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Use of nuclear power sources in outer space

Potential implementation options for establishing an international technically based framework of goals and recommendations for the safety of planned and currently foreseeable nuclear power source applications

Working paper submitted by the United Kingdom of Great Britain and Northern Ireland

I. Introduction

1. At its fortieth session, in 2003, the Scientific and Technical Subcommittee adopted a new multi-year work plan on the use of nuclear power sources (NPS) in outer space, covering the period 2003-2006 (see A/AC.105/804, annex III). The work plan was designed to develop an international technically based framework of goals and recommendations for the safety of NPS applications in outer space.

2. The Subcommittee has before it a note by the Secretariat, prepared jointly by the secretariat of the Office for Outer Space Affairs and the International Atomic Energy Agency (IAEA) on possible organizational plans for potential co-sponsorship of an effort to develop an international space NPS technical safety standard and potential IAEA advice to the Subcommittee in the preparation of such a standard (A/AC.105/C.1/L.268). This constitutes the final action of the schedule of work for 2003 (A/AC.105/804, annex III, para. 1, 2003 (f)).

3. The schedule of work for 2004 is as follows:

* A/AC.105/C.1/L.270.



(a) Review of information from national and regional space agencies on the content of relevant national (including bilateral and multilateral) space NPS programmes and applications planned or currently foreseeable;

(b) Review of information from national and regional space agencies on the applications enabled or significantly enhanced by space NPS;

(c) Review of IAEA-specific processes and mechanisms (including their timeframe, resources and administrative requirements) that the Agency could use to participate with the Subcommittee in developing space NPS technical safety standards;

(d) Preparation of a draft outline of the objectives, scope and attributes for an international technically based framework of goals and recommendations for the safety of planned and currently foreseeable space NPS applications;

(e) Preparation of a draft set of potential implementation options for establishing an international technically based framework of goals and recommendations for the safety of planned and currently foreseeable space NPS applications;

(f) If appropriate, taking a preliminary decision on whether to recommend co-sponsorship with IAEA of a technical standard development effort starting in 2006.

4. The present working paper relates to subparagraphs (e) and (f) of the 2004 work schedule and is intended to assist the Working Group on the Use of Nuclear Power Sources in Outer Space of the Scientific and Technical Subcommittee in completing the actions required under the two subparagraphs.

II. Potential implementation options

5. A number of members of the Working Group on the Use of Nuclear Power Sources in Outer Space held informal discussions in Vienna on 10 June 2003, immediately prior to the forty-sixth session of the Committee on the Peaceful Uses of Outer Space. They agreed that there were basically four options open to the Scientific and Technical Subcommittee for establishing an international technically based framework of goals and recommendations for the safety of planned and currently foreseeable space NPS applications. The four options are listed below and are also considered in the note by the Secretariat of 23 September 2003 (A/AC.105/C.1/L.268, annex), though, for the purposes of the present paper, they will be mentioned in a slightly different order.

Option 1

(referred to as the fourth option in document (A/AC.105/C.1/L.268, annex, para. 2)

6. This option is for the Scientific and Technical Subcommittee to take no further action.

7. The main arguments in favour of this option are:

(a) The General Assembly has already adopted the existing Principles Relevant to the Use of Nuclear Power Sources in Outer Space (resolution 47/68), which have provided, over the past decade, an international framework for space NPS activities devoted to the generation of electric power on board space objects for non-propulsive purposes;

(b) There are no urgent calls from any Member States for a framework of goals and recommendations for the safety of planned and currently foreseeable space NPS applications.

8. The arguments against adopting this option are:

(a) In adopting the existing Principles Relevant to the Use of Nuclear Power Sources in Outer Space, the General Assembly recognized that the Principles would require future revision in view of emerging nuclear power applications and of evolving international recommendations on radiological protection;

(b) The Scientific and Technical Subcommittee decided in February 2003 that it would be constructive to continue efforts to build upon the report of the Working Group on the Use of Nuclear Power Sources in Outer Space, entitled "A review of international documents and national processes potentially relevant to the peaceful uses of nuclear power sources in outer space" (A/AC.105/781) in order to take account of the most recent advances in nuclear safety and radiation protection standards. As a result, the Subcommittee adopted the current work plan (A/AC.105/804, annex III).

9. The authors of the present working paper strongly recommend that the Scientific and Technical Subcommittee continue with a positive programme of work aimed at establishing an international technically based framework of goals and recommendations for the safety of planned and currently foreseeable space NPS applications.

Option 2

(referred to as option 1 in document A/AC.105/C.1/L.268, annex)

10. This option is to initiate a joint programme of work with IAEA to develop a safety standard for nuclear power sources in outer space, using the Agency's safety standard development process with appropriate involvement of experts from the Committee on the Peaceful Uses of Outer Space and its Scientific and Technical Subcommittee. Such a cooperative effort would naturally have to take into consideration the reporting mechanisms and procedures of both IAEA and the Committee.

11. A paper prepared by the IAEA in cooperation with the Office for Outer Space Affairs is attached to document A/AC.105/C.1/L.268 as appendix I. It provides a summary of the main features of the Agency's process and indicates suggested procedures for the involvement of experts of the Committee on the Peaceful Uses of Outer Space in the various stages of that process.

12. The IAEA/Office for Outer Space Affairs paper focuses on a cooperative standard-making exercise between the Committee on the Peaceful Uses of Outer

Space and IAEA. It recognizes but does not deal in any depth with other possible mechanisms for involving IAEA (see option 4).

13. The main arguments in favour of this option are:

(a) IAEA has a uniquely authoritative function to establish or adopt, in consultation and, where appropriate, in collaboration with the competent organs of the United Nations and with the specialized agencies concerned, standards of safety for protection of health and minimization of danger to life and property, associated with the practical application of nuclear energy (Statute of the International Atomic Energy Agency).¹ The participation of the Agency would give great weight to any international space NPS technical safety standard that might be developed jointly between IAEA and the Committee on the Peaceful Uses of Outer Space;

(b) IAEA has well-developed mechanisms for reporting back to its relevant committees to keep them informed about progress with the development of any particular standard and to ensure a timely clearance of the draft document at specified points;

(c) IAEA is able to draw on a wide spectrum of nuclear and radiation safety experts and its secretariat is accustomed to dealing with the technical and administrative procedures associated with the development of standards in the nuclear field, sometimes in collaboration with other international agencies.

14. The main arguments against adopting this option are:

(a) IAEA experience in the development of safety standards is almost entirely in the area of terrestrial nuclear applications (see A/AC.105/781, para. 89). This represents an issue since although there are similarities at a fundamental level between terrestrial nuclear power sources or systems and space NPS, there are significant differences with regard to their design and use that are relevant to safety processes and standards (A/AC.105/781, para. 84);

(b) The approval mechanisms and processes of the Committee on the Peaceful Uses of Outer Space and IAEA are substantially different and could be difficult to harmonize;

(c) There may be practical difficulties concerning working languages (English only) and lack of interpretation facilities in any joint venture with IAEA;

(d) IAEA may have views about the relationship of any new international space NPS technical safety standard to the existing Principles Relevant to the Use of Nuclear Power Sources in Outer Space that the Committee on the Peaceful Uses of Outer Space may not share.

15. The authors of the present paper recognize that there are a number of substantive issues and uncertainties that would need to be resolved before recommending a specific form of collaboration between IAEA and the Committee on the Peaceful Uses of Outer Space on a technical safety standard development activity for space NPS. These include both administrative matters associated with the different processes and approval mechanisms of the Committee and IAEA and technical issues such as the historical experience base of each body.

16. The authors do, however, consider that there are strong arguments in favour of an eventual collaboration between the Committee and IAEA, provided that the administrative and technical issues can be resolved satisfactorily.

Option 3

(referred to as option 2 in document A/AC.105/C.1/L.268, annex)

17. As explained in document A/AC.105/C.1/L.268, this option would be for the Office for Outer Space affairs to organize, jointly with IAEA, a workshop/technical meeting to discuss the scope and general attributes of a potential technical safety standard for space NPS. The aim would be to improve each set of experts' understanding of the other set's perspectives and to move towards a shared vision of the scope and general attributes of a potential safety standard. This option could complement either option 2 or option 4.

18. The main arguments in favour of this option are that:

(a) It would provide a useful opportunity for IAEA and space experts to meet and exchange experience and perspectives on nuclear standard-making in general and, in particular, as related to NPS in outer space;

(b) It would provide an opportunity to discuss potential resolutions of the issues identified in paragraphs 14 and 15 above;

(c) The papers presented and the ensuing discussions would form a useful basis for any future collaboration in this field between the Committee on the Peaceful Uses of Outer Space and IAEA;

(d) In particular, such a joint meeting should help to move towards establishing a shared vision of the objectives, scope and attributes of an international technically based framework of goals and recommendations for the safety of planned and currently foreseeable space NPS applications.

19. The arguments against pursuing this option are essentially administrative, namely:

(a) The lack of interpretation facilities, which is a common feature of IAEA technical meetings, might constrain participants from the Committee on the Peaceful Uses of Outer Space and curtail the discussion to an unacceptable degree;

(b) The timing of the meeting could be difficult, given that, for efficiency, it should take place immediately prior to or after either a meeting of the Committee on the Peaceful Uses of Outer Space or of one of the IAEA committees of experts. This would be a particular issue for interested member States of the Committee with limited travel resources;

(c) Planning and preparing for such a meeting would require a significant amount of time and resources from the Working Group on the Use of Nuclear Power Sources in Outer Space and the Office for Outer Space Affairs secretariat.

20. The authors of the present paper consider that, on balance, the potential benefits to be obtained from holding such a joint workshop/technical meeting could outweigh the disadvantages and recommend that the Working Group study this

option further, including giving consideration to the terms of reference proposed in appendix II of document A/AC.105/C.1/L.268, and all the relevant technical, administrative and resource implications.

Option 4

(referred to as option 3 in document A/AC.105/C.1/L.268, annex)

21. As explained in document A/AC.105/C.1/L.268, this option is to promote work by interested members of the Working Group on the Use of Nuclear Power Sources in Outer Space to develop common standards on a multilateral basis, for consideration by the Scientific and Technical Subcommittee, with a view to the latter's requesting IAEA to undertake a peer review of the draft standards.

22. The main arguments in favour of this option are:

(a) Interested member States would be starting from a common basis of understanding of the technical aspects and safety issues related to space NPS;

(b) The multilateral group would involve both space NPS application experts and nuclear safety standard experts from interested member countries, thus enhancing the potential for development of space NPS safety standards consistent with the latest developments in nuclear safety standards;

(c) Substantive progress in the development of a technical standard could occur in the intersessional period of the Committee on the Peaceful Uses of Outer Space and be reported to the Scientific and Technical Subcommittee on an annual basis. For example, a multilateral group of interested members, with expertise in both space NPS applications and nuclear safety standards, could devote considerable attention to identifying those aspects of existing terrestrial nuclear safety standards and existing national space NPS standards relevant to a potential international technically based space NPS safety standard;

(d) The Scientific and Technical Subcommittee resource issues concerning interpretation and translation common to meetings of the Committee on the Peaceful Uses of Outer Space could be minimized by the focus of the meeting on a single topic;

(e) The work of the multilateral group could be provided to the Scientific and Technical Subcommittee and the Legal Subcommittee as a basis for pursuing a co-sponsorship effort with IAEA or requesting IAEA peer review.

23. The main arguments against this option are:

(a) As with option 2, the review mechanisms and processes of the Committee on the Peaceful Uses of Outer Space and IAEA are substantially different and could be difficult to harmonize;

(b) In the absence of endorsement by the Committee and/or IAEA, any multilateral technical standards would have limited international status.

24. The authors of the present paper recognize that this option requires further study, especially in the area of understanding the process for initiation and mechanisms for IAEA to conduct a technical peer review in response to a request

from the Scientific and Technical Subcommittee and in the area of incremental resources and administrative arrangements required to support such an approach. Also, as with option 2, the different processes and review mechanisms of the Committee on the Peaceful Uses of Outer Space and IAEA would need to be harmonized.

25. It is considered, however, that there are arguments in favour of promoting work by interested members to develop common standards on a multilateral basis, especially from the viewpoint of facilitating a continuing dialogue between experts in space NPS applications and nuclear safety standards.

III. Conclusions and recommendations

26. The authors of the present working paper conclude that:

(a) There are compelling arguments for continuing with a positive programme of work towards establishing an international technically based framework of goals and recommendations for the safety of planned and currently foreseeable space NPS applications;

(b) While there are potentially significant benefits from the Committee on the Peaceful Uses of Outer Space joining with IAEA to develop an international space NPS technical safety standard, there are a number of concerns and uncertainties about the technical and administrative arrangements that would need to be addressed before the Working Group on the Use of Nuclear Power Sources in Outer Space could make an unqualified recommendation to pursue this option;

(c) While there would be considerable mutual benefit to both the members of the Committee on the Peaceful Uses of Outer Space and IAEA from an early joint workshop/technical meeting to discuss the scope and general attributes of a potential safety standard for space NPS, there are questions of timing, resource requirements and administrative arrangements that would need to be addressed before the Working Group could make an unqualified recommendation to pursue this option;

(d) While there are potentially significant benefits from interested member States carrying out work on a multilateral basis to develop common standards, there are a number of uncertainties about the technical and administrative arrangements of IAEA conducting a technical peer review that would need to be addressed before the Working Group could make an unqualified recommendation to pursue this option.

27. Based on these conclusions, it is recommended that the Working Group on the Use of Nuclear Power Sources in Outer Space should:

(a) Advise the Scientific and Technical Subcommittee that it is sensible to continue with a positive programme of work towards establishing an international technically based framework of goals and recommendations for the safety of planned and currently foreseeable space NPS applications;

(b) Recommend to the Subcommittee that it seek to make a provisional (without prejudice) arrangement with IAEA for possible joint involvement in an activity on space NPS safety standards, beginning in 2006;

(c) Request the Subcommittee's agreement to the Working Group's entering into discussions with IAEA to address the issues, concerns and uncertainties about the timing, technical and resource requirements and administrative arrangements associated with options 2, 3 and 4.

(d) Prepare a detailed specification for a potential joint workshop/technical meeting, based on the terms of reference proposed in appendix II of document A/AC.105/C.1/L.268 and submit it to the Scientific and Technical Subcommittee for approval.

Notes

¹ United Nations, *Treaty Series*, vol. 276, No. 3988.
