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AN ASSESSMENT OF THE UNITED NATIONS PRINCIPLES ON THE USE OF NUCLEAR POWER SOURCES IN OUTER SPACE

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Abstract

The Principles on the Use of Nuclear Power Sources in Outer Space adopted by the United Nations General Assembly in 1992 represent the international community's best effort to ensure that spacecraft with NPS systems on board are used in a safe and effective manner. They are not aimed at limiting or banning the use of such systems. At the same time, the Principles are not a perfect document and there are many areas which need to be clarified and strengthened. This was precisely the objective of the drafters of the Principles as they provided for their early revision. These include possibly expanding the Principles to cover emerging applications of NPS technology, particularly for propulsion; clarifying whether the Principles apply to NPS systems placed on planetary surfaces; and further defining several legal terms which are currently ambiguous. The issue of space debris, and its relationship with the safe use of NPS in outer space, will likely prove to be one of the more difficult items discussed during the review process but which will be facilitated by the addition of space debris to the agenda of the Scientific and Technical Subcommittee of COPUOS. The review process itself might be lengthy and difficult but will be made easier by international consensus on the need to ensure the safe use of NPS in outer space.

The Principles Relevant to the Use of Nuclear Power Sources in Outer Space, adopted by the United Nations General Assembly in 1992[1] were the result of over a decade of sometimes tortuous debate and negotiations within the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS). A key element of the Principles is the inclusion of a clause which recommends that they be opened for review and possible revision within two years after their adoption by the General Assembly.

Except for a brief review, this paper will not detail the history of the negotiations which led to the formulation of the final set of Principles, as that has been done in many other scholarly papers.[2] The paper will address, though, possible ways in which the Principles may be strengthened

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during the mandated review process and a brief discussion of the mechanisms for that process.

In discussing elements of the Principles which may ultimately be revised, it is important to keep in mind the political context in which they were negotiated and the original goals of the framers. The primary goal, of course, was to develop a set of guidelines for the safe use of NPS in outer space under the realization that NPS are desirable, and in some cases necessary, for certain space missions. The primary objective of the review process must therefore be aimed at strengthening the guidelines through which NPS systems may be utilized safely and effectively.

BACKGROUND

The decision to ultimately place the issue of NPS on the agenda of COPUOS and its subcommittees grew out of the 1978 incident in which the Soviet Cosmos 954 satellite re-entered the Earth's atmosphere and spewed radioactive debris over the territory of Canada. This was not the first incident in which NPS systems were involved but the fact that significant levels of radioactive material landed on the soil of a third party state -- as opposed to in the oceans -- prompted the international community to consider ways to prevent such incidents in the future.[3]

The primary reason for the slow pace of progress on this issue in COPUOS was that because the Committee operates on the basis of consensus, this required *de facto* unanimity among all 53 Member States on the draft set of principles. The political realities of the Cold War, however, often placed the countries of the Western and Eastern blocs on the opposite side of many issues, NPS being only one, which prevented the achievement of consensus on a draft set of NPS principles.

Nevertheless, during the course of over a decade of negotiations and debate within the Committee, the members of COPUOS had by 1991 achieved consensus on a draft set of Principles Relevant to the Use of Nuclear Power Sources in Outer Space. The draft Principles were rooted in existing international law, most significantly other international agreements elaborated by the United Nations, primarily the Outer Space Treaty.

However, in 1991 a problem arose when the United States insisted that the key Principle 3, dealing with guidelines and criteria for the safe use of NPS, be revised. Critics have charged that the goal of the United States was to dilute the value of the Principles and thereby ensure that they would have no practical effect on the U.S. space nuclear power programme which at the time was moving ahead with applications of NPS to ballistic missile defense.[4] The official U.S. position, though, was that the scientific and technical guidelines for the safe use of NPS needed to be revised solely in order to enhance their technical strength. While many delegations were inclined to agree, they feared that reopening negotiations on Principle 3 would subject other areas of the Principles to revision, thereby delaying adoption of the Principles.[5]

At the 1992 session of the Committee agreement was reached on a compromise text proposed by the

COPUOS chairman. This text kept intact the central elements of Principle 3 but, as part of an earlier compromise, also included a stipulation that the Principles would be reopened for revision by the Committee no later than two years after their adoption. The revised set of Principles was then adopted by the General Assembly at its 1992 session.[6] The Principles, as adopted, do not represent, as some critics have suggested, an attempt to limit or ban the use of nuclear power sources in outer space, but rather an attempt by the international community to encourage their use in a safe and effective manner.

GROUNDS FOR REVISION

This brief review of the history of the NPS Principles brings us to the present day and allows us to focus on ways in which the Committee is likely to proceed in the revision process and, most importantly, to examine ways in which the Principles might best be strengthened so that they take into account the legitimate concerns of certain countries and while retaining their original intent.

The 1993 sessions of the Committee and its two subsidiary bodies, the Legal Subcommittee and the Scientific and Technical Subcommittee, illustrate the difficulties that will be encountered during the review process.

At the 1993 session of the Scientific and Technical Subcommittee, for example, several delegations, including Germany and India, called for an immediate move to begin the revision process in order to take into account new technological developments and changes in nuclear safety philosophy and to add areas neglected by the original Principles, such as the possible collision of NPS with space debris.

In its discussions of possible ways to revise the Principles, the Working Group on NPS raised the issues of expanding the scope of the Principles to other uses of nuclear power in space, establishing criteria for acceptable risk, the applicability of probalistic risk assessments and the application of the relevant recommendations of the International Atomic Energy Agency (IAEA) and the International Commission on Radiological Protection (ICRP).

While it recognized some of the shortcoming of the Principles as adopted by the General Assembly, the Subcommittee did not take any formal action on revision and decided to continue its debates at the 1994 session.[7]

There was a similar outcome at the 1993 session of the Legal Subcommittee. The Subcommittee's Working Group on NPS held several meetings and a wide variety of views were expressed on the need to revise the Principles although some delegations were of the view that any move to immediately revise the Principles would indicate that the existing Principles were in some way flawed and would therefore weaken them. It was also suggested that a good method by which to proceed, and one which would retain the integrity of the original Principles, would be to not reopen discussions on the principles already adopted, but to attempt to supplement those principles with new provisions, if necessary.

In addition to these procedural and philosophical debates, there was some substantive discussion on areas of the Principles which need to be strengthened. The most detailed discussion involved Principle 4, dealing with safety assessments, and centered on the need to clarify the rights, if any, of a third party State which disagreed with the results of launching state's pre-launch safety assessment of an NPS system.

The Subcommittee, though, did not take any definitive action, because, it said, any future revision of the substantive scientific and technical provisions should be based on developments in these areas and that therefore it was advisable to await input from the Scientific and Technical Subcommittee.[8]

What these discussions illustrate, then, is that the process of revising the Principles will be more difficult than anticipated. Most delegations seem to agree that something needs to be done to strengthen the Principles, particularly to make sure they keep pace with the inexorable march of technology, but nobody seems sure of precisely how this should be done.

WHERE TO BEGIN

What is needed, therefore, are some constructive suggestions, both on which areas of the Principles should be considered for revision and the ways in which this might best be accomplished.

One of the most problematic areas of the Principles, as evidenced by the difficult negotiations, is Principle 3, Guidelines and Criteria for Safe Use. There is no doubt that the Committee will continue to struggle with this in the future.

The primary problem with this principle is that, as many delegations pointed out in the endgame of the negotiations in 1992, it does not take fully into account all the applications of nuclear power sources in outer space or the most recent technological and scientific developments in the field of nuclear power, energy and propulsion.

Because space technology and its applications is a dynamic, not static field it can be argued on the one hand that any set of principles will never be completely up to date and could, at least in theory, be made obsolete by a breakthrough in any number of scientific disciplines. However, by taking this stance, one would seem to argue that because technology is always advancing, it would be futile to attempt to develop guidelines and regulations for its use. Therefore this presents the international community with what can be perceived to be a no-win situation -- any guidelines developed will almost certainly fall short of being ideal but not developing any guidelines at all will clearly not accomplish anything.

While in a broad sense, this is indeed true, particularly when dealing with specific applications of a specific technology such as NPS, it is clear that the development of guiding principles, as COPUOS has done in the case of NPS, even if they are not perfect, is a necessary first step in the incremental development of international space law. There is simply no other way for international regulation to keep pace

with the rapid scientific and technological developments in this field.

Indeed, in many cases the framers of international space law have drafted legal documents with virtually no mention of scientific and technical details, relying instead on political vision and imagination. Perhaps the finest example of this is the foundation document of international space law, the 1967 Outer Space Treaty, which despite its lack of technical detail, has encouraged the development of space science, technology and applications.[9]

In the case of the NPS Principles, it is clear that a fair amount of technical detail is needed in order to fulfill the *raison d'etre* of the Principles. A certain amount of imagination and political vision will also be needed during the review process in order to make the Principles an effective instrument of international law.

One area which will require a good deal of both imagination and political vision is the question of nuclear propulsion systems, which, at the moment, are specifically excluded from the NPS Principles. The decision to exclude propulsion systems from the guidelines contained in the Principles may have been a prudent one at the time the Principles were negotiated, but in the long-run, the failure to adequately address what will certainly be a key future application of nuclear technology, could serve to limit the effectiveness of the Principles.

Looking at this issue from the perspective of those countries with the technical and financial resources to pursue nuclear propulsion applications it is quite easy to understand why any restrictions on these applications would be hotly opposed. Indeed, the argument can be made that it is impossible to regulate technologies that are not close to maturation. But, this would again lead us back to our previous no-win situation, and again, it may be argued that it would be useful to take some action, even if it is tentative, on this issue.

A second, perhaps more straightforward area which the Committee might wish to consider is whether the Principles should be expanded to cover the use of nuclear power sources on the Moon and other celestial bodies. As it is written, the set of Principles does not specifically refer to the use of NPS on celestial bodies but rather seeks to define standards for their use in outer space. An argument has been made that although not specifically mentioned in the Principles, the Moon and other celestial bodies are nevertheless covered by them.[10]

The significance of this issue should not be overlooked. Although declining space budgets and lingering questions over feasibility have delayed some space exploration efforts, the space powers still have detailed plans for returning to the lunar surface and the establishment of a human presence on other celestial bodies, most probably Mars. Just because these plans are unlikely to be implemented in the near future, we should not discount the possibility that they might be implemented at some point.

The common thread in many of these plans is the use of nuclear power, both for propulsion and energy

generation, for spacecraft involved in these missions. In addition, some plans call for the use of nuclear reactors for energy generation on planetary surfaces. Although the NPS Principles adopted by the General Assembly in 1992 would clearly apply to some, if not all, the spacecraft used on these kinds of missions, the argument can also be made that they do not apply to the use of NPS systems on planetary surfaces.

This legal grey area has prompted one expert in the field to conclude that "no provision of existing law prevents the use of nuclear reactors on the Moon. Some language appears to regulate their use, however, and other provisions would affect their launch and journey" there.[11] Because it is unlikely that any country or group of countries will soon attempt to use nuclear power sources for energy generation on planetary surfaces, there is no urgency to this matter, but the clarification of these ambiguities should still be part of the COPUOS revision process.

Imagination might also be needed when it comes to refining the safety standards contained in Principle 3 regarding recommended radiation exposure levels. The drafters of the Principles recognized that evolving international recommendations on radiological protection would likely require the Principles to be revised, but did not put in place a mechanism for this revision.

Unlike the case of technological developments in the applications of nuclear power sources to space activities, which clearly cannot be anticipated, it could be unequivocally stated that if the recommendations of the International Atomic Energy Agency (IAEA) and the International Committee for Radiological Protection (ICRP), regarding the safe limits of radiation exposure are revised, then the principles should be altered to reflect these changes.

This could be accomplished either by adding a new principle stating that the most recent recommendations of these two organizations should be adhered to in the case of NPS systems or by adding a phrase to the existing Principle 3, paragraph (c), which would state that if the recommendations of those organizations were lower than those in the original Principles, then those recommendations would take precedence over the ones in the Principles.

A similar area which should be addressed by the Committee is the compatibility of the Principles with the IAEA Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency which were developed in the wake of the Chernobyl incident. These conventions clearly apply to NPS use in outer space. The Convention on Notification, for example, applies to accidents involving "any nuclear reactor, wherever located;" and cover "the use of radioisotopes for power generation in space objects."

It has been noted that certain provisions of the IAEA conventions are contradictory to those in the NPS Principles.[12] One way to overcome these contradictions and apparent duplications would be to include in any revised set of NPS Principles specific references to the IAEA conventions which would provide

guidance to ensure that the notification and assistance provisions in the Principles are complementary to those in the conventions. As IAEA is an observer to COPUOS this matter can be easily clarified and the necessary coordination can take place during the review process.

Many of the delegates at the 1993 sessions of the Scientific and Technical Subcommittee argued that certain terms in the Principles need to be clarified in order to strengthen the overall document.[13]

Among these is the issue of what exactly constitutes a "sufficiently high orbit," as referred to in Principle 3. As currently written, the Principles say that a space object with NPS can be operated in sufficiently high orbits "in which the orbital lifetime is long enough to allow for a sufficient decay," of the fissionable material. It is clear that the orbital lifetime must be sufficient and of such character as to avoid space debris and re-entry into the Earth's atmosphere. While this provides guidelines for safe use, there appears to be substantial agreement with the conclusions of a British working paper submitted to the 1993 session of the Scientific and Technical Subcommittee which stated that "there is no adequate definition of a safe orbit because, to date, the problem of space debris has not been properly addressed."[14]

Similarly, the provision in Principle 3 that NPS may be operated in low-Earth orbits as long as they are stored in sufficiently high-orbits after completing their mission is dependent on the subsequent statement that the means of disposal to that orbit be "highly reliable." The term highly reliable is questionable because all systems when tested on the ground can be proven to be highly reliable and can remain such until they actually fail and, as has been pointed out, has little practical meaning. The best example of this is the case of Cosmos 954, which precipitated international concern on the issue of NPS, and had what was thought to be a highly reliable disposal booster system until it failed, which caused the satellite to plummet to the Earth.[15]

THE QUESTION OF SPACE DEBRIS

One of the thorniest issues that will be encountered by the Committee is how precisely the NPS Principles relate to the question of space debris. While these two issues have been separated in the past, the 1993 decision of COPUOS to place space debris on the agenda of the Scientific and Technical Subcommittee means that, in the future, the two issues will become increasingly intertwined.

Recent discussions in the Committee and its two subcommittees on NPS illustrate the concerns of Member States regarding the possibility of a collision between a spacecraft with a nuclear power source onboard and space debris. The consequences of such a collision could be disastrous and result in the dispersion of radioactive material into the upper atmosphere or low-Earth orbit where it would have a negative impact on scientific research in space.

The risks and radiological consequences of debris collisions with NPS in space was the subject of a Pakistani working paper submitted at the 1993 session of the Scientific and

Technical Subcommittee.[16] That paper concluded that although the probable risk of a collision between space debris and a space object with a nuclear power source on board that would cause reactor dispersion is low, the actual amount of radiological dispersion would depend primarily on atmospheric conditions at the time of such a collision and therefore could not be accurately predicted.

Indeed, the Subcommittee has for several years recognized the potential problem of collisions of space objects, including those with NPS on board, with space debris and has asked Member States to submit reports on national research on these issues to the Subcommittee.

With the formal decision at the 1993 session of COPUOS to place space debris on the agenda of the Scientific and Technical Subcommittee, it is likely that the issues involved in operating space objects with nuclear power sources on board, in context of the problem of space debris, will receive more prominent attention in the Subcommittee. The discussions on this issue in the Scientific and Technical Subcommittee, will, in turn, likely generate new ideas on how the NPS Principles might be strengthened to ensure their safe use.

MECHANISMS FOR REVISION

It is quite clear that there is ample room for clarification and strengthening of the NPS Principles. What is less clear, however, is the precise mechanism that will be followed during the revision process. This is due to the fact that although the Principles state in two places, the sixth preambular paragraph and in Principle 11, the intent of the drafters for the Principles to be revised in the future to reflect scientific and technological progress, they do not spell out the procedures to be followed during this process.

According to one analysis, it is the General Assembly, not COPUOS, which has ultimate control over the review process.[17] Indeed, it has been argued that even though the Committee and its subcommittee's held discussions on the Principles at their 1993 sessions, and despite the fact that the Legal Subcommittee now has an item on its agenda entitled "Question of Early Review and Possible Revision of the Principles Relevant to the Use of Nuclear Power Sources in Outer Space" on its agenda, only the General Assembly can take the formal action necessary to reopen the Principles for revision.[18]

According to the Principles themselves, this action by the General Assembly must be forthcoming "no later than two years after their adoption," or by 14 December 1994.

Once the General Assembly directs COPUOS to reopen the Principles for revision, it still retains control over the review process because it can dictate when the review period should be terminated. In reality, though, it is likely that the General Assembly will defer to the members of COPUOS on how they wish to proceed with the revision of the Principles.

Keeping in mind that the Principles took over a decade to negotiate within COPUOS, it should be expected that once the Principles are

*eopened for revision, progress will also be slow. However, during the entire review process and until such time the Principles are amended by the General Assembly, the current Principles will remain in force.

CONCLUSION

Any careful study of the Principles Relevant to the Use of Nuclear Power Sources in Outer Space as adopted by the General Assembly in 1992 will reveal certain flaws and shortcomings. However, keeping in mind the circumstances under which they were negotiated and the general feeling among members of the Committee on the Peaceful Uses of Outer Space that the Principles reflected "a delicate balance of expectations and frustrations," the Principles represent a substantial accomplishment for the Committee.[19]

As part of the negotiations that led to the adoption of the current Principles, certain delegations insisted on the inclusion of a review clause in order to ensure that the Principles continued to keep pace with scientific and technological developments related to nuclear power sources for space activities and in the field of radiological protection. In retrospect it now appears that the inclusion of a review clause also allowed Member States to finesse certain difficult issues while at the same time allowing the Committee to continue work on them during the review process.

This does not diminish the value of the Principles but merely underscores the importance of the review process. There are a host of issues related to revising the Principles which have already been broached in COPUOS and its two subcommittees and there will certainly be new issues to deal with as the review process gathers steam in the coming years.

What is important to keep in mind, especially for participants in the debate over how the principles might best be revised, is not the differences that exist among countries but rather the main areas of agreement. Of this we can be sure: all countries are interested in ensuring that the Principles are strengthened in such a way as to ensure the safe operation of nuclear power sources in outer space, both now and in the future. In this context, it is clear that the goal of the Principles is not to limit the use of NPS systems in any way, but merely to determine the best ways in which they can be utilized.

With careful consideration, the international community, through the United Nations, will be able to achieve this goal.

Notes

[1] General Assembly Resolution 47/68, 14 December 1992.

[2] See for example, N. Jasentuliyana, "Multilateral Negotiations on the Use of NPS in Outer Space," AASL vol, XIV, 1989, p. 297-337; Kopal, V., "The Use of Nuclear Power Sources in Outer Space: A New Set of United Nations Principles?" Proc., 34th Colloquium on the Law of Outer Space, p. 124. (1991).

[3] Lodigo, Y., "Developing Legal Principles for the Safe Use of Nuclear

Power Sources in Outer Space," Proc., 34th Colloquium on the Law of Outer Space, p. 133 (1991).

[4] Aftergood, S., "Space Nuclear Policy and the UN: A Growing Fiasco," Space Policy, vol. 8, no. 1, Feb. 1992.

[5] U.N. doc. A/46/20

[6] id.; U.N.G.A. Res 47/68 (Dec. 14, 1992).

[7] U.N. doc. A/AC.105/543.

[8] U.N. doc. A/AC.105/544.

[9] Perek, L., "The Scientific and Technological Basis of Space Law," in N. Jasentuliyana, (ed.), Space Law: Development and Scope, (Praeger Publishers).

[10] Smith, M.S., "Legal Aspects of Using Nuclear Reactors on the Moon," Proc., 35th Colloquium on the Law of Outer Space, P. 312, (1992).

[11] id.

[12] Terekhov, A.D., "The 1986 IAEA Conventions on Nuclear Accidents and the Consideration of the Use of Nuclear Power Sources in Outer Space in the Legal Subcommittee of COPUOS," Proc., 30th Colloquium on the Law of Outer Space, p. 403, (1987).

[13] U.N. Doc. A/AC/105/543

[14] U.N. Doc. A/AC.105/C.1/LO.188.

[15] Aftergood, S., *Supra* note 4.

[16] U.N. Doc. S&T/1993/CRP.2.

[17] Terekhov, A.D., "Review and Revision of the Principles Relevant to the Use of Nuclear Power Sources in Outer Space, to be published in Proc., 36th Colloquium on the Law of Outer Space (1993).

[18] id.

[19] U.N. Doc. A/AC.105/PV.378, (July 9, 1992).