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Regional centres for space science and technology education (affiliated to the United Nations)

I. Introduction

1. Space science and technology education can be pursued at the elementary, secondary and university levels. In spacefaring nations, elements of space science and technology have been introduced into science curricula at those levels. Such an innovation has not taken place in many developing countries, partly because the benefits of space science and technology have not been appreciated enough and partly because the facilities and resources for teaching science and technology at educational institutions are not yet well developed. Education in space science and technology in developed countries has become highly interactive; the World Wide Web and other information technologies have become useful tools in education programmes at all levels.

2. The incorporation of elements of space science and technology into university- level science curricula can serve a dual purpose for developed and developing countries. It can enable all countries to take advantage of the benefits inherent in the new technologies, which, in many cases, are spin-offs from space science and technology. It can revitalize the educational system, introduce the concepts of high technology in a non-esoteric fashion and help create national capacities in science and technology in general. In that regard, Lewis Pyenson emphasized in his recent work entitled *Servants of Nature*[1] that:

> "Both geographical decentralization and inter-disciplinary innovation have become watchwords in academic science. Electronic information processing to some extent obviates the necessity for a scientist or scholar to reside at an ancient college of learning. Universities everywhere have adapted to new socioeconomic conditions by expanding curricula. They have always responded in this way, although never as quickly as their critics would like. Measured and deliberate innovation is one of academia's heavy burdens. It is also a great strength. Emerging fields of knowledge become new scientific disciplines only after they have found a secure place in universities. We look to universities for an authoritative word about the latest innovations. New scientific ideas emerge in a variety of settings, but they become the common heritage of humanity only when processed by an institution for advanced instruction like the modern university."

3. There are many challenges in the teaching of science at university level, both in developing and developed countries, but the challenges are of a higher magnitude in developing countries. The general problem confronting science education is the inability of students to see or experience the phenomena being taught, which often leads to an inability to learn basic principles and to see the relationship between two or

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more concepts and their practical relevance to problems in real life. Added to those problems are a lack of skills in the relevant aspects of mathematics and in problem-solving strategies. There are also language problems in countries in which science is not taught in the national language(s). Over the years, developed countries have overcome most of the basic problems, except perhaps a psychological problem, namely that students may consider science to be a difficult subject. In developing countries, however, basic problems linger, exacerbated by the fact that there are not enough academically and professionally well-trained teachers.

4. The General Assembly, in its resolution 45/72 of 11 December 1990, endorsed the recommendation of the Working Group of the Whole of the Scientific and Technical Subcommittee, as endorsed by the Committee on the Peaceful Uses of Outer Space, that the United Nations should lead, with the active support of its specialized agencies and other international organizations, an international effort to establish regional centres for space science and technology education in existing national/regional educational institutions in the developing countries (A/AC.105/456, annex II, para. 4 (n)).

5. The General Assembly, in its resolution 50/27 of 6 December 1995, paragraph 30, also endorsed the recommendation of the Committee on the Peaceful Uses of Outer Space that those centres be established on the basis of affiliation to the United Nations as early as possible and that such affiliation would provide the centres with the necessary recognition and would strengthen the possibilities of attracting donors and of establishing academic relationships with national and international space-related institutions.

6. Regional centres have been established in India for Asia and the Pacific, in Morocco and Nigeria for Africa, in Brazil and Mexico for Latin America and the Caribbean and in Jordan for Western Asia, under the auspices of the Programme on Space Applications, implemented by the Office for Outer Space Affairs (A/AC.105/749). The objective of the centres is to enhance the capabilities of Member States, at the regional and international levels, in various disciplines of space science and technology that can advance their scientific, economic and social development. Each of the centres provides postgraduate education, research and application programmes with emphasis on remote sensing, satellite communications, satellite meteorology and space science for university educators and research and application scientists. All centres are implementing nine-month postgraduate courses (in remote sensing, satellite communications, meteorological satellite applications, and space and atmospheric sciences) based on model curricula that emanated from the United Nations/Spain Meeting of Experts on the Development of Education Curricula for the Regional Centres for Space Science and Technology Education, held in Granada, Spain, in 1995. Since 1995, these curricula (A/AC.105/649 and http://www.oosa.unvienna.org/SAP/centres/centres.htm) have been presented and discussed at regional and international educational meetings.

7. The Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III), held in Vienna in July 1999, recommended that collaboration should be established between the regional centres and other national, regional and international organizations to strengthen components of their education curricula.[2] In its resolution 54/68 of 6 December 1999, the General Assembly endorsed the resolution of UNISPACE III entitled "The Space Millennium: Vienna Declaration on Space and Human Development", in which action was recommended to ensure sustainable funding mechanisms for the regional centres.[3]

II. United Nations Expert Meeting on the Regional Centres for Space Science and Technology Education: Status and Future Developments

8. The Office for Outer Space Affairs of the Secretariat organized, in cooperation with the European Space Agency (ESA), the United Nations Expert Meeting on the Regional Centres for Space Science and Technology Education: Status and Future Development in Frascati, Italy, from 3 to 7 September 2001. The Meeting was hosted by the ESA European Space Research Institute in Frascati.

9. The Meeting reviewed the status of establishment and operation of the regional centres with a view to enhancing cooperation between the centres. The main objective of the Meeting was to review and update curricula at the university level and across cultures in

four areas: remote sensing, satellite meteorology, satellite communications and space science. The Meeting considered that education varied significantly between countries and even between institutions within the same country which led to differences in space science and technology education curricula in terms of course content and modes of presentation. The Meeting noted that the model curricula (A/AC.105/649) had contributed to resolving such problems.

10. The Meeting established five working groups to focus on the following specific topics and respective education curriculum: (a) management issues of the centres; (b) remote sensing; (c) satellite meteorology; (d) satellite communications; and (e) space science. The working groups drew on the knowledge and expertise of participants, thereby taking into account the results of previous nine-month postgraduate courses, particularly those organized since 1996 at the Centre for Space Science and Technology Education in Asia and the Pacific and since 1998 at the African Centre for Space Science and Technology—in French Language and the African Regional Centre for Space Science and Technology Education—in English Language.

11. The Meeting, through its working groups, updated the four education curricula and drew up course syllabuses that differ from most of those available in literature and on the World Wide Web. They are based on physics, mathematics and engineering as taught in many universities around the world. They are not tailored to any specific space-related project or mission that may have been or will be executed by any specific institution. The deliberations of the working groups and specifications for the curricula are contained in documents A/AC.105/L.238, A/AC.105/L.239, A/AC.105/L.240 and A/AC.105/L.241.

Notes

[1] L. Pyenson and S. Sheets-Pyenson, *Servants of Nature: a History of Scientific Institution, Enterprises, and Sensibilities* (New York, W. W. Norton and Company, 1999).

[2] *Report of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space, Vienna, 9-30 July 1999* (United Nations publication, Sales No. E.00.I.3), chap. II, sect. G, para. 220.

[3] Ibid., chap. I, resolution 1, para. 1 (e) (ii). The Declaration is also available on the home page of the Office for Outer Space Affairs (http://www.oosa.unvienna.org).