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COMMITTEE ON THE PEACEFUL USES  
OF OUTER SPACEREPORT OF THE SCIENTIFIC AND TECHNICAL SUB-COMMITTEE  
ON THE WORK OF ITS SEVENTEENTH SESSION

## INTRODUCTION

1. The Scientific and Technical Sub-Committee of the Committee on the Peaceful Uses of Outer Space held its seventeenth session at United Nations Headquarters from 28 January to 13 February 1980 under the chairmanship of Professor J. H. Carver (Australia).
2. Representatives of the following Member States attended the session. Argentina, Australia, Austria, Belgium, Brazil, Bulgaria, Canada, Chile, Colombia, Czechoslovakia, Ecuador, Egypt, France, German Democratic Republic, Germany, Federal Republic of, Hungary, India, Indonesia, Iraq, Italy, Japan, Kenya, Mexico, Mongolia, Netherlands, Niger, Pakistan, Philippines, Poland, Romania, Sierra Leone, Sudan, Sweden, Turkey, Union of Soviet Socialist Republics, United Kingdom of Great Britain and Northern Ireland, United Republic of Cameroon, United States of America, Venezuela and Yugoslavia.
3. Representatives of the United Nations Environment Programme (UNEP), the Division for Natural Resources and Energy (DNRE) of the Department of Technical Co-operation for Development (DTCD), the Food and Agriculture Organization of the United Nations (FAO), the International Telecommunication Union (ITU), the World Meteorological Organization (WMO), the United Nations Educational, Scientific and Cultural Organization (UNESCO), the Inter-Governmental Maritime Consultative Organization (IMCO), the International Atomic Energy Agency (IAEA), the European Space Agency (ESA), the Committee on Space Research (COSPAR) of the International Council of Scientific Unions (ICSU) and the International Astronautical Federation (IAF) also attended the session.
4. A list of representatives of Member States and specialized agencies attending the session is contained in document A/AC.105/C.1/INF.9 and Add.1.

Agenda

5. At the opening of the session, the Sub-Committee adopted the following agenda:
  1. Adoption of the agenda
  2. Statement by the Chairman
  3. General exchange of views
  4. Consideration of the United Nations programme on space applications and the co-ordination of space activities within the United Nations system
  5. Questions relating to remote sensing of the earth by satellites
  6. Use of nuclear power sources in outer space
  7. Co-ordinating role of the United Nations in the use of space science and technology, particularly in the developing countries
  8. Preparations for the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space
  9. Questions relating to space transportation systems and their implications for future activities in space
  10. Examination of the physical nature and technical attributes of the geostationary orbit
  11. Other matters
    - (a) Review of the future role and work of the Scientific and Technical Sub-Committee
    - (b) Other reports
  12. Report to the Committee on the Peaceful Uses of Outer Space.

Meetings and documentation

6. The Sub-Committee held 19 meetings.
7. A list of the documents which were before the Sub-Committee is provided in annex I.
8. At the opening meeting the Chairman made a statement outlining the work of the Sub-Committee at its current session. The Chairman also informed the Sub-Committee that the General Assembly, at its thirty-fourth session, had adopted

resolution 34/50 in which it decided to discontinue, for an experimental period of two years, the provision of summary records. Accordingly, he stated that the Sub-Committee would not have summary records this year.

9. The Sub-Committee discussed whether or not it should hold a general exchange of views. Some delegations stated that they did not wish to participate in the general exchange of views in order to allow more time for the discussion of specific items. Other delegations were of the opinion, however, that the general exchange of views contributed toward the effective conduct of the Sub-Committee's work.

10. General statements were made by the following delegations: Bulgaria, Czechoslovakia, German Democratic Republic, Hungary, India, Kenya, Philippines, Poland, Romania, Union of Soviet Socialist Republics, as well as by the representative of ITU and the observer for COSPAR.

11. At the same meeting, a statement was also made by the Chief of the Outer Space Affairs Division introducing the documents before the Sub-Committee.

12. At the 225th meeting, the United Nations Expert on Space Applications made a statement outlining the activities carried out and future activities under the space applications programme.

13. In accordance with a recommendation made at its previous session (A/AC.105/238, para. 78) and endorsed by the Committee on the Peaceful Uses of Outer Space and the General Assembly, the Sub-Committee, at its seventeenth session, gave priority to the consideration of agenda items 4, 5, 6 and 7.

14. In accordance with paragraph 50 of the report of the Committee on the Peaceful Uses of Outer Space (A/34/20), the Working Group on the Use of Nuclear Power Sources in Outer Space met during the first week of the session of the Sub-Committee under the chairmanship of Professor J. H. Carver (Australia).

#### Tribute to the Chairman of the Scientific and Technical Sub-Committee

15. At its 239th meeting on 12 February, the Sub-Committee adopted by acclamation the following resolution which paid tribute to the 10 years of chairmanship of the Scientific and Technical Sub-Committee by Professor John H. Carver of Australia:

"Tenth anniversary of the assumption of the chairmanship of the Scientific and Technical Sub-Committee of the Committee on the Peaceful Uses of Outer Space by Professor John H. Carver

"The Scientific and Technical Sub-Committee of the Committee on the Peaceful Uses of Outer Space,

"Noting that this is the tenth anniversary since Professor John H. Carver has assumed the chairmanship of the Scientific and Technical Sub-Committee,

"Confirming the significant contribution and diligent leadership which he has provided throughout this decade,

"Expresses its appreciation for his distinguished service and substantial contribution to the studies of the technical and scientific aspects of the peaceful uses of outer space."

#### Tribute to the Chief of the Outer Space Affairs Division

16. The Sub-Committee learned with regret that Mr. Lubos Perek, Chief of the Outer Space Affairs Division for the last five years, was leaving that office. The Sub-Committee noted with great appreciation the outstanding and dedicated service which Mr. Perek had rendered to the Sub-Committee and had expressed the hope that he would, in future years, continue his association with the work of the Sub-Committee.

#### Recommendations of the Scientific and Technical Sub-Committee

17. After considering the various items before it, the Sub-Committee, at its 241st meeting on 13 February 1980, adopted its report to the Committee on the Peaceful Uses of Outer Space containing its views and recommendations as set out in the paragraphs below.

##### I. PREPARATIONS FOR THE SECOND UNITED NATIONS CONFERENCE ON THE EXPLORATION AND PEACEFUL USES OF OUTER SPACE

18. During the course of the session, the Sub-Committee, acting as Advisory Committee to the Preparatory Committee for the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space, in accordance with General Assembly resolution 33/16, considered this item and adopted a report (A/CONF.101/PC/1).

##### II. USE OF NUCLEAR POWER SOURCES IN OUTER SPACE

19. In accordance with the recommendation of the Committee on the Peaceful Uses of Outer Space at its last session (A/34/20, para. 118), the Working Group on the Use of Nuclear Power Sources in Outer Space continued its work at this year's session. The Working Group met from 28 January to 1 February under the Chairmanship of Professor J. H. Carver (Australia). At a meeting held on 12 February 1980, the Working Group adopted its report (A/AC.105/C.1/L.120).

20. At its 240th meeting, on 13 February 1980, the Sub-Committee considered and adopted the report of the Working Group, which is annexed to the present report (annex II).

III. CONSIDERATION OF THE UNITED NATIONS PROGRAMME ON SPACE APPLICATIONS AND THE CO-ORDINATION OF SPACE ACTIVITIES WITHIN THE UNITED NATIONS SYSTEM

A. Report of the United Nations Expert on Space Applications to the Scientific and Technical Sub-Committee

21. The Sub-Committee noted that the United Nations programme on space applications for 1979 (A/AC.105/257) had been carried out satisfactorily and commended the work accomplished by the Expert in carrying out his work programme as endorsed by the Sub-Committee at its last session.

(1) Panel/seminars/training workshops

22. With regard to the programmes carried out during 1979, the Sub-Committee expressed its appreciation to: (a) the Government of Italy and FAO for conducting the fourth international training course on the applications of remote sensing techniques to fisheries from 14 May to 1 June 1979 at FAO headquarters in Rome (A/AC.105/253); (b) the Government of Argentina for hosting and organizing, in co-operation with the United Nations, a regional training course on remote sensing applications in Buenos Aires from 5 to 23 November 1979 for the benefit of developing countries in the Economic Commission for Latin America (ECLA) (A/AC.105/255); (c) the Government of Nigeria for hosting an African regional training seminar on remote sensing in Ibadan, Nigeria, from 5 to 23 November 1979 which was co-sponsored by FAO (A/AC.105/254); and (d) the Government of Syria for hosting a United Nations training seminar on remote sensing in Damascus from 1 to 11 December 1979 for the benefit of Member States in the Economic Commission for Western Asia (ECWA) region (A/AC.105/256).

23. The Sub-Committee took note of the status of the 1980 programme of seminars which it had approved at its last session. This programme includes the following activities: (a) a United Nations regional training seminar on satellite remote sensing applications for the benefit of Member States in the Economic Commission for Africa (ECA) region, hosted by the Government of Upper Volta in Ougadougou from 9 to 23 January 1980; (b) an international United Nations/FAO seminar to be organized by the Environmental Research Institute of Michigan (ERIM) and the Costa Rican Instituto Geografico Nacional (IGN) on the benefits of remote sensing for national development, to be held in San José, Costa Rica, from 20 to 22 April 1980; (c) the Fifth International Training Course on Applications of Remote Sensing to Water Resources to be held at FAO headquarters, Rome, from 19 May to 16 June 1980; (d) a United Nations seminar on remote sensing applications to be held in Tokyo, Japan, in September 1980 for the benefit of Member States in the Economic and Social Commission for Asia and the Pacific (ESCAP) region; (e) a United Nations/FAO regional training seminar on remote sensing applications for land resources for the benefit of Member States in the Economic Commission for Western Asia (ECWA) and the Mediterranean regions, to be held in Athens, Greece, from 7 to 17 October 1980; and (f) a United Nations training seminar on remote sensing applications in the field of geology and hydrology to be held in Baku, USSR, from 17 to 29 November 1980. Further details relating to these seminars are provided in paragraphs 28 to 30 of the report of the Expert on space applications (A/AC.105/257).

24. In taking note of these 1980 activities and programmes, the Sub-Committee particularly welcomed the invitations extended by the Governments of Upper Volta, Italy, Japan, Greece and the USSR to host these training seminars as well as the plans being made by the COSPAR and the Committee for Science and Technology in Developing Countries (COSTED) of ICSU, together with the United Nations, for holding in the United States in May 1980 an international workshop on applications of remote sensing to marine resources in developing countries.

(2) Fellowships

25. The Sub-Committee expressed its gratitude to the Governments of Italy and the Netherlands for having offered fellowships in 1979 and noted with appreciation the offers extended by the Governments of Belgium and Italy to renew their sponsorship of training fellowships.

26. In this connexion, the Sub-Committee expressed its hope that more such fellowships might be extended or initiated in 1980. Further, the Sub-Committee stressed the need for providing more opportunities with financial assistance to developing countries in order to enable them to gain advanced knowledge of space applications.

(3) United Nations programme on space applications for 1980 and review of future programmes

27. With regard to the space applications programme proposed for 1981, the Sub-Committee approved the programme of activities as outlined by the Expert in paragraphs 31 to 40 of his report (A/AC.105/257), together with a statement on the administrative aspects of that programme (A/AC.105/L.117).

28. The Sub-Committee noted, in particular, that the 1981 programme includes the following: (a) a sixth international training course on remote sensing applications to be held at FAO headquarters in co-operation with the United Nations, FAO and the Government of Italy, in May/June 1981; (b) an interregional United Nations training seminar on remote sensing applications for the benefit of developing countries, in the ECWA and Mediterranean regions, possibly to be held in Bulgaria in the latter half of 1981; (c) a United Nations regional seminar on remote sensing and satellite communications for education and development for the benefit of developing countries in the ECLA region, to be held in Buenos Aires, Argentina, from 31 March to 8 April 1981; (d) a United Nations regional seminar on remote sensing applications and satellite communications for education and development for the benefit of developing countries in the ECA region, to be held in April/May, possibly in co-operation with ECA at ECA headquarters in Addis Ababa or at the invitation of a Member State of the region having an active space applications programme; (e) a United Nations regional seminar on remote sensing and use of meteorological data, to be held, possibly in co-operation with ESCAP, in September at ESCAP headquarters in Bangkok or in a developing country in the region having an active space applications programme; alternatively, a United Nations regional seminar on remote sensing and communications for education and development, to be held preferably in a developing country such as India or Indonesia, which have carried out national programmes in these areas; (f) a United

Nations regional remote sensing seminar for the benefit of developing countries in the ECWA and Mediterranean regions to be held in October/November, possibly in one of the Member States having an active remote sensing programme, and (g) a United Nations interregional seminar on remote sensing applications and satellite communications for education and development, for the benefit of developing countries, to be held possibly in Toulouse, France, in the latter part of March 1981.

29. The Sub-Committee expressed its appreciation to the Governments of Bangladesh, Ecuador, India and Pakistan for indicating their interest in hosting United Nations regional seminars in 1982.

30. The Sub-Committee reiterated the view it had expressed at its past session that the United Nations programme on space applications should be expanded both in scope and content if it was to better accommodate the needs of the developing countries.

B. Co-ordination of outer space activities within the United Nations system

31. The Sub-Committee noted the information provided by the Chief of the Outer Space Affairs Division on the progress achieved in furthering consultation on and co-ordination of outer space activities among organizations within the United Nations system. In this connexion, the Sub-Committee expressed its appreciation for the report submitted by the Secretary-General (A/AC.105/242), which reflected recent and future activities of the organizations concerned, and noted that the report had been prepared in an integrated subject-oriented form rather than on an organizational basis.

32. The Sub-Committee also noted that the Administrative Committee on Co-ordination (ACC), recognizing the need for continued co-ordination of activities within the United Nations system in the field of international co-operation in the peaceful uses of outer space, had convened an interagency meeting on outer space activities in Geneva from 26 to 28 September 1979. It also noted that, as requested in document ACC/1979/80, representatives at the meeting considered the need for further consultation on and consideration of activities and programmes, particularly as related to the participation of the United Nations agencies and organizations in preparing for the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space. It further noted that the meeting agreed to recommend to ACC that a second interagency meeting be held in the latter part of 1980.

33. The Sub-Committee continued to stress the necessity of ensuring continuous and effective consultations and co-ordination in the field of outer space activities among organizations within the United Nations system.

IV. CO-ORDINATING ROLE OF THE UNITED NATIONS IN THE USE  
OF SPACE SCIENCE AND TECHNOLOGY, PARTICULARLY IN  
THE DEVELOPING COUNTRIES

34. At its sixteenth session, the Sub-Committee agreed to the inclusion of this item as a matter of priority on this session's agenda and recommended further that the Secretariat prepare, for its consideration, a comprehensive study examining the current and potential benefits of space science and technology to Member States, particularly the developing countries. Special attention was to be devoted to individual areas of space applications such as remote sensing and communications, as well as to the benefits which might be derived by co-ordinating the activities of the United Nations system in those various areas.

35. The study prepared by the Secretariat in response to this recommendation was presented to the Scientific and Technical Sub-Committee (A/AC.105/243, Add.1 and Corr.1-2). The Sub-Committee noted that in preparing the study, the Secretariat was guided by the consideration that its preparation should be undertaken in stages in order to ensure that its content remains in accordance with the wishes of the Sub-Committee. As a result, this study is considered the first stage and encompasses two aspects of the subject: (a) a general survey of current and potential benefits of space science and technology, and (b) an explanation of the manner in which the United Nations system is attempting to meet the requests of Member States for assistance in the field of space applications. The Sub-Committee also noted the conclusion in the study that the United Nations system has sufficient expertise and flexibility to play an effective role in assisting Member States, particularly the developing countries, in realizing the benefits to be derived from outer space activities. It noted further that the activities and programmes undertaken within the United Nations system have encompassed both space science and space technology, the latter related primarily to its practical applications. The Sub-Committee concluded that before an assessment could be made of the benefits to be derived from co-ordination of space science activities, it would be necessary to survey in more detail and through close interagency consultations the various space science programmes which already exist.



V. QUESTIONS RELATING TO REMOTE SENSING  
OF THE EARTH BY SATELLITES

36. At the current session, the Sub-Committee resumed its priority consideration of questions relating to remote sensing of the earth by satellites (agenda item 5). Before the Sub-Committee were a number of papers devoted to various aspects of this item. These papers included documents A/AC.105/250 and Add.1, A/AC.105/251, A/AC.105/257 and Add.1, A/AC.105/260 and A/AC.105/C.1/L.116.

37. At its 230th meeting, the Sub-Committee decided to establish a drafting group under the chairmanship of Dr. Murray Strome of Canada. The drafting group held two meetings.

A. Questions relating to remote sensing data

38. Some delegations expressed the hope that efforts would continue to be made towards an arrangement that could result in an agreement on questions relating to dissemination of primary data. However, in the course of the debate on this item, delegations reaffirmed their basic positions which had been reflected in the report of the sixteenth session of the Sub-Committee (A/AC.105/238), namely:

(a) "Some delegations expressed the view that remote sensing data should be freely disseminated. In this connexion, it is the view of those delegations that if dissemination of data is to be restricted in any way, only States operating satellite systems will have complete access to data. This, in fact, places the nations who cannot afford or do not wish to develop their own systems at a distinct disadvantage vis-à-vis the sensing States."

(b) "The view was expressed that the dissemination of data obtained by remote sensing must be subject to prior consent and should be made available freely to the sensed State as an expression of respect for its sovereignty and not be distributed to third parties without its consent."

(c) "Other delegations expressed the view that some classification of data should be established. Based upon such a classification, there should be an agreement on a limit beyond which the dissemination of data should have the prior consent of the sensed States. In this connexion, some delegations were of the view that a sensing State possessing primary data about a sensed State finer than a certain spatial resolution should not disseminate such data to a third State without the permission of the sensed State. Some delegations suggested that the appropriate limit be a photographic resolution of 50 metres, since it was their view that dissemination of data with finer resolution might affect the economic and/or defence interest of sensed States."

39. In addition, the Sub-Committee reiterated the view which it had expressed at its fourteenth session (A/AC.105/195, para. 41) that there was no scientific or

technical basis for a sensed State not having timely and non-discriminatory access to data of its territory.

40. In relation to the classification of data for the purpose of dissemination, some delegations reiterated the view that one of the criteria for the classification of the data could be the types of application for which the data would be used.

41. Some delegations expressed the view that there are no objective scientific or technical reasons for classifying primary data in some rigid fashion into categories which could be subjected to different dissemination rules.

42. Some delegations expressed the view that very little public information exists about certain very high resolution earth observation systems. Unless such information is taken into account while discussing the issue of classification of data, the Sub-Committee might find it difficult to arrive at concrete results.

43. The Sub-Committee noted document A/AC.105/250 which contains the replies from Governments and international organizations on the definition of the terms "coarse", "medium" and "fine" as applied to spatial resolution in remote sensing. In summary, the view of those Governments who replied was that these terms cannot be given precise quantitative definitions and that these concepts, which should only be used in a relative sense, may require different definitions depending upon applications. The Sub-Committee also noted the document on the definition of spatial resolution in imaging radar systems (A/AC.105/251) prepared by the United Kingdom. In summary, the paper noted that a number of definitions of spatial resolution existed for imaging radar systems and that these definitions were related to the particular applications of the data; in addition, the relationship between the spatial and the radar radiometric resolution was emphasized.

44. The Sub-Committee noted the report on the concept of "effective resolution element" (ERE) (A/AC.105/260) that it had requested the Secretariat to prepare for its seventeenth session. The report discussed two concepts: "effective radiometric resolution element" (ERRE) and "spatial effective resolution element" (SERE). The Sub-Committee, noting that the report did not provide finalized definitions, requested the International Society of Photogrammetry to review these concepts and to inform the Sub-Committee, at its next session, of more precise definitions, if any.

#### B. The co-ordinating role of the United Nations

45. As the Sub-Committee has done in the past, it also considered the extent to which the United Nations can play a co-ordinating role as well as foster international co-operation in future operational remote sensing systems.

46. In this connexion, some delegates were of the view that a panel of experts should be established in order to assist the United Nations in its co-ordination

of remote sensing activities. Other delegations felt that there was no need for such a panel of experts. The view was expressed that the Sub-Committee should continue to be the focal point for the study of technical and scientific aspects of remote sensing. Still another view was expressed that some activities envisaged for the proposed panel could better be undertaken through direct bilateral and multilateral co-operation among interested States. The view was expressed that an officer within the Secretariat should be nominated for the purpose of ensuring that the Sub-Committee should be kept fully informed of any remote sensing co-ordination activities being carried out outside the United Nations framework.

47. Some delegates expressed the view that remote sensing is not a science by itself; rather, it is a tool forged out of different branches of science and technology, which could be used to gather information required for decision making in resources management. As such, these delegations felt that the application of remote sensing techniques to different areas of resource management requires different methodologies and approaches, and that a single panel of experts would not be in a position to address itself to this wide range of activities.

48. During the course of the discussion, some delegations concerned about the lack of progress on this question expressed the view that the Working Group on Remote Sensing should be reconvened within the Sub-Committee. The view was expressed, however, that reconvening the Working Group was unlikely to ensure progress in this field.

49. The view was expressed that an international body with international remote sensing satellites should be established under the auspices of the United Nations, and that this body should function and provide data under conditions that would best suit the international community. The Sub-Committee, however, recalled its earlier position at its thirteenth session (A/AC.105/170, para.52) that because "of the high cost and technical difficulties, the United Nations could not be expected to own or operate the ground or space segment of an operational remote sensing system in the foreseeable future".

50. The Sub-Committee noted with appreciation the list of applications in remote sensing prepared by the Secretariat in accordance with its request made last year (A/AC.105/257/Add.1 and Corr.1). The Sub-Committee recommended that the Secretariat should prepare a detailed catalogue, based on information available, on the uses of remote sensing. The catalogue should also contain presentations of examples on resource management, problems and possible methods of solution; on other information sources; on remote sensing techniques applied; on benefits derived through the use of remote sensing and other relevant information. Member States should be requested to assist in the compilation of such a catalogue. The Sub-Committee felt that a catalogue prepared by the Secretariat on this basis could be useful in the preparations for the Second Space Conference.

51. The Sub-Committee recognized the need that the five existing regional remote sensing centres in Africa should receive from the United Nations any technical assistance and co-operation which could be made available.

C. International co-operation

52. The Sub-Committee was of the opinion that remote sensing from outer space should be carried out with the greatest possible international co-operation and participation. In this context, the Sub-Committee recognized the need to provide assistance to developing countries. The United Nations, through its space applications programme and the remote sensing centres of FAO and of DNRE, and interested agencies, could play an important role in providing such assistance. The Sub-Committee, recognizing the value of remote sensing to agriculture and non-agricultural resources, encouraged FAO and DNRE to give high priority to activities in these fields.

53. The Sub-Committee, recognizing the necessity of regional co-operation, encouraged the establishment of new and the strengthening of existing regional remote sensing centres, with a view to creating an indigenous capacity, especially within the developing countries, and urged the United Nations to continue its co-operation with these centres.

54. The Sub-Committee noted with satisfaction the various activities of DNRE and of the United Nations agencies, especially FAO, WMO, UNESCO and ITU, in the area of remote sensing. The Sub-Committee also noted with appreciation the important contributions of the Italian Government to the annual United Nations training course on remote sensing hosted by FAO in Rome.

55. Some delegations were of the opinion that there is a great need to view remote sensing in the perspective of resource management. Such an approach would avoid the over-emphasis on remote sensing and would highlight requirements which need to be fulfilled, such as training of personnel, establishment of facilities, etc., in order to integrate remote sensing into the over-all activity of resource management.

56. Some delegations expressed the view that a special programme of fellowships for nationals of the less developed countries should be established by the United Nations Development Programme to train scientists at the Master and Ph.D. levels in order to form leading human resources capable of undertaking research and planning in the field of space science and technology in their respective countries. It was also observed that, in such a case, every effort should be made to select appropriate beneficiaries for this programme and, at the conclusion of their particular training, to place them in positions appropriate, as far as possible, to their specializations.

D. Existing and planned space segment

57. At the current session, the Sub-Committee continued to consider the current pre-operational/experimental phase of remote sensing, as well as possible future operational satellite land remote sensing systems.

58. The Sub-Committee noted the information that the United States had decided to establish an operational LANDSAT remote sensing programme and was currently planning the transition from the experimental to the operational system.

59. The Sub-Committee also noted the information that the Government of the Netherlands had completed a study on satellite remote sensing applications and mission objectives in developing countries, which would be made available to the Sub-Committee in due time.

VI. QUESTIONS RELATING TO SPACE TRANSPORTATION  
SYSTEMS AND THEIR IMPLICATIONS FOR FUTURE  
ACTIVITIES IN SPACE

60. In accordance with General Assembly resolution 34/66 and the recommendation of the Committee on the Peaceful Uses of Outer Space at its last session (A/34/20, para. 41), the Sub-Committee continued its consideration of this item and took note of a report (A/AC.105/244) presented by the Secretariat concerning the international implications of new space transportation systems. This report, prepared in response to a request made by the Sub-Committee at its sixteenth session (A/AC.105/238, para. 61), contains a summary of existing systems and those under development, a survey of present and future requirements for space transportation systems and a discussion of issues which will arise as a consequence of the deployment of space transportation systems.

61. The Sub-Committee also had before it a report (A/AC.105/262 and Add.1) containing the views of Member States on space transportation systems.

62. In response to a request of the Committee on the Peaceful Uses of Outer Space at its twenty-second session, the Secretariat provided, with the assistance of ESA, a bibliography (A/AC.105/265) of literature on activities which might be undertaken using space platforms.

63. In the course of its discussions, the Sub-Committee took note of the progress being made in the various programmes related to space transportation systems and recognized, in particular, that such progress was providing the international community with a much wider choice in such systems. The Sub-Committee took special note of the progress being made in the development of space transportation systems as reported by the USSR concerning Soyuz and Progress. France concerning Ariane, the United States concerning the Space Shuttle and ESA concerning Ariane and SPACELAB. The Sub-Committee decided to continue consideration of this item at its next session.

64. The Sub-Committee heard a presentation by the head of the USSR delegation, Academician O. G. Gazenko, on human factors in space flight. This presentation was accompanied by a documentary film on the orbital station Salyut mission.

VII. EXAMINATION OF THE PHYSICAL NATURE  
AND TECHNICAL ATTRIBUTES OF THE  
GEOSTATIONARY ORBIT

65. In accordance with its decision at the sixteenth session, the Sub-Committee continued its consideration of this item at the current session. Two papers were before the Sub-Committee, both submitted by the Secretariat in response to requests of the Sub-Committee made at its previous session (A/AC.105/238, para. 66).

66. The first paper (A/AC.105/259 and Add.1), which was prepared with the assistance of COSPAR, provides an examination of the dynamics of space objects. The study focused on two major aspects of such objects: (a) satellite orbit stability and the various factors which disturb that stability (i.e., the earth's gravitational field, air drag and lunisolar disturbances), and (b) three methods of removing inactive satellites from their orbits (i.e., pushing the satellite into the earth's atmosphere, pushing the satellite out of the earth's gravitational field and placing the satellite in a disposal orbit), including a description of the specific conditions under which each of these methods would be most efficient and economical.

67. The second paper before the Sub-Committee (A/AC.105/252, and Corr.1, and Add.1) contained the views of Member States, received by the Secretariat as of 1 October 1979, concerning the most efficient and economical means of using the geostationary orbit. The Sub-Committee noted that these views would be used in the preparation of future studies on this subject.

68. In this connexion, the Sub-Committee noted that a comprehensive study on this subject, as requested by it at its last session (A/AC.105/238, para. 66), was under preparation. This study, the Sub-Committee was informed, would be available as of 31 July 1980. The Sub-Committee also reiterated its request that the study on the physical nature and technical attributes of the geostationary orbit (A/AC.105/203 and Add.1-3) continue to be brought up to date as required.

69. Some delegations reaffirmed their view that planning is one of the principal means of assuring effective use of the geostationary orbit, in keeping with resolution BP "relating to the use of the geostationary satellite orbit and to the planning of space services utilizing it", adopted by the World Administrative Radio Conference of 1979, which lays down in its operative paragraph 3.2 that special consideration should be given to the special geographical situation of particular countries on regulating the geostationary orbit. Those delegations were also of the opinion that a promising way to avoid saturation of the geostationary orbit would be the use of geosynchronous orbits with small inclinations and quasi-stationary orbits. Other possible ways of more effective use of the geostationary orbit would be the establishment of criteria of compatibility of geostationary orbit satellite networks, the introduction of new equipment with better direction of onboard and ground antennae, the application of interference-resistant methods of transmission from geostationary satellites which requires a study of methods for multiple use of the frequencies already in operation and the use of new frequency bands. Other delegations expressed doubts on the possibility of reaching the best possible use of the geostationary orbit by means of planning and furthermore, requested that the work carried out at the

the Scientific and Technical Sub-Committee level not duplicate the studies conducted by ITU and, in particular, the International Radio Consultative Committee (CCIR).

70. Also during its discussions, the Sub-Committee noted the conclusions reached at WARC (1979) concerning the use of the geostationary orbit and further noted that another such conference, to be held in two sessions, would be convened not later than 1984 in order to devote further study to this question.

#### VIII. OTHER MATTERS

##### (a) Reports

71. The Sub-Committee expressed its appreciation to Member States that had submitted reports on their national and co-operative international space activities for the year 1979, as contained in document A/AC.105/264, and called upon them to continue to submit such reports, in good time, for consideration by the Sub-Committee.

72. The Scientific and Technical Sub-Committee noted with interest the information paper submitted by the Secretariat concerning mutual relations of space missions (A/AC.105/261). It particularly noted the conclusion of the report that some of the problems of current and future space activities might well be alleviated through technical solutions or organizational arrangements which might be developed within the international community.

73. The Sub-Committee welcomed the report of WMO on its tropical cyclone project (A/AC.105/245), which was submitted in response to General Assembly resolution 33/16. This year's report provided not only information on the tropical cyclone project, but also further designated the form which the intensified programme determined by the WMO Eighth Congress will take during the period 1980-1983.

74. The Sub-Committee also expressed its appreciation for the information provided by ITU concerning the recommendation and reports of CCIR, 1978 (A/AC.105/247) and concerning the study programme being initiated by that Committee (A/AC.105/249). The Sub-Committee further welcomed the document provided and the presentation made by the representative of ITU concerning the results of WARC (1979).

75. On 4 February, a briefing on WARC (1979) was held for the benefit of the members of the Sub-Committee under the auspices of IAF.

76. The Sub-Committee noted with interest the sixth annual report by the International Telecommunications Satellite Organization (INTELSAT) covering the period from 1 April 1978 to 31 March 1979 (A/AC.105/266).

77. The Sub-Committee noted with appreciation the participation in its session by representatives of United Nations bodies, specialized agencies and

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international organizations, and found the reports they had submitted helpful in enabling the Sub-Committee to fulfil its role as "focal point" for international co-operation, especially with respect to the practical application of space science and technology in developing countries. The Sub-Committee further expressed its appreciation to the specialized agencies for their continued co-operation with the Sub-Committee and, in particular, for their participation in the United Nations programme on space applications and in interagency co-operation and consultation in works relating to outer space in general.

78. The Sub-Committee welcomed once again at this year's session the participation of COSPAR and IAF in its work and, in particular, noted that, in accordance with its request, both organizations had continued to provide valuable reports to the Sub-Committee on an annual basis on scientific and technical development in the exploration and practical uses of outer space. In this connexion, it expressed its appreciation to COSPAR for its annual report (A/AC.105/248) and for its study on the dynamics of space objects (A/AC.105/259), as well as to IAF for both its annual report (A/AC.105/246) and for the study which it had prepared on the implications of space transportation systems (A/AC.105/244). The Sub-Committee also expressed its appreciation to these two organizations for the informative statements made by their representatives in presenting their reports to the Sub-Committee.

(b) Review of the future role and work of the Scientific and Technical Sub-Committee

79. During the discussions on this item, some delegations expressed the view that the future work of the Sub-Committee might be facilitated by eliminating the general exchange of views from the agenda. Other delegations, however, were of the view that the general exchange of views was a useful element of the Sub-Committee's work programme. Still other delegations expressed the view that the Sub-Committee should maintain a flexible position concerning whether or not it might be worthwhile to hold a general exchange of views. In this connexion, some delegations stated that it might be useful to invite selected speakers to address the Sub-Committee on specific topics of scientific or technical interest.

80. Some delegations expressed the view that the Sub-Committee should keep its agenda under review for the purpose of assessing, as required, the relevance and potential for progress of its items or parts thereof.

81. Some delegations suggested that consideration be given by the Committee on the Peaceful Uses of Outer Space to the possibility of holding simultaneous meetings of the two Sub-Committees in order to facilitate an effective dialogue between them. Other delegations, however, did not consider it necessary to revise the working methods of the Sub-Committee.



82. After considering various suggestions for the next session's agenda, the Sub-Committee recommended that the agenda of its eighteenth session include the following priority items:

- (a) Consideration of the United Nations programme on space applications and the co-ordination of space activities within the United Nations system;
- (b) Questions relating to remote sensing of the earth by satellites;
- (c) Preparations for the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space;
- (d) The use of nuclear power sources in outer space.

The Sub-Committee also recommended that the agenda of the eighteenth session include the following items:

- (a) Questions relating to space transportation systems and their implications for future activities in space;
- (b) Examination of the physical nature and technical attributes of the geostationary orbit.

83. With regard to the dates for the eighteenth session, the Sub-Committee recommended that its meetings be scheduled for 2 to 13 February 1981, while reserving the possibility of extending the session for a few days in the light of the tasks which were assigned to it. In this connexion, the Sub-Committee took note of the recommendation made by the Working Group on the Use of Nuclear Power Sources in Outer Space in its report (annex II, para. 28) that arrangements be made for the Working Group to meet for one week during the 1981 session of the Sub-Committee.



Annex I

DOCUMENTS BEFORE THE SEVENTEENTH SESSION OF THE  
SCIENTIFIC AND TECHNICAL SUB-COMMITTEE

Item 1: Adoption of the agenda

1. A/AC.105/C.1/L.112 - Provisional agenda, with annotations, for the seventeenth session of the Scientific and Technical Sub-Committee.
2. A/AC.105/C.1/L.117 - Documents before the seventeenth session of the Scientific and Technical Sub-Committee.

Item 4: Consideration of the United Nations programme on space applications and the co-ordination of space activities within the United Nations system

3. A/AC.105/242 - Co-ordination of outer space activities within the United Nations system: programmes of work for 1980 and 1981 and future years.
4. A/AC.105/253 - Report on the fourth United Nations Food and Agriculture Organization of the United Nations training course on the applications of remote sensing techniques to fisheries in co-operation with the Government of Italy (Rome, Italy, 14 May-1 June 1979).
5. A/AC.105/254 - Report on the United Nations/Food and Agriculture Organization of the United Nations regional training seminar on remote sensing applications (Ibadan, Nigeria, 5-23 November 1979).
6. A/AC.105/255 - Report on the United Nations training course on remote sensing applications (Buenos Aires, Argentina, 5-23 November 1979).
7. A/AC.105/256 - Report on the United Nations regional training seminar on remote sensing applications (Damascus, Syria, 1-11 December 1979).
8. A/AC.105/257 and Corr.1 - Report of the United Nations Expert on Space Applications to the Scientific and Technical Sub-Committee.
9. A/AC.105/L.117 - Consideration and review of the United Nations programme on space applications - Administrative aspects of the United Nations programme on space applications for 1981 proposed by the Expert on Space Applications in his report for 1981 (A/AC.105/257).
10. ACC/1979/80 - Interagency Meeting on Outer Space Activities - Note by the United Nations Secretariat (WMO headquarters, Geneva, 26-28 September 1979).

Item 5: Questions relating to remote sensing of the earth by satellites

11. A/AC.105/250 and Add.1 - Definition of the terms "coarse", "medium" and "fine" as applied to spatial resolution in remote sensing.

12. A/AC.105/251 - The definition of spatial resolution in imaging radar systems - Working paper presented by the United Kingdom of Great Britain and Northern Ireland.

13. A/AC.105/257/Add.1 and Corr.1 - Report of the United Nations Expert on Space Applications to the Scientific and Technical Sub-Committee. Addendum. List of remote sensing applications in the developing countries.

14. A/AC.105/260 - Report on effective resolution element and related concepts.

15. A/AC.105/C.1/L.116 - First meeting of the Conference of Plenipotentiaries of the African Remote Sensing Council (Ouagadougou, 3-5 October 1979).

(See also A/AC.105/253 to 256 under item 4 above.)

Item 6: Use of nuclear power sources in outer space

16. A/AC.105/C.1/WG.V/L.5 - Questions relating to the use of nuclear power sources in outer space. Japan: working paper.

17. A/AC.105/C.1/WG.V/L.6 - Questions relating to the use of nuclear power sources in outer space. Sweden: working paper.

18. A/AC.105/C.1/WG.V/L.7 and Add.1 - Questions relating to the use of nuclear power sources in outer space. Canada: working paper.

19. A/AC.105/C.1/WG.V/L.8 - Questions relating to the use of nuclear power sources in outer space. United States of America: working paper.

20. A/AC.105/C.1/WG.V/L.9 - Questions relating to the use of nuclear power sources in outer space. United States of America: working paper.

21. A/AC.105/C.1/WG.V/L.10 - Questions relating to the use of nuclear power sources in outer space. Union of Soviet Socialist Republics: working paper.

22. A/AC.105/C.1/WG.V/L.11 and Add.1 - Questions relating to the use of nuclear power sources in outer space. United Kingdom of Great Britain and Northern Ireland: working paper.

23. A/AC.105/C.1/WG.V/L.12 - Questions relating to the use of nuclear power sources in outer space. India: working paper.

24. A/AC.105/C.1/WG.V/L.13 - Questions relating to the use of nuclear power sources in outer space. France: working paper.

25. A/AC.105/C.1/WG.V/L.14 - Questions relating to the use of nuclear power sources in outer space. Canada: working paper.

26. A/AC.105/C.1/L.120 - Report of the Working Group on the Use of Nuclear Power Sources in Outer Space on the work of its second session.

(See also A/AC.105/259 under item 10 below.)

Item 7: Co-ordinating role of the United Nations in the use of space science and technology, particularly in the developing countries

27. A/AC.105/243 and Corr.1-2 and Add.1 - An examination of the benefits of space science and technology emphasizing the advantages of co-ordinating the activities of the United Nations system in areas of space applications. Part I - A general survey.

Item 8: Preparations for the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space

28. A/AC.105/258 - Draft list of topics of background papers for the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space.

29. A/AC.105/C.1/L.118 - Preparations for the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space.

30. A/AC.105/C.1/L.121 and Add.1 - Report of the Advisory Committee to the Preparatory Committee for the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space.

31. A/CONF.101/PC/L.1 - Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space - Preparatory activities involving the promotion of public awareness of the benefits of space exploration.

32. A/CONF.101/INF.1 - Information note on the preparation of national papers.

Item 9: Questions relating to space transportation systems and their implications for future activities in space

33. A/AC.105/244 - International implications of new space transportation systems.

34. A/AC.105/262 and Add.1 - Views of Member States on space transportation systems.

35. A/AC.105/265 - Bibliography of the literature on activities that might be carried out using space platforms.

(See also A/AC.105/261 under item 11 (a) below.)

Item 10: Examination of the physical nature and technical attributes of the geostationary orbit

36. A/AC.105/252 and Corr.1 and Add.1 - Views of Member States on the most efficient and economical means of using the geostationary orbit.

37. A/AC.105/259 - Study on the dynamics of space objects.

38. A/AC.105/259/Add.1 - Study on the dynamics of space objects - Addendum. Electrically and magnetically active radius of a satellite.

Item 11 (a): Review of the future role and work of the Scientific and Technical Sub-Committee

39. A/AC.105/261 - Mutual relations of space missions: information paper prepared by the Secretariat.

Item 11 (b): Other reports

40. A/AC.105/245 - WMO tropical cyclone project: the World Meteorological Organization.

41. A/AC.105/246 - Annual report to the United Nations Committee on the Peaceful Uses of Outer Space of the International Astronautical Federation.

42. A/AC.105/247 - Recommendations and reports of the International Radio Consultative Committee, 1978.

43. A/AC.105/248 - Progress of space research 1978-1979 - Report submitted by the Committee on Space Research (COSPAR) of the International Council of Scientific Unions (ICSU).

44. A/AC.105/249 - Study programme on technical characteristics of systems providing communication and/or radiodetermination using satellite techniques for aircraft and/or ships.

45. A/AC.105/264 - Review of national and co-operative international space activities for the calendar year 1979.

46. A/AC.105/266 - Sixth annual report by the International Telecommunications Satellite Organization (INTELSAT).

47. A/AC.105/261 - See item 11 (a) above.

Annex II

REPORT OF THE WORKING GROUP ON THE USE OF NUCLEAR POWER SOURCES  
IN OUTER SPACE ON THE WORK OF ITS SECOND SESSION

1. The Working Group on the Use of Nuclear Power Sources in Outer Space, established by the Scientific and Technical Sub-Committee in accordance with General Assembly resolution 33/16 of 10 November 1978 (para. 8) to consider the technical aspects and safety measures relating to the use of nuclear power sources (NPS) in outer space, held its second session at United Nations Headquarters from 28 January to 12 February 1980. Professor J. H. Carver (Australia) served as its Chairman.
2. The Working Group held eight formal meetings and, in addition, a number of closed informal meetings. A list of experts who attended the Working Group is annexed (annex I).
3. The Working Group had before it working papers presented by Japan (A/AC.105/C.1/WG.V/L.5), Sweden (A/AC.105/C.1/WG.V/L.6), Canada (A/AC.105/C.1/WG.V/L.7 and Add.1 and L.14), United States of America (A/AC.105/C.1/WG.V/L.8 and L.9), Union of Soviet Socialist Republics (A/AC.105/C.1/WG.V/L.10), United Kingdom of Great Britain and Northern Ireland (A/AC.105/C.1/WG.V/L.11 and Add.1), India (A/AC.105/C.1/WG.V/L.12), and France (A/AC.105/C.1/WG.V/L.13). A full list of these working papers is annexed (annex II).
4. At its first meeting, the Working Group agreed to discuss the following items: (a) elaboration of an inventory of the safety problems involved in the use of NPS in outer space; (b) implementation of the International Commission on Radiological Protection (ICRP) recommendations for populations and the environment in the context of space vehicles utilizing NPS; (c) evaluation of existing methods in understanding orbital mechanics to determine if improvements may be made in predicting re-entry phenomena, and (d) definition of technical considerations with regard to a format for notification.
5. The Working Group agreed that its consideration of the item at the present session should be a continuation of the discussion reflected in the report of the first session (A/AC.105/238, annex II).
  - A. Elaboration of an inventory of the safety problems involved in the use of nuclear power sources in outer space
6. The Working Group noted that, starting with the pre-launch phase, a variety of safety measures should be carefully considered in each phase of the operation of space vehicles with NPS on board. In this connexion, the Working Group had before it a list of safety problems that might be involved in the use of NPS in outer space (A/AC.105/C.1/WG.V/L.5, annex I, pp. 3-6). Some delegations believed

that a comprehensive list of this type should be generated by the Working Group. Other delegations considered that compiling such a list was beyond the mandate of the Working Group.

7. The Working Group noted that even a highly reliable system should be subjected by the launching State to a detailed safety evaluation including accident probability analysis in order to assess the risk of using a NPS in space. In this connexion, the Working Group was informed by States launching space vehicles with NPS that they are following their own guidelines with the objective of assuring their safety. Such technical guidelines are outlined in documents A/AC.105/C.1/WG.V/L.8 and L.10.

B. Implementation of the ICRP recommendations for populations and the environment in the context of space vehicles utilizing NPS

8. The Working Group reaffirmed the agreement expressed at its first session that appropriate measures for adequate radiation protection during all phases of an orbital mission of a space vehicle with a NPS - launch, parking orbit, operational orbit or re-entry - should be derived principally from the existing and internationally recognized basic standards recommended by ICRP, particularly as contained in ICRP publication 26.

9. The Working Group noted that the recommendations contained in ICRP publication 26 were intended to provide "the fundamental principles upon which appropriate radiation protection measures can be based" whereas "detailed guidance on the application of its recommendations, either in regulations or in codes of practice, should be elaborated by the various international and national bodies that are familiar with what is best for their needs" (para. 5).

10. Since radiation protection problems which might arise before launching a NPS are covered by the ordinary radiation protection regulations of the States concerned, guidelines based on the ICRP recommendations are needed for use by launching States principally for launching, operation in space, and re-entry.

11. The Working Group took particular note of the ICRP recommendations contained in paragraph 12, which are as follows:

"(a) No practice shall be adopted unless its introduction produces a positive net benefit;

"(b) All exposures shall be kept as low as reasonably achievable, economic and social factors being taken into account; and

"(c) The dose equivalent to individuals shall not exceed the limits recommended for the appropriate circumstances by the Commission."

It was recognized by some delegations that a careful analysis of these issues should be undertaken by the launching States prior to the use of NPS in space.



The Working Group felt that the results of such an analysis should be communicated to other States to the extent feasible. In this connexion, some delegations stated that their understanding of the above provision would be that a launching State shall communicate to other States the results of such analysis when in its opinion they could be of practical use.

12. With regard to the ICRP recommendation concerning dose limits, the Working Group agreed that, in each case prior to launch, an assessment of the collective and individual dose equivalent commitments must be carried out for all planned phases of a space mission with a NPS. Appropriate guidelines are provided in ICRP publication 26, paragraphs 129 to 132, on exposure of populations. In this connexion, the Working Group noted that ICRP publication 26 recommends an annual dose equivalent limit for workers of 50 mSv (5 rem) whole body dose (or equivalent doses to parts of the body) and an annual dose equivalent limit for the most highly exposed members of the public (the critical group) of 5 mSv from all man-made sources. The Working Group recommended that these limits should not be exceeded during any phase of a NPS mission.

13. The Working Group noted paragraph 220 of ICRP publication 26 which deals with the release of radioactive material into the environment and paragraph 222 which deals with the nature and the physical and chemical forms of radioactive materials. The Working Group took particular note of the concept contained in paragraph 220 that the restriction of the exposure depends on "appropriate arrangements for reducing the probability of accidents giving rise to the releases of radioactive materials into the environment and for limiting the magnitude of these releases, should they occur". It also took note of the effort made to quantify, through probability analyses, the radiological risks inherent in using NPS in space missions (A/AC.105/C.1/WG.V/L.11 and Add.1). This study showed that, in some possible accident situations, the dose limits of ICRP publication 26 could be exceeded. Some delegations considered that internationally agreed guidelines to deal with these issues should be developed.

14. The Working Group reaffirmed the statement previously agreed upon in paragraph 15 of the report on its first session (A/AC.105/238, annex II). The Working Group noted the results of a study (A/AC.105/C.1/WG.V/L.7) which indicate, as an example, that for U 235 fuelled reactors, the fission product activity at 400 years after shutdown is reduced to about 1/1000th of the amount at one year after shutdown.

15. In this connexion, given a situation in which achieving a sufficiently high orbit to enable radioactive decay prior to re-entry depends on boosting the NPS from a lower orbit, the Working Group noted the information contained in the study on the dynamics of space objects (A/AC.105/259 and Add.1). This analysis highlighted, in particular, the need for sufficient energy, propellant and control to be available to achieve the higher orbit. The Working Group noted that this might be ensured, for example, by having enough reserve fuel on board the original vehicle, by installing an extra booster system or by utilizing an independent vehicle. The Working Group also noted that some means of retrieving the NPS after an adequate cooling time would also be helpful in protecting the environment.

C. Evaluation of existing methods in understanding orbital mechanics to determine if improvements may be made in predicting re-entry phenomena

16. The Working Group noted that, as stated in its conclusions in paragraphs 20 to 25 of the report on its first session (A/AC.105/238), the prediction of satellite life-times and re-entry paths remains at best an inexact science. However, it welcomed the co-ordinated efforts necessary to improve existing methods of predicting life-times and re-entry paths of satellites.

17. In this connexion, the Working Group welcomed the studies that had been carried out and presented to the Working Group pursuant to the request made in paragraph 25 of the above report. On the basis of these studies, the Working Group determined that substantial improvements in predicting the life-times of space objects can only be achieved if solar activity and, consequently, atmospheric density predictions can be improved. The Working Group recognized, however, that the above studies also indicate that no major improvements in such predictions can be made in the near future and that improvements or additions to the tracking network itself will improve long-term orbital predictions only marginally.

18. The Working Group further recognized that short-term predictions of re-entry trajectories might be further improved through augmented tracking networks.

D. Definition of technical considerations with regard to a format for notification

19. The Working Group agreed that it is the responsibility of those States which launch space vehicles utilizing NPS to conduct safety tests and evaluations.

20. Some delegations considered that these tests and evaluations should be consistent with international safety standards to assure the international community that NPS can be utilized safely.

21. Those delegations also considered that launching States should provide the Secretary-General of the United Nations with generic design data, safety test data, and information pertaining to primary and back-up devices, systems and procedures.

22. Those delegations also considered that, when the launching State is in a position to predict with reasonable certainty that a particular space vehicle utilizing a NPS will be re-entering the atmosphere, the launching State should provide to the Secretary-General, for transmission to Member States, information relating to the re-entering vehicle in addition to that provided under the Convention on Registration of Objects Launched into Outer Space. The purpose of this additional information would be to enable Member States to make their own assessment of the likelihood and consequences of a particular re-entry into the atmosphere and to carry out preparations as necessary for search and recovery efforts and the protection of their own people. In the view of those delegations,

this information should include complete updated osculating orbital parameters as well as information on the nuclear power source used and, in particular, the type of NPS (radioisotopic/reactor); structure and materials of components of NPS; radioisotopic inventory at time of re-entry and in the case of reactors, the power operating history; quantity and type of other chemically toxic materials; materials which may produce activation products; chemical composition, form, size, and mass of nuclear fuel or radioisotope; radiation dose rate at one metre for those packages that may survive re-entry, and identification of packages containing radioactive materials. Those delegations also believed that the launching State should provide information required for prediction of trajectory, information to aid in tracking spacecraft and forecasting orbit trajectory, lifetime and impact region. A more complete list of elements to be included in this information is contained in document A/AC.105/WG.V/L.14.

23. Other delegations were of the opinion that the scope of information that a launching State may be required to provide in case of an unplanned re-entry of its space object utilizing a NPS should be dependent on the specific circumstances of such a re-entry and the nature of the NPS used. These delegations considered that, if a malfunction is discovered on board a space vehicle utilizing NPS, thereby causing a risk of accidental re-entry of radioactive materials to the earth, the launching State should so inform other States on whose territory such re-entry is most likely to occur. They also felt that when there is a danger of unplanned re-entry to the earth of radioactive materials contained in a space vehicle with NPS on board, the launching State should be ready to extend the necessary technical assistance of its experts and equipment upon request of any State on whose territory such materials might be discovered.

24. Some delegations expressed the view that there is a technical necessity for a launching State to inform of its launch of a NPS at the time of launch because (a) this would facilitate proper handling of any radioactive materials recovered from a malfunction occurring during the ascent phases of placing the space vehicle into orbit, and (b) this would enable the international community to assess the over-all risk posed by NPS in earth orbits.

25. Other delegations did not agree with this view, since they did not consider that providing such information would be technically or practically justified.

#### Conclusions and recommendations

26. On the basis of studies submitted in response to the request in its first report, the Working Group reaffirmed its conclusion that NPS can be used safely in space provided that all necessary safety requirements are met.

27. The Working Group agreed that study should continue on the following subject areas:

(a) Elaboration of an inventory of the safety problems involved in the use of NPS in outer space;

(b) Implementation of ICRP recommendations for populations and the environment in the context of space vehicles utilizing NPS;

(c) Evaluation of existing methods in understanding orbital mechanics to determine if improvements may be made in predicting re-entry phenomena;

(d) Definition of technical considerations with regard to a format for notification.

The work should be carried out on the basis of the various studies which have been submitted (see para. 3 above) and others that may be undertaken in the next year. Some delegations felt that further study should also be given to the development of guidelines for the safe design of NPS and for evaluating the acceptability of the radiological risk of NPS in space vehicles.

28. The Working Group recommended that, at the eighteenth session of the Scientific and Technical Sub-Committee, arrangements be made for the Working Group of experts to meet for one week during the Sub-Committee's session to continue its consideration of questions related to the use of NPS in outer space. In this regard, interested members are encouraged to include appropriate experts in their delegations.

29. The Working Group further requested that the Secretariat circulate those studies already submitted plus any new material to Member States in advance of the Sub-Committee's next session.

Appendix I

LIST OF EXPERTS

Chairman: Prof. J. H. Carver (Australia)

ARGENTINA

Dr. Edgardo Salvatelli, Comisión Nacional de Investigaciones Espaciales,  
Buenos Aires

AUSTRALIA

Mr. F. Perry Nolan, First Secretary, Permanent Mission

AUSTRIA

Mr. Erwin Mondré, Austrian Solar and Space Agency, Vienna

BELGIUM

M. Louis Groven, conseiller scientifique à l'Ambassade de Belgique à Washington

BRAZIL

Mr. Gastao Estellita Lins de Salvo Coimbra, Ministry for External Relations

BULGARIA

Professor Kiril Serafimov, Corresponding Member of the Bulgarian Academy of  
Sciences, Chairman of the National Committee for the Peaceful Uses of Outer Space  
Mr. Yuli Minchev, Third Secretary, Permanent Mission

CANADA

Mr. P. F. Walker, Director, Science, Environment and Transportation Policy  
Division, Department of External Affairs  
Mr. P. Kirsch, First Secretary, Permanent Mission  
Dr. R. Eaton, Atomic Energy Control Board  
Dr. R. Mamen, Communications Research Centre, Department of Communications

CHILE

Sr. Patricio Torres, Segundo Secretario de Embajada, Misión Permanente

COLOMBIA

Dr. Ramiro Zambrano, Ministry for Foreign Affairs  
Dr. Alvaro Bonilla, Minister Counsellor, Permanent Mission

EGYPT

Mr. Hussein Mesharrafa, Minister Plenipotentiary

FRANCE

M. Michel Levy, Comité interministériel pour la sécurité nucléaire

GERMAN DEMOCRATIC REPUBLIC

Prof. Dr. R. Knuth, Scientific Adviser, Academy of Sciences of the German  
Democratic Republic

GERMANY, FEDERAL REPUBLIC OF

Prof. Dietrich Rex, Technische Universität, Braunschweig

INDIA

Prof. Yash Pal, Director, Space Applications Centre, Government of India,  
Ahmedabad  
Mr. M. K. Gupta, Reactor Control Division, Bhabha Atomic Research Centre,  
Trombay, Bombay

INDONESIA

Mr. Juwana, First Secretary, Permanent Mission

IRAQ

Dr. S. A. Abdulla, Ministry of Higher Education, Baghdad  
Dr. K. A. A. Hamza, Atomic Energy Commission, Baghdad

ITALY

Mr. Alain Giorgio Economides, Permanent Mission  
Mr. Giovanni Benedetti, National Research Council

JAPAN

Mr. Toshiyasu Sasaki, Head, Space Activities Planning Division, Research  
Co-ordination Bureau, Science and Technology Agency  
Dr. Tatsuo Yamanaka, Senior Researcher, Space Research Group, National Aerospace  
Laboratory, Science and Technology Agency

KENYA

Mr. John Thiong'o, Voice of Kenya

MEXICO

Dra. Ruth Gall

MONGOLIA

Mrs. Boldyn Navcha, First Secretary, Permanent Mission

NETHERLANDS

Mr. N. de Boer, Netherlands Agency for Aerospace Programs, Delft

NIGER

M. Moutari Ousmane, Premier Secrétaire, Mission permanente

POLAND

Prof. Stefan Piotrowski, Vice-Chairman of the Committee on Outer Space Research,  
Polish Academy of Sciences, Warsaw

SUDAN

Ms. Salwa Gabriel Berberi, First Secretary, Permanent Mission

SWEDEN

Mr. Peter Osvald, First Secretary, Permanent Mission  
Mr. Sune Danielsson, Head of Section, Ministry for Foreign Affairs  
Mr. Kay Edvarson, Director of Research, National Swedish Institute of Radiation  
Protection

UNION OF SOVIET SOCIALIST REPUBLICS

Dr. A. I. Beliakov, Academy of Sciences of the USSR  
Mr. B. G. Maiorski, Ministry of Foreign Affairs of the USSR  
Dr. V. I. Serbine, Atomic Energy Committee of the USSR

UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND

Dr. B. Wade, United Kingdom Atomic Energy Authority  
Mr. M. McTaggart, Ministry of Defence

UNITED STATES OF AMERICA

Mr. Kenneth S. Pedersen, Director of International Affairs, National Aeronautics  
and Space Administration  
Mr. Thomas B. Kerr, N16-3/Safety Office, National Aeronautics and Space  
Administration  
Dr. Gary L. Bennett, United States Department of Energy, Chief, Safety and  
Isotope Fuels Section, Space and Terrestrial Systems Branch, Advanced Nuclear  
Systems and Projects Division  
Mr. Thaddeus J. Dobry, United States Department of Energy

VENEZUELA

Lic. Víctor Carazo, Segundo Secretario, Misión Permanente  
Sr. Humberto Campins, Astrónomo

Secretariat of the Working Group

Mr. Lubos Perek, Chief, Outer Space Affairs Division  
Mr. N. Jasentuliyana, Secretary  
Mr. D. Felske, Assistant Secretary



Appendix II

LIST OF DOCUMENTS

- (1) A/AC.105/C.1/WG.V/L.5 - Questions relating to the use of nuclear power sources in outer space. Japan: working paper.  
  
(List of safety problems involved in the use of NPS in outer space: implementation of ICRP recommendations in the context of space vehicles utilizing NPS; satellite's orbit and re-entry; format of notification.)
- (2) A/AC.105/C.1/WG.V/L.6 - Questions relating to the use of nuclear power sources in outer space. Sweden: working paper.  
  
(Implementation of the recommendations of ICRP; evaluation of existing methods for understanding orbital mechanics; definition of technical consideration with regard to a format of notification.)
- (3) A/AC.105/C.1/WG.V/L.7 - Questions relating to the use of nuclear power sources in outer space. Canada: working paper.  
  
(Radiological hazards and the use of NPS in outer space - A relationship between satellite altitude and radioactivity after shutdown; recent Canadian progress on the prediction of satellite orbit list times.)
- (4) A/AC.105/C.1/WG.V/L.7/Add.1 - Questions relating to the use of nuclear power sources in outer space. Canada: working paper - Addendum.  
  
(Literature survey in satellite orbit decay and re-entry prediction.)
- (5) A/AC.105/C.1/WG.V/L.8 - Questions relating to the use of nuclear power sources in outer space. United States of America: working paper.  
  
(Criteria for the use of NPS in outer space: safety guidelines for radioisotope heat sources.)
- (6) A/AC.105/C.1/WG.V/L.9 - Questions relating to the use of nuclear power sources in outer space. United States of America: working paper.  
  
(Potential improvements in predicting re-entry phenomena.)
- (7) A/AC.105/C.1/WG.V/L.10 - Questions relating to the use of nuclear power sources in outer space. Union of Soviet Socialist Republics: working paper.  
  
(The problem of radiation safety in connexion with the use of NPS in outer space; applications of ICRP recommendations, assessment of the existing methods of orbital mechanics for determining the possibilities of improving the forecasting of process involved in the re-entry of space vehicles.)

- (8) A/AC.105/C.1/WG.V/L.11 - Questions relating to the use of nuclear power sources in outer space. United Kingdom of Great Britain and Northern Ireland: working paper.

(Implementation of ICRP recommendations and the environment in the context of space vehicles utilizing NPS: study showing that the radiological risks inherent in the use of radioisotopic generators or nuclear reactors can be quantified using a methodology that enables potential users to identify the crucial design features and to balance the detriment against the benefits of using a NPS.)

- (9) A/AC.105/C.1/WG.V/L.11/Add.1 - Questions relating to the use of nuclear power sources in outer space. United Kingdom of Great Britain and Northern Ireland: working paper - Addendum.

(Appendixes containing studies on: consequences of ground level releases; footprints; event trees; migration of small particles from the stratosphere; gamma-ray dose rates round reactor core and radioisotopic capsule.)

- (10) A/AC.105/C.1/WG.V/L.12 - Questions relating to the use of nuclear power sources in outer space. India: working paper.

(Study on technical considerations related to a format for notification of the launch/re-entry of space objects containing NPS.)

- (11) A/AC.105/C.1/WG.V/L.13 - Questions relating to the use of nuclear power sources in outer space. France: working paper.

(Study on the application of the ICRP recommendations in the use of NPS in outer space.)

- (12) A/AC.105/C.1/WG.V/L.14 - Questions relating to the use of nuclear power sources in outer space. Canada: working paper.

(Format for notification for space operation of nuclear power sources.)

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