched into outer space and that ownership of such objects is not affected by their presence in outer space.

C. Use of Related Terms Other than "Space Objects" in the Space Treaties

Apart from "space object," the treaties also use such related phrases as "objects launched into outer space"[17] or "into earth orbit or beyond,"[18] or placed "in orbit around the Earth,"[19] or "around or other trajectory to or around the moon"[20] and other celestial bodies within the solar system.[21] They also speak of "objects landed or constructed on a celestial body,"[22] and an occasional reference may also be found to "man-made space objects"[23] and a variety of other "objects."

Issues of Interpretation

The panorama of additional phrases dealing with objects in the five space treaties and the possible future scenarios that they may imply, call for a consideration of a number of significant legal and policy issues, a clarification of which may shed light on the notion of "space object" and its applicability in the context of the space treaties. These issues and possible interpretations may be conveniently discussed under the following headings: (a) the relevance and purpose of "launching," (b) the pre-launch and landing phases, (c) outer space, (d) objects landed or constructed on the moon or other celestial bodies, (e) extraterrestrial objects, (f) stations and habitats in free space, and (g) the notion of an "object."

(a) Relevance and Purpose of "Launching"

The space treaties occasional allusion to "objects launched" or the "launching" of an object makes one wonder whether the act of launch or launching is an essential prerequisite for an object to be regarded as a space object. The space treaties do not define "launching" or "launch" apart from a stipulation in the Liability Convention that the term "launching" includes "attempted launching."

This issue will assume particular relevance in connection with the advent of the aerospace plane which is expected to take off as a conventional airplane without being launched and may reach outer space. Would such a

vehicle have to be "launched" to be regarded as a space object? Should the fact of launching make a difference? Is the meaning of "launch" crucial? Should the aerospace plane be regarded as a space object throughout its flight or, more precisely, should the Liability Convention's provision be applicable to the flight of the aerospace plane in the airspace or in outer space?

Obviously, in the absence of an authoritative determination, several conjectures may be envisaged. The policy choice may well be not to apply space laws to an aerospace plane and adopt the functional approach if the vehicle is used in the course of a point-to-point transportation on earth even though, during its flight, it may reach the fringes of outer space. Another possibility would be to apply provisions of space law while the plane is in outer space. Admittedly, such a solution would require a clarification of the boundary line where outer space begins and the line where airspace ends. [24]

If the term "launch," that is, the manner in which the object ascends, is not crucial in determining whether to regard the aerospace plane as a space object, one may use the term take-off or "lift-off" which could conceivably be applied to both the aerospace plane and the shuttle. What appears important, however, is that the act of launching in the sense of lift-off or take-off or its "attempt" must in fact take place before an object may be regarded as a space object, assuming of course that the purpose of the intended activity was to put the object in orbit around the earth or beyond and there was a realistic expectancy of achieving it. If, under such circumstances, the launch or lift-off is attempted but fails and the object does not reach outer space, the respective space treaty provisions regarding liability for damage and the return of space objects would still be applicable. For the same reason, sounding rockets which are not launched with this required purpose would not be regarded as space objects.

Launching may take place from land, water, or even from the airspace as recently demonstrated when a B-52 released a Pegasus rocket in the air carrying a satellite into outer space. Karl-Heinz Böckstiegel suggests among several possible alternatives that one might consider the start of the airplane already as the beginning of the launch so that the state from whose territory this start was effected would be regarded as the launching state.[25] However, it is more likely that, in the absence of contrary understanding, the state from the airspace of which the object was launched by the airplane would be the launching state.

Another issue which may be raised in connection with launching is whether the launch from a celestial body or from free space would entail the application of the discussed space treaty provisions. Inasmuch as the provisions of several space treaties refer to objects launched "into" outer space, strictly speaking there would be no such occurrence since the object would be launched "in" and "from" outer space and not "into" outer space. Would damage done by such objects on the moon and other celestial bodies in the course of human intervention call for the application of the space treaties? The answer to this question may not be as significant as it appears to be. Liability in such a case under the provisions of the Liability Convention would be predicated on fault and such liability would likely exist even without the provisions of the space treaties. Of course, whatever advantages a recourse to the Liability Convention may carry would be lost if the objects are not considered to be space objects.

(b) Pre-launch and Landing Phases

Another aspect of the definitional issue of space object relates to the pre-launch and post-landing or disembarkation phases, that is, the relevance of time and place. Does the location of an object or the time element make any difference with respect to the occurrence of damage caused by the object in determining liability? To put it differently, at what point in time and place does the Liability Convention's provision become operational or at what point should we regard an object, such as a launch vehicle, to have become a space object or have ceased to be one for purposes of the Convention? Should it always be regarded as a space object and damage caused by it always entail liability irrespective of where and when the damage occurs? Should it make any difference whether the damage causing object is in a manufacturing plant, or in a test facility, or in the process of being transported to the launch site, or being

assembled but not installed there as yet? An additional question is whether such flight includes the space object's ascent and descent through the airspace,

Under the definition of a proposed Draft for a Convention on Manned Space Flight, an object with a human being on board intended to be launched into space would be regarded from the point of embarkation through the launch, in orbit, deorbit, reentry, landing, and disembarkation phases as a manned space object.[26] While the use of the phrase "embarkation" and "disembarkation" may be questioned,[27] the only query that arose during the drafting process was in relation to the possible use of the term "post-landing" rather than "disembarkation." However, "disembarkation" appeared to be a better term considering that reference to a "post-landing" phase might have implied an extension of the time period after landing without any specific limitation.

For certain purposes, such as the exercise of jurisdiction and control, the fact of embarkation and the closing of the doors may be significant as provided, for instance, in the application of U.S. territorial jurisdiction and control. Nonetheless, there is no indication that the drafters intended to have the space treaty provisions apply to objects prior to a launch from earth or an attempted launch. Thus an abortive fire on the launch pad, even after embarkation, prior to an attempted launch, would appear to preclude the application of the Liability Convention. Acts preparatory to the launch, including the embarkation and count-down, by themselves, would not be regarded as an attempted launch. Only when the engines fire and the lift-off is endeavored would it appear to be an attempted launch. In this connection, it may be important to stress that for an act to qualify as an attempt, it must be intended; it cannot be absolutely impossible of commission; it must involve "perpetration" or "execution" rather than mere "preparation;" it must come "close to success" and the "means" used must be adequate.

If space law were to be applied to the flight of an aerospace plane, it would have to be determined at what point in time (take-off, closing of the doors, etc.) such laws would apply to it. Short of an authoritative determination to the contrary, most likely a lift-off would have to be attempted in order to have relevant space treaty provisions applicable to it.

In sum, from the viewpoint of the *lex lata*, it may be better to regard the launching and attempted launching rather than the embarkation and closing of the doors as the crucial element in the determination of international liability. Such a position appears to be more in line with the space treaty provisions which only refer to launching and attempted launching and make no reference to embarkation, disembarkation, closing of the doors and similar expressions.[28]

In light of the preceding considerations, it would also appear that, prior to a launch or attempted launch, the launch vehicle and its parts should not be regarded as space objects, just as an object or component parts of an object would not become space objects prior to a launch or an attempted launch. They would not qualify for such characterization in the manufacturing plant or test facility or on their way to the launch site or at any time, prior to an attempted launch.

Does it make any difference if the damage occurs at the moment or shortly after the object's return to earth or in the course of its subsequent refurbishment? At what point in time and place does the Liability Convention's provision cease to be operational or at what point should we regard an object, such as a launch vehicle, to have ceased to be one for purposes of the Convention? The Outer Space Treaty and the Rescue Agreement speak of "landing" of astronauts and "return" of objects to earth and it may be assumed that such landing and return was intended to serve as the cut-off point.[29] *De lege ferenda* another more specific event, like "opening of the doors," or perhaps the Draft's provision designating disembarkation[30] as a point of termination for manned space flight may be considered for possible adoption by international policy makers.

(c) Relevance of Outer Space

When the space treaties speak of objects "launched," they occasionally add the phrase "into outer space" or "in orbit around the earth," or "into earth orbit or beyond,"[31] and, thereby, they raise the question whether it is

necessary for the object to reach "outer space." In other words, should one draw the conclusion that, for an object to be regarded as a space object, it must have reached outer space or be or remain in orbit around the earth? This would mean that, if the object is no longer in orbit, it would cease to be a space object and, as a result, the relevant provisions of the Liability Convention and the Rescue Agreement would not be applicable to it. Such position would appear to run contrary to the intention of the drafters of the space treaties which speak of liability for damage caused by a space object on the surface of the earth. How could there be international liability if the object would have ceased to be a space object upon its return to earth?

Some space law commentators, invoking Article II of the Registration Convention, appear to suggest that an object is not a space object unless it is already in earth orbit or beyond.[32] However, the particular provision was not intended to define the space object but only to determine what objects were subject to the requirement of registration. An object not only can be but is in fact a space object during its flight from earth to outer space and back throughout the indicated phases and it remains a space object during its flight in outer space. Such an object would not be subject to the requirements of registration until it is in earth orbit or beyond. The Registration Convention stipulates that when "a space object is launched into earth orbit or beyond" the launching state shall register the object.[33] This statement makes it clear that the object to which the registration applies is already a space object, otherwise reference would have been made to an "object" and not to "a space object." Also, the reference in Article IV to space objects concerning which the state of registry has previously transmitted information, and which have been and are no longer in earth orbit,[34] implies that such objects remain space objects irrespective of whether they are in orbit or not, and so also during their phase of descent.

Another issue which has relevance to outer space, in connection with the characterization of objects and the attendant policy alternatives, is whether there can be any objects which are launched from earth into outer space or reach outer space as a result of human intervention and are not to be regarded as space objects. Are personal belongings which accompany an astronaut during the flight into and in outer space considered space objects? Possibly so.[34a] Does damage caused by such objects make it subject to the application of the relevant provision of the space treaties and do such objects have to be returned to the launching authority under the Rescue Agreement? The space treaty provisions do not appear to shed light on these issues and in the absence of contrary provisions, it would appear that such objects would be regarded as space objects.

(d) Space Objects Landed on the Moon or Other Celestial Bodies

In connection with the moon and other celestial bodies, some of the space treaties make occasional references to a variety of other objects such as, for instance, "objects landed or constructed on the Moon," "vehicle"[35] and "space vehicle,"[36] "supplies,"[37] "equipment," "installations," "facilities,"[38] and "manned and unmanned stations."[39] The envisaged scenarios that may be associated with these references raise a number of additional issues which have a bearing on the notion of "space object."

First and foremost, the question arises whether an object launched from earth would lose its legal characterization as a space object upon its landing on the moon, or Mars or another celestial body? Would a moon rover or other movable objects, equipment or supplies originating from the earth cease to be space objects and would the relevant space treaty provisions not be applicable to them following such landing? Or would such objects continue to remain space objects and, if so, for how long?

While there is a temptation to argue that such objects should no longer be regarded as space objects after their landing or during their stay on a celestial body, it is somewhat doubtful that, in the course of a mission to Mars, a temporary landing is likely to be regarded as a sufficient justification for taking the objects out of the operation and application of the relevant provisions of the space treaties. A contrary position would have to come to grips with the issue whether such objects following their landing would again become space objects after their relaunch. The Draft left open the

question whether a space object remains a space object following its landing on the moon or another celestial body.[40] Logically, and by definition, a flight would come to an end after landing if flight is understood in the conventional sense of the word. Also, a space flight from a celestial body would presumably involve similar phases of embarkation, launch, in orbit, deorbit, and disembarkation, as a flight does from earth to outer space. Notwithstanding the logic of this reasoning, looking at this issue from the vantage point of an earthly perspective, states parties to a convention similar to the Draft who participate in a manned expedition to Mars, may not regard a temporary stopover on the moon or another celestial body as necessarily suspending the operation of the convention. For purposes of both the uniform application of the law as well as reason and logic, it would appear preferable to regard such objects as space objects during such stay.

In general, two things may be emphasized which may be important for the policy choice: the length of time during which space objects are utilized after their landing on the moon or another celestial body and the associated preferability of making a break with what may likely entail an endless extension of the Liability Convention's application to situations for which it was originally not intended. Admittedly, authoritative policy makers would have to make a determination.

Another issue that arises apart from the landing and length of stay of a space object on a celestial body relates to the possibility of a moveable space object being made into or becoming part of an immovable structure in the form of a station or facility on a celestial body. In such a case, it is doubtful that the policy choice would be to continue to regard such objects as space objects.

(e) Extraterrestrial Objects

The Moon Agreement envisages the eventual exploitation of "natural resources" of the moon and other celestial bodies under the auspices of an international regime[41] and also makes reference to "samples of mineral and other substances"[42] which may be used for scientific purposes. The possible use of extraterrestrial materials may also be envisaged by the Outer Space Treaty's reference to objects "constructed" on celestial bodies.[43] If such natural resources and other extraterrestrial materials cause damage at the time of their collection or at a later stage in the course of their use in support of a space mission or upon their return, should liability attach on the basis of the application of the provisions of the Liability Convention or the Outer Space Treaty? Should such objects be required to be returned to the launching authority in appropriate instances under the provisions of the Rescue Agreement? Briefly put, should they be regarded as space objects in given contexts?

As to objects not originating from the Earth, there is some doubt that the provisions of the major space treaties applicable to space objects could be properly invoked. The Outer Space Treaty, the provisions of which were further developed by the Liability Convention, speaks of the "return" of space objects to earth, thereby implying that the objects had to be on the earth beforehand to be regarded as space objects. Up to now, the issue has not been pressing but it could assume significance in future scenarios involving the exploitation of natural resources in space and the use of extraterrestrial materials in support of a space mission.

In the course of the construction of objects on the moon or another celestial body, the question may also arise whether such movable materials made in part of terrestrial and in part of extraterrestrial materials will remain space objects or whether they will lose their legal identity? If the notion of space object were extended to cover extraterrestrial objects handled by humans as space objects for purposes of the relevant space treaty provisions, then all such composite materials would automatically be regarded as space objects.[44] In the absence of such policy determination, the likelihood is that the space treaty provisions relating to space objects would not be applicable to them.

(f) Stations and habitats in free space

The reference to "stations" in the Outer Space Treaty and to "manned and unmanned stations" in the Moon Agreement[45] relate to such structures located on the moon or another

celestial body. However, legal and associated policy issues may further present themselves in conjunction with the building of space stations and habitats in free space in which both terrestrial and extraterrestrial materials may be used.

There is little doubt that the US/International Space Station built of terrestrial materials would be regarded as a space object or cluster of space objects or parts of a space object to which the space treaty provisions pertaining to such objects would be applicable. This conclusion is fully substantiated by the relevant provisions of the US/International Space Station Agreement.[46] Even if some extraterrestrial materials were used, the likelihood is that this fact alone would not change the outcome.

Permanent habitats in free space, as in L-5, which could conceivably be built in whole or in part from materials not originating from the earth may require further scrutiny and consideration by policy makers, This is not a far-fetched possibility in the 21st century. For instance, Professor O'Neil from Princeton University worked on the design of a mass driver to be located on the moon for the purpose of hurling lunar materials into space which could be used when building a habitat in free space, possibly for manufacturing solar power satellites.[47] Even if the materials originate exclusively from the Earth, the long term extension of the applicability of the Liability Convention may have to be reexamined.

(g) Notion of an "Object"

Finally a word may be added relating to the connotation to be attached to the word "object." This term in every day usage refers to a person or material thing that can be seen or touched and is stable in form.[48] Seen in such a context, solar energy, electromagnetic impulses, cosmic and other forms of radiation, as well as nontangible biological or chemical agents, are not regarded as objects.[49] At the same time, installations, equipment, materials, payloads, fragments and debris would be included in the category of objects or parts of objects.

Notwithstanding the seeming simplicity of the foregoing differentiation, questions may arise, for instance, with respect to the applicability of the Liability Convention's provisions when damage is caused by atomic radiation, or solar energy. Under the relevant stipulations, damage must be caused by a space object[50] and if nuclear or solar energy does not qualify as an object how can liability arise? In such cases, the object regarded to be causing the damage is the nuclear power source from which the radiation emanates, or the solar power satellite which transmits solar energy to earth via microwave or laser.

D. Conclusion

The preceding overview and analysis is intended to shed light on the multifaceted issues presented by a single but central notion in the space law literature, that of "space object." The discussed scenarios underscore the need for further delineation of the term, especially in situations when different people can legitimately and, in some cases with equally strong logic, maintain divergent views. Definitional clarifications involve policy choices which decision makers will have to make in light of their value judgments on behalf of the countries they represent.

From among many possible alternatives, space limitations only permit a few examples of definitions, the variations being indicated by additions or omissions of words in square brackets and parentheses. Within the context of the main space treaties, a space object may be defined as "an object launched or attempted to be launched in orbit around the earth or beyond [and includes stations, installations and other objects (whether terrestrial or extraterrestrial) constructed or used by humans in outer space, including the moon or another celestial body]. Such object [or a part of it] is a space object [or a part of it] from the time of its launch or attempted launch, through its ascent from earth to outer space or while in outer space, as well as during its orbit, deorbit, reentry and landing on earth. [In case of a manned space flight, a space object (or a part of it) is a space object (or a part of it) from the time of embarkation (closing of the door) to that of disembarkation (opening of the door) on earth.] [A space object (or a part of it) landed on the moon or another celestial body which becomes part of an immovable structure ceases to be a space object (or a part of it).]

Associated with the definitional clarification is the issue whether to split the single legal notion of "space object" into several well defined categories, such as "space station," "space object" in the narrower sense, and "space debris," as suggested by Vladimir Kopal. In his view, such a split will become sooner or later inevitable.[51]

Even with the adoption of one of the intimated definitional alternatives, there will be many remaining issues which may need further consideration. Of course, it is well to keep in mind that there is no fool-proof definition to take care of all possible scenarios which may arise in the future. Nonetheless, even a limited removal of some of the uncertainties associated with the notion of "space object" would go a long way in allaying concerns of private entrepreneurs when undertaking space activities. In addition, a clarification of some of the authoritative policy choices would also help in eliminating possible sources of disputes.

The clarification of definitional issues will be ever more pressing as we expand the horizons of space exploration and use in the 21st century. In light of the reduction of international tensions and disappearance of the cold war psychology, the unique opportunities of world-wide international cooperation make the objective of achieving consensus on the scope and meaning of undefined or only partly defined legal terms less difficult to achieve. It is this writer's belief that the time has arrived to advance suitable proposals to clarify key notions and phrases of space law for consideration in a multidisciplinary effort by national and international institutions and policy makers. It is hoped that strides in this direction will continue unabated and will eventually lead to positive results.

NOTES

1 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, Jan. 27, 1967, 18 U.S.T. 2410, T.I.A.S. No. 6347, 610 U.N.T.S. 205 (*entered into force for the United States* Oct. 10, 1967) [hereinafter "Outer Space Treaty"].

2 Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched into Outer Space, April 22, 1968, 19 U.S.T. 7570, T.I.A.S. No. 6599, 672 U.N.T.S. 119 (*entered into force for the United States* Dec. 3, 1968) [hereinafter "Rescue Agreement"].

3 Convention on International Liability for Damage Caused by Space Objects, March 29, 1972, 24 U.S.T. 2389, T.I.A.S. No. 7762, 961 U.N.T.S. 187 (*entered into force for the United States* Oct. 9, 1973) [hereinafter "Liability Convention"].

4 Convention on the Registration of Objects Launched into Outer Space, *opened for signature* Jan. 14, 1975, 28 U.S.T. 695, T.I.A.S. No. 8480, 1023 U.N.T.S. 15 (*entered into force for the United States* Sept. 15, 1976) [hereinafter "Registration Convention"].

5 Agreement Governing the Activities of States on the Moon and Other Celestial Bodies - adopted by the U.N. Gen. Assembly on December 5, 1979, opened for signature on Dec. 18, 1979, entered into force July 11, 1984 (not in force for the United States), U.N. Doc. A/RES/34/68 (1979) [hereinafter "Moon Agreement"].

6 While occasional definitions of the notion of "space object" may be encountered in the scholarly literature since the dawn of the Space Age, it was not until the Montreal IISL Colloquium in 1991 that, under the chairmanship of this writer, a special session was devoted to "Definitional Issues in Space Law" which *inter alia* also touched upon issues relating to space objects. *See* Bin Cheng, *"Space Objects," "Astronauts" and Related Expressions*, 34 PROC. COLLOQ. L. OUTER SPACE 17 (1992); HE Qizhi, *Review of Definitial Issues in Space Law in the Light of Development of Space Activities*, *id.* at 32; Vladimir Kopal, *Issues Involved in Defining Outer Space, Space Object and Space Debris*, *id.* at 38; William B. Wirin, *Space Debris and Space Objects, id. at 45.*

7 Liability Convention, art. I(d), Registration Convention, art. I(c).

8 Outer Space Treaty, art. VII.

9 Rescue Agreement, art. 5.

10 For a discussion of this issue, see STEPHEN GOROVE, DEVELOPMENTS IN SPACE LAW - ISSUES AND POLICIES 151-52 (1991)

11 *See* art. 5 of the Agreement Among the Government of the United States of America, Governments of Member States of the European Space Agency, the Government of Japan, and the Government of Canada on Cooperation in the Detailed Design, Development, Operation, and Utilization of the Permanently Manned Civil Space Station, Signed September 29, 1988, in Washington, D.C. (hereinafter US/International Space Station Agreement). For a text of the Agreement, see UNITED STATES SPACE LAW - NATIONAL AND INTERNATIONAL REGULATION, Sec. II. A. 22 (Stephen Gorove ed., 1982-1994).

12 Liability Convention, arts. II and III.

13 See, for instance, HE Qizhi, *Review of Definitial Issues in Space Law in the Light of Development of Space Activities, supra* note 6, at 35. In Wirin's view, "space objects and components" should be distinguished from small pieces and fragments of debris which are not capable of reentering the atmosphere and should not be regarded as space objects or components. *See* William B. Wirin, *Space Debris and Space Objects, supra* note 6, at 50.

14 Cheng states that "Fragments of a space object that fall on the earth are certainly treated as parts of that space object, and are given exactly the same status as the whole object, were the object to come back in one piece.... Nothing suggests otherwise, or that shattered fuel tanks or flakes of paint from space objects in outer space should be treated any differently." Bin Cheng, *"Space Objects," "Astronauts" and Related Expressions, supra* note 6, at 24. Prof. I.H. Ph. Diederiks-Verschoor in her recent book "AN INTRODUCTION TO SPACE LAW" (1993), at pp. 117-18, appears to support this position which is also shared by E. Zhukova. See her paper (IISL-94-IISL.2 827) on *"The term 'Space Debris': An Attempt of Definition"* prepared for the Jerusalem Colloquium.

15 Stephen Gorove, *Space Debris in International Legal Perspective*, 32 PROC. COLLOQ. L. OUTER SPACE 97 (199); *Cf.* International Academy of Astronautics, Committee on Safety, Rescue and Quality, *Position Paper on Orbital Debris, August 27, 1992*, at 1.

16 Outer Space Treaty, art. VIII.

17 *Id*, at arts. VII and VIII; Registration Convention, Preamble.

18 Registration Convention, art. II.

19 Outer Space Treaty, art. IV, para. 1.

20 Moon Agreement, art. 3, para. 2.

21 *Id.* at art. 1, para. 1.

22 Outer Space Treaty, art. VIII.

23 Moon Agreement, art. 3.

24 For a detailed discussion of the legal and policy choices associated with the aerospace plane, see Stephen Gorove, *Legal and Policy Issues of the Aerospace Plane*, 16 J. SPACE L. 147 (1988).

25 Karl-Heinz Böckstiegel, *The terms "Appropriate State" and "Launching State" in the Space Treaties - Indications of State Responsibility and Liability for State and Private Space Activities*, 34 PROC. COLLOQ. L. OUTER SPACE 15 (1992).

26 *See* art. I, para. 2 of the Draft for a Convention on Manned Space Flight (hereinafter "Draft") which was prepared by three leading institutions in Germany, the former Soviet Union, and the United States and submitted by this writer to the U.N. Committee on the Peaceful Uses of Outer Space in 1991 on behalf of the International Institute of Space Law. For a text of the Draft, see 18 J. SPACE L. 209 (1990).

27 *See* comments of Judge Guillaume, in MANNED SPACE FLIGHT - LEGAL ASPECTS IN THE LIGHT OF SCIENTIFIC AND TECHNICAL DEVELOPMENT, PROCEEDINGS OF AN INTERNATIONAL COLLOQUIUM, COLOGNE, MAY 20-22, 1992, at 201 (Karl-Heinz Böckstiegel ed., 1993)

28 *Cf.* Stephen Gorove, *Environmental Risks Arising from Space Activities, in* ENVIRONMENTAL ASPECTS OF ACTIVITIES IN OUTER SPACE - STATE OF THE LAW AND MEASURES OF PROTECTION 130 (Karl-Heinz Böckstiegel ed., 1989).

29 *E.g.* Outer Space Treaty, arts. V and VIII; Rescue Agreement, arts. I, 2, 4, and 5.

30 Draft, art. I, para, 2.

31 *E.g.* Outer Space Treaty, arts. IV, VII, VIII; Registration Convention, art. II.

32 HE Qizhi, *Review of Definitial Issues in Space Law in the Light of Development of Space Activities, supra* note 6, at 32.

33 Registration Convention, art II.

34 *Id.* art. IV, para, 3.

34a In his written exchange of views,

Vereshchetin noted that this idea is "rather disputable."

35 Moon Agreement, art. 12.

36 Outer Space Treaty, arts. V and XII; Moon Agreement, arts. 8 and 12.

37 Moon Agreement, art. 12.

38 Outer Space Treaty, arts. IV and XII; Moon Agreement, arts. 3, 8, 10 and 12.

39 Moon Agreement, art. 9.

40 *Cf.* Draft, art. I, para, 2.

41 Moon Agreement, art. 11, para. 5.

42 *Id.* at art. 6.

43 Outer Space Treaty, art. VIII.

44 Bin Cheng favors an expansion of the definition of space objects to include "Stations and Installations constructed by humans in outer space or on the moon or other celestial bodies." *See* Bin Cheng, *"Space Objects," "Astronauts" and Related Expressions, supra* note 6, at 24.

45 Outer Space Treaty, art. XII; Moon Agreement, art. 9.

46 *See, e.g.*, US/International Space Station Agreement, *supra* note 11, at arts. 2, 5 and 17.

47 See G.K. O'NEIL, THE HIGH FRONTIER, HUMAN COLONIES IN SPACE (1977); *idem, The Colonization of Space,* PHYSICS TODAY 32 (Sept. 1974); For a comprehensive assessment of the international legal implications of solar power satellites, see STEPHEN GOROVE, SATELLITE POWER SYSTEMS - INTERNATIONAL AGREEMENTS (U.S. Dept. of Energy, 1978). For a recent discussion, see Eilene Galloway, *The Legal and Regulatory Framework for Solar Power Satellites, in* SOLAR POWER SATELLITES - THE EMERGING ENERGY OPTION 183 (Peter E. Glaser et al. eds., 1993).

48 *Cf.* THE RANDOM HOUSE DICTIONARY OF THE ENGLISH LANGUAGE 993 (unabridged ed. 1966).

49 Referring to Prof. L. Perek, E. Zhukova notes in her paper (IISL-94-IISL.2. 827) that only "dust particles, molecules and gaseous components" are not regarded as debris.

50 Liability Convention, arts. II and III.

51 Vladimir Kopal, *Issues Involved in Defining Outer Space, Space Object and Space Debris, supra* note 6, at 41.