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REVIEW OF THE IMPLEMENTATION OF THE REGIONAL SPACE APPLICATIONS PROGRAMME FOR SUSTAINABLE DEVELOPMENT IN ASIA AND THE PACIFIC

(Item 4 of the provisional agenda)

Note by the secretariat

SUMMARY

The Ministerial Conferences on Space Applications for Sustainable Development of Asia and the Pacific held in Beijing in 1994 and in New Delhi in 1999 resulted in two agendas for collaboration, known as the Regional Space Applications Programme (RESAP) Phase I and Phase II, respectively.

The present document provides an overview of the implementation of RESAP Phase II. While the first phase of RESAP focused on awareness raising and networking, the second phase focused on capacity-building for the operational uses of space technology in prioritized fields, such as, environmental and natural resource management, food security, education, health, sustainable development planning, and natural disaster reduction. Phase II was particularly designed to promote cooperative mechanisms for disaster management. While the overall impact of RESAP has been satisfactory, there are still some shortfalls, particularly in the sustainable provision of the benefits of space technology applications to least developed countries, including Pacific island developing countries, which need attention in its future phase.

The senior officials will be invited to exchange information on national activities that were implemented in the light of the recommendations of the Delhi Declaration, particularly with respect to those of regional importance, and the contribution of RESAP to national capacity-building in space technology applications.

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I. INTRODUCTION

1. Society is undergoing rapid transformation through improvements in education, healthcare, agriculture, and community empowerment. In addition, trade and investment have become global; in such a system, sound governance depends upon near-instant communication of prices and market intelligence. An increasing proportion of everyday activities, such as, advertising, banking, education, entertainment, health care, travel and tax collection, now rely on information and communication technology (ICT). Even traditional livelihoods such as agriculture are being transformed through the use of computers, weather satellites and communication networks.

2. There is an increasing integration and mutual dependency of space technologies, such as, satellite-based remote sensing, communications, meteorology and positioning systems, with computers, digital databases and land- cable- or wireless based communications. This digital "convergence" is accelerating the provision of information services at a lower cost and with broader penetration. Advances in space technologies have helped to immeasurably strengthen ICT physical infrastructure, and also provide the source of vital information content. At the same time, advances in information and communication technology have made it possible to use and operate satellites more effectively, either on a stand-alone basis or as part of hybrid communication networks.

3. Space technology exhibits a strategic dimension because of its capacity to gather and deliver information over very large areas. Cooperative space activities, including information sharing and joint projects, help to build confidence in the continuation of the peaceful use of space. It also helps to ensure that the unique benefits of space are accessible without discrimination and on a basis of equality in the common interest of all humanity, as embodied in international law through the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies.[1]

4. Given the high entry cost typical of space technology, as well as the scope for mutual benefit through contributions to and use of common infrastructure, the value of international cooperation in space applications and the necessity for recognizing the special needs and circumstances of developing countries have been recognized internationally, as in the Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of all States, Taking into Particular Account the Needs of Developing Countries.[2]

5. Rapid growth of space applications in the region has stimulated cooperation at the regional level. ESCAP was the first United Nations regional commission to recognize the enabling role of space technology within a development context. The efforts of ESCAP commenced with the regional remote sensing programme (RRSP), initiated in 1983 in cooperation with United Nations Development Programme. It was the first regional forum to significantly increase the awareness of

[1] General Assembly resolution 2222 (XXI) of 19 December 1966, annex.

[2] General Assembly resolution 51/122 of 13 December 1996, annex.

decision makers regarding the relevance of satellite remote sensing to sustainable development. Its success led to the launching of the Regional Space Applications Programme for Sustainable Development (RESAP), involving a wider spectrum of space technology applications, including satellite communication, satellite-based positioning and satellite meteorology.

6. The status of implementation of the initial phase of RESAP was reported to the Second Ministerial Conference[3] in November 1999. The present document focuses on the achievements of the second phase of RESAP.

II. REVIEW OF RESAP IMPLEMENTATION

A. Background

7. Based on Commission resolution 49/5 of 29 April 1993 on a regional programme on space applications for development, the ESCAP secretariat organized the First Ministerial Conference on Space Applications for Development in Asia and the Pacific, held in Beijing from 19 to 24 September 1994. The Conference launched RESAP and the ESCAP secretariat created a Space Technology Applications Section, which worked on extending cooperative activities to cover all the major space technologies as applied to development.

8. At its fifty-third session, in 1997, the Commission requested that the secretariat organize another ministerial conference, taking into account the technological trends, opportunities and challenges of the new millennium.[4] The Second Ministerial Conference on Space Applications for Sustainable Development in Asia and the Pacific was held in New Delhi from 15 to 20 November 1999. The Delhi Conference led to two important enhancements to regional collaboration in space applications and development: the Delhi Declaration on Space Technology Applications in Asia and the Pacific for Improved Quality of Life in the New Millennium,[5] and the Strategy and Action Plan on Space Technology Applications for Sustainable Development in Asia and the Pacific for the New Millennium.[6] In its resolution 56/3 of 7 June 2000 on regional cooperation on space applications for sustainable development in Asia and the Pacific, the Commission endorsed the recommendations of the Ministerial Conference, the Delhi Declaration, the Strategy and Action Plan and the launching of RESAP II.

9. At its fifty-ninth session, in 2003, the Commission recommended that the secretariat initiate preparations for the third Ministerial Conference,[7] and at its sixtieth session, in 2004, it agreed to hold

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[3] See E/ESCAP/ENR/SOSA(2)/1.

[4] See *Official Records of the Economic and Social Council, 1997, Supplement No. 18* (E/1997/38-E/ESCAP/1080), para. 149.

[5] E/ESCAP/1166, annex I.

[6] Ibid., annex II.

[7] See *Official Records of the Economic and Social Council, 2003, Supplement No. 19* (E/2003/39/Add.1-E/ESCAP/1298/Add.1), para. 234.

the Conference in 2007.[8] At its sixty-second session, in 2006, the Commission recommended the continuation of the RESAP[9] and welcomed the generous offer of the Government of Malaysia to host the Conference.[10]

B. RESAP structure and regional cooperative network

10. To implement RESAP, the ESCAP secretariat instituted a three-tiered structure, comprising:

(a) The Intergovernmental Consultative Committee (ICC), the supervisory body which provides policy and technical guidance, forms the nucleus of the regional network. Since 1995, representatives from member countries and international and regional organizations have been attending the annual session to review progress, identify priorities and nominate activities for implementation under RESAP. The ICC, comprising National Focal Points representing the Governments participating in the programme, has expanded to 24 members.

(b) Four Regional Working Groups comprised of National Contact Points, specializing in the following application aspects of space technology:

(i) Remote sensing, geographic information systems (GIS) and satellite-based positioning

(ii) Communications satellite applications

(iii) Meteorological satellite applications and natural hazards monitoring

(iv) Space science and technology applications.

A number of countries have appointed additional contact points from government, industry and academia to the regional working groups in conformity with the recommendations of the Second Ministerial Conference.

(c) The Regional Information Service and Education and Training Network has been supported by China, India and Indonesia in the provision of specialized education and training in satellite communications, remote sensing, geographic information systems, satellite meteorology and space science.

11. The Second Ministerial Conference recommended that RESAP be continued into a second phase. RESAP II addressed operational uses of space technology in prioritized areas of concern, encompassed by the Minimum Common Programme (MCP). Following the Conference, the Commission endorsed its recommendations, recommending a focus on regional cooperation and capacity-building. The Commission encouraged a self-sustaining mechanism for harnessing space applications in support of sustainable development.

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[8] Ibid., *2004, Supplement No. 19* (E/2004/39-E/ESCAP/1330), para. 198.

[9] Ibid., *2006, Supplement No. 19* (E/2006/39-E/ESCAP/1390), para. 224.

[10] See Commission resolution 62/5 of 12 April 2006.

12. While the first phase of RESAP focused on networking, awareness raising and training-centered capacity-building, RESAP II focuses on covering technical, policy and institutional capacity-building. These efforts are aimed at operational uses of space technology relevant to the major development priorities summarized below.

C. RESAP priority areas and integration within the ESCAP secretariat

13. Under RESAP II, the priority development areas, to which space applications may contribute, were identified as: (i) environmental and natural resource management; (ii) food security and agriculture systems; (iii) capacity-building; (iv) human resources development and education; (v) poverty alleviation; (vi) natural disaster reduction; (vii) health care and hygiene; and (viii) sustainable development planning.

14. Following the Second Ministerial Conference, the integration of RESAP into the ESCAP secretariat's programatic activities was a significant achievement. The biennial work programme and the medium-term plan of ESCAP were revised, taking into account the Conference recommendations, as endorsed by the Commission.

15. The Commission at its fifty-seventh session, held in April 2001, emphasized the Commission's priorities on the three thematic areas of poverty alleviation; addressing the issues related to globalization; and tackling emerging social issues. Accordingly, the emphases of RESAP were mapped to these generic priorities, as illustrated in table 1.

16. In 2002, the secretariat established the Information, Communications and Space Technology Division and subprogramme. The aim was to create an enabling environment for development, transfer and application of information, communication and space technology in the region, and to enhance the capacity of ESCAP to respond effectively and efficiently to the needs of its members and associate members in the context of globalization, the information society, and changing regional circumstances.

Table 1. Mapping RESAP to the priorities of ESCAP

RESAP essential goals	ESCAP thematic areas		
	Poverty alleviation	**Managing globalization**	**Emerging social issues**
Environment and natural resource management	√	√	√
Food security and agriculture systems	√		√
Capacity-building	√	√	√
Human resource development and education	√	√	√
Poverty alleviation	√		
Natural disaster reduction	√	√	√
Health care and hygiene	√		√
Sustainable development planning	√	√	√

D. Common denominator projects

17. To implement RESAP II, four types of common denominator projects (CDPs) were envisaged: (i) studies and pilot projects demonstrating the effectiveness of space technology applications in addressing the eight designated development priorities; (ii) human resource development to improve national capacity to address those priorities; (iii) technology cooperation to minimize duplication, idle capacity and waste of resources; and (iv) building an information infrastructure to support space technology applications. CDPs were intended to address one or more of the RESAP priority areas, for which the subjects and geographic areas involved were of interest to more than one participating RESAP member.

18. During 2000, representatives of several ESCAP members and associate members, regional and international organizations, and invited experts, drafted project profiles conforming to the above requirements. Those profiles were discussed and refined by the four regional working groups of RESAP in 2000-2001. The regional working groups added additional CDPs, based on their professional assessments of factors such as need, opportunities, national priorities, and the identified interests of RESAP members and development agencies. The projects involved space agencies and information service providers as well as end-user agencies such as disaster management authorities or agricultural agencies.

19. The RESAP II projects described below were funded by China, France, the European Space Agency, India, Japan and the Republic of Korea, with in-kind support from Indonesia, Malaysia, Singapore and Thailand. The major outcomes of these activities are summarized in Part III of this paper.

- Capacity-building for monitoring and assessment of rice crops in the Asian and Pacific region;
- Integrated land and water resources management in arid areas using remote sensing and GIS project activities;
- Capacity-building for monitoring and assessment of crops in support of sustainable natural resources development and poverty alleviation;
- Capacity-building in disaster management in the Asian and Pacific region;
- Enhanced national capacity in policymaking on natural disaster management using information, communication and space technology;
- Follow-up to the Asian Conference on Disaster Reduction;
- Pilot community e-centres in least developed areas;
- Strengthening rural family planning through satellite-based e-learning; and
- Regional training workshops in soil erosion risk assessment in a tropical environment.

E. Regional cooperative mechanisms

20. The First Ministerial Conference which launched RESAP also laid the foundation for regional cooperation towards implementing the programme at both the national and regional levels. This mechanism catalyzed the genesis of several national programmes and projects, and had significant long-term impact on national capacity-building and the promotion of space technology applications. After the Second Ministerial Conference, the modality of the RESAP implementation shifted from training and awareness raising, to promoting regional cooperative mechanisms which support operational applications of space technology. In order to reduce duplication of effort and to search out synergies, an enhanced dialogue commenced between RESAP and major regional space initiatives such as the Asia-Pacific Multilateral Cooperation in Space Technology Applications (AP-MCSTA) and the Asia-Pacific Regional Space Agency Forum (APRSAF).

21. Regional cooperative mechanisms (RCMs), suited for implementing aspects of RESAP and based on regional and national initiatives, have evolved in the course of the programme. Workshops were held in Beijing and Bangkok in June and November 2002, respectively as part of the regional strategy on disaster reduction of the ESCAP secretariat. Those meetings plus subsequent deliberations during ICC and RWGs (i) identified floods and drought as being foremost among disasters affecting the region over the long term (ii) emphasized building regional networks and enhancing national capacities to integrate space technology applications suitable for reducing those disasters. Specialized workshops held in Singapore in January 2004, Hyderabad in May 2004 and Bali in August 2004 were organized. These workshops focused on relevant space information products and services and also their access and outreach in the region through the networks for exchange of data, information and knowledge.

22. A regional action plan aimed at addressing vulnerability and risk assessment was envisaged as a key area for building RCMs. The Expert Group Meeting on key information products and services for floods and drought held in Beijing in November 2004 emphasized integrating space information products and services into risk reduction strategies while building RCMs. While the World Conference on Disaster Reduction, held in Kobe, Japan, in January 2005, paved the way for bringing the international disaster management community together, the ESCAP Expert Group Meeting held in Chiang Mai, Thailand, in November 2005 defined the RCM framework on space technology applications for disaster reduction. This framework was subsequently endorsed by the 2005 session of ICC in Isfahan, the Islamic Republic of Iran.

F. Policy studies and regional information service

23. Under RESAP II, the ESCAP secretariat conducted numerous policy studies and expert group meetings addressing topical institutional and policy issues about operationalizing space technology applications. These activities aimed to help developing countries enhance their technical capacity to

develop space application programmes, to have easier access to space-based data and information, to obtain technical advice, and to implement appropriate policies and regulations. ESCAP publications arising from studies conducted by RESAP have become standard reference manuals on space applications in a number of developing countries. Major guidelines and studies published by the ESCAP secretariat from the expert group meetings and policy studies under RESAP II include:

- *The Minimum Common Programme Framework: Regional Space Applications Programme for Sustainable Development: Phase II*, 2001 (ST/ESCAP/2162);
- *Towards a Policy Framework for Integrating Space Technology Applications for Sustainable Development on the Information Superhighway*, 2003 (ST/ESCAP/2226);
- Study of Coastal Zone Environment Management with Emphasis on Mangrove Ecosystem to Assist in Poverty Alleviation, 2003;
- *Use of Space Technology Applications for Poverty Alleviation: Trends, Strategies and Policy Frameworks*, 2003 (ST/ESCAP/2309);
- *Towards Regional Cooperative Mechanisms for Managing Floods and Drought in Asia and the Pacific Using Space Technology*, 2003 (ST/ESCAP/2318);
- A Policy Framework Towards Enhancing the Operational Utilization of Space Information Products and Services for Drought Management, 2004;
- A Policy Framework Towards Enhancing the Operational Utilization of Space Information Products and Services for Flood Management, 2004;
- Framework for regional cooperation on space technology supported disaster reduction strategies in Asia and the Pacific, 2005.

24. The secretariat also published and distributed the biannual *Asian-Pacific Remote Sensing and GIS Journal* for several years. This was replaced by a information, communication and space technology journal. A quarterly space technology applications newsletter was published until 2002, at which time news on RESAP developments and activities began to be regularly disseminated through the ESCAP website. In addition to the monographs and studies listed above, proceedings of numerous regional workshops, seminars and expert meetings have been produced in hard-copy, and/or in electronic form in the RESAP section of the ESCAP website.[11] Member surveys have demonstrated that ESCAP publications on space applications are an important source of information to member countries.

G. Capacity-building through human resources development

25. Capacity-building under RESAP II was primarily oriented towards human resources development, via a combination of long-term, medium-term and short-term courses. These courses

[11] www.unescap.org/icstd/space/index.asp

covered satellite communication, remote sensing and GIS, satellite meteorology and space science. Under RESAP II, the ESCAP secretariat supported fellowships and travel expenses to short-term training courses organized by various organizations including the AP-MCSTA in China, the Centre for Space Science and Technology Education in Asia and the Pacific (CSSTEAP) in India, the National Coordination Agency for Surveys and Mapping (BAKOSURTANAL) in Indonesia, the National Remote Sensing Centre of China (NRSCC) and the National Space Development Agency of Japan (NASDA, now the Japanese Aerospace Exploration Agency or JAXA) as summarized in table 2 below. Additional financial support has been given by, among others, CSSTEAP, AP-MCSTA, the Asian Institute of Technology (AIT), and the United Nations Office of Outer Space Affairs.

Table 2. Support for human resources development in space applications for development under RESAP II, 1999-2006

Organization/country	Post-graduate course		Medium-term course		Short-term course	
	RESAP	Total	RESAP	Total	RESAP	Total
AP-MCSTA, China - Remote sensing			15	15	13	22
NRSCC, China - Remote sensing and GIS	8	8			13	13
CSSTEAP, India - Remote sensing and GIS - Satellite communication - Satellite meteorology - Space science - Geo-informatics	 42 14 6	 139 59 55 22			 5 6 15	 26 5 6 15
BAKOSURTANAL, Indonesia - Remote sensing and GIS			87	87		
NASDA (now JAXA), Japan - Remote sensing (held at AIT)					10	> 30
Total trained	70	283	102	102	62	117

26. In addition to the subjects already noted, topics covered by these training and human resource development activities included disaster management; soil erosion risk assessment, space technology for social scientists, GIS applications for biodiversity assessment, land use analysis, coastal zone management, and water resource management. Many specialists who completed these courses, especially from least developed countries, are still engaged in programmes on space applications in their respective countries and are thus contributing indirectly to the goals of RESAP. The human resources development activities promoted by RESAP also stimulated similar action by subregional organizations such as the Association of Southeast Asian Nations (ASEAN) and the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC).

27. ESCAP conducted a number of other human resources development activities towards national capacity-building in space technology applications. These included workshops and seminars on remote sensing and GIS for land resources and environmental management; tropical ecosystem management; coastal zone development planning; sustainable rural development; and use of space technologies for poverty alleviation and rural development. In addition, a number of other initiatives also contributed to national capacity-building in the region. For example, JAXA conducted numerous training workshops on the development applications of various Japanese Earth observation and communications satellites. The activities were designed to meet the needs of end users in different countries and contributed to information exchange and knowledge transfer between over 1,000 participants from member countries.

H. Inter-agency cooperation and coordination

28. The First Ministerial Conference identified the need for an inter-agency forum to ensure cooperation and coordination within the United Nations system and among donor agencies. Following this recommendation, the secretariat established the Inter-agency Subcommittee on Space Applications for Sustainable Development in Asia and the Pacific in October 1995. The forum was later replaced by the Inter-agency Working Group on ICT. The ESCAP secretariat also participates in the United Nations Inter-Agency Meeting on Outer Space Activities.

29. ESCAP works closely with other United Nations bodies and specialized agencies such as the International Telecommunication Union (ITU), United Nations Office of Outer Space Affairs, the Food and Agriculture Organization of the United Nations (FAO) and the International Strategy for Disaster Reduction (ISDR) to mobilize resources for capacity-building. Jointly with United Nations Office of Outer Space Affairs, a United Nations Regional Workshop on the Use of Space Technology for Disaster Management for Asia and the Pacific was held in Bangkok in November 2002. An FAO/ESCAP joint project on a multi-purpose environmental and natural resources information base for food security and sustainable development in the Asian and Pacific region was initiated in 2003 with funds from the FAO Technical Cooperation Programme. The ESCAP secretariat, with support of the United Nations Office for Coordination of Humanitarian Affairs, ITU and AP-MCSTA, organized the Expert Meeting on Technical Options for Disaster Management Systems: Tsunami and Others, held in Bangkok in June 2005. The secretariat supported the Asian Conference on Disaster Reduction, jointly organized by the Government of China, ISDR, the Asian Disaster Preparedness Center, UNDP Beijing office and ESCAP held in Beijing from 27 to 29 September 2005. Subsequently, the ESCAP secretariat has been active in elaborating a regional cooperative mechanism on space information for drought disaster management.

I. Harmonization of regional cooperation initiatives

30. Following a 1997 study of various regional initiatives on space technology applications, the ESCAP secretariat organized four meetings of the Dialogue Forum on Regional Initiatives for Space Cooperation in Asia and the Pacific, at alternate meetings of AP-MCSTA and APRSAF. The aim of these forums was the harmonization of regional initiatives on space technology applications and the promotion of regional cooperation through the continued exchange of information. The representatives to AP-MCSTA and APRSAF discuss ways to synergize benefits from activities in the region and explore avenues towards mechanisms for improved regional cooperation.

31. ESCAP has also regularly participated in significant global and regional space forums, including APRSAF, AP-MCSTA, the Committee on Earth Observation Satellites (CEOS), Asian Conference on Remote Sensing, and the Asia-Pacific Satellite Communications Council. The secretariat has attempted to reduce unnecessary duplication of effort at these forums. Although it has not been entirely successful in those efforts, the main forums have become more closely harmonized. Given the high volume of space activity in the region, the wide range of activities carried out by national space entities, and the geo-political dimension of space technology, it is perhaps unrealistic to expect that all of the space coordination efforts in the region could be conducted at a single forum.

J. Financial support and other contributions

32. Traditional and non-traditional donors provided ESCAP with funds for the implementation of RESAP II. In addition, ESCAP provided a significant financial contribution from its regular budget.

33. Additionally, member countries provided considerable in kind contributions to support the implementation of RESAP. This support came in a variety of forms such as the provision of long-term experts on a non-reimbursable loan basis to ESCAP, and short-term experts for RESAP activities. This type of support has become an indispensable part of the programme. A number of developing countries contributed in kind resources to the programme via technical cooperation among developing countries (TCDC) arrangements, allowing many pilot projects and fellowship programmes to be undertaken and contributing significantly to the programme's successes.

K. Other recommendations of the Second Ministerial Conference

34. In the Delhi Declaration on Space Technology Applications in Asia and the Pacific for Improved Quality of Life in the New Millennium, the members and associate members of the Commission adopted the Strategy and Action Plan, declared the launching of the second phase of RESAP, urged donors and international organizations to support the implementation of RESAP and committed themselves to participate actively in its second phase. The Second Ministerial Conference also made some other recommendations, which either have been implemented as RESAP II evolved or were effectively resolved in parallel to RESAP, as summarized in table 3.

Table 3. Outcome of other recommendations of the Second Ministerial Conference

Recommendation	Outcome/Actions
To promote operationalization of space applications, issues need to be addressed, namely - human resource development - strengthening institutional frameworks - improved national coordination mechanisms - awareness raising among policymakers.	These issues have been incorporated into RESAP activities and planning, with results as detailed in Part II and III of this document.
Regional cooperative mechanisms should be institutionalized to equitably share benefits of space applications.	Approach has been central to RESAP activities and planning, with results as detailed in Part II and III of this document.
Cognate international organizations, specialized agencies of the United Nations and other bodies should strive to work synergistically and to avoid unnecessary duplication.	A range of harmonization and cooperative activities have been carried out under RESAP which have reduced duplication and increased synergy of efforts (Refer Part II-H above).
Address issues relating to satellite data archives, access and utilization, data policy and commercialization.	The objective of the regional cooperative mechanisms promoted under RESAP is to assist in addressing these core issues. Space-faring countries expressed intent to provide satellite data archives to support the regional cooperative mechanism on disaster management. Relevant policy frameworks were developed and endorsed by the ICC sessions.
Provision of real-time data, free of charge, to countries facing a natural disaster.	The regional cooperative mechanisms on space information for disaster management, such as Sentinel-Asia and the mechanism for drought disaster management, are under development. ESCAP also promoted awareness on the international Charter on Space and Major Disasters. Members from the region include the space agencies of India and Japan.

III. IMPACT OF RESAP IMPLEMENTATION

A. At regional level

35. RESAP had significant impact on national capacity-building, enhancing regional cooperation and capabilities and raising the statue of the Asian and Pacific region in global space technology applications. Through RESAP, ESCAP established networks of space technology professionals to act as national focal points and national contact points for regional cooperation in the different themes of space applications. In addition, ESCAP studied various mechanisms for regional space cooperation; carried out a range of policy studies focusing on the operational use of space technology to meet some of the region's development objectives; supported training and education; and integrated RESAP into the overall work programme of ESCAP.

36. Through RESAP, ESCAP developed the concept of the regional cooperative mechanisms on space technology applications for disaster management, which aims to provide common platforms to major space information providers, local service providers and disaster management authorities for harmonized and affordable access to relevant information and technical resources. Major regional space-faring countries, such as China, India and Japan, have taken concrete steps towards the establishment of such mechanisms. Other countries in the region also expressed their strong desire to contribute to and benefit from such approaches.

37. RESAP projects had a substantial and beneficial impact in the region. For example, the feasibility study for the establishment of an Earth space information network for Asia and the Pacific (ESINAP) outlined the topology and functions of a cooperative multi-node regional information network for sharing Earth observation data products, such as processed imagery for use in disaster response and for natural resources management. This study identified inadequacies in the communications backbone as the major impediment to implementing an operational system. With subsequent improvements to regional ICT infrastructure, a similar network is about to become a reality in the form of the Sentinel Asia project initiated by JAXA and supported by other countries through APRSAF.

38. Similarly, the ESCAP publication *Small is Beautiful: Affordable Space Missions for Sustainable Development in Asia and the Pacific*[12] had an impact in subsequent collaborative small satellite projects in the region, including those in Australia, the Republic of Korea, Singapore and Malaysia. It achieved this by compiling good practices on low-cost micro-satellites and by proposing the "common simple payload" approach. This approach is a method aimed at using the same space technology in order to reduce development costs, avoid duplication of effort, simplify information-sharing and achieve interoperability of several national satellite systems.

39. Of the 62 ESCAP members and associate members, 24 have significant space-related activities, including 17 which have national space agencies. A total of 12 of the most space-active nations in the region have either established national space agencies or comprehensively revised their government space activities since the commencement of RESAP. By far the greatest portion of the world's civil space activities takes place within ESCAP members. In terms of absolute budget expenditure in national civil space activities, ESCAP members are collectively responsible for over US$ 20 billion, or over 80 per cent of the global total.[13] Six of the eight largest national civil space programmes (based on 2004 figures) belong to ESCAP members. On a purchasing power parity basis, the proportion would be even higher, given the generally low cost of conducting high technology enterprise in the region.

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[12] ST/ESCAP/1823.

[13] Euroconsult, *World Prospects for Government Space Markets: 2004 Edition* (Paris, Euroconsult, 2004).

40. The region has taken action towards more permanent cooperation arrangements. The AP-MCSTA has been a forum at which initial discussions about the Asia-Pacific Space Cooperation Organization (APSCO) have occurred. APSCO aims to develop substantive technical cooperation on space science, technology and application missions, and also to provide space application resources to other non-member countries through the RESAP network. As of October 2006 nine countries (including eight ESCAP members) had signed the APSCO Convention, which has been ratified by Bangladesh, China, Mongolia, the Islamic Republic of Iran and Peru.

41. APRSAF focused its efforts on establishing a regional disaster management support system through the initiation in 2005 of the Sentinel-Asia project. This initiative was supported by Japan with its Earth observation and communication satellite systems and by resources from other participating countries. The web-based platform established under this project would be used to develop a harmonized regional cooperative mechanism for space applications for disaster management in the Asia-Pacific region. In partnership with JAXA and APRSAF, RESAP is working on the early planning phase of the project to encourage participation by ESCAP members.

42. CSSTEAP, affiliated to the United Nations, was established by the Government of India in 1995, just after the commencement of RESAP. The curricula of the Centre stress space applications in development-related fields such as tele-education, natural resource management, meteorology, and climate services, as well as in the basic atmospheric and space sciences underpinning the development of new space technologies. From 1995 to 2005, with assistance from ESCAP and other sources, over 600 tertiary-level students from 46 countries in the region have achieved post-graduate degrees at CSSTEAP.[14]

B. At national level

43. RESAP achievements range from national policies and strategy formulation, programming and planning, to institutional restructuring. As a result, in many developing countries, space applications have been given higher priority in national development programmes. With the help of RESAP, many regional space applications have moved from the research and development to the operational phase. Twenty-four ESCAP members now have a national space agency and/or significant space projects under one or more government Ministries. Many national space activities have been formed or have been substantially revised during the RESAP period.

44. The impact of RESAP implementation is summarized below from two perspectives: firstly as space infrastructure development; secondly in terms of benefit to least developed, landlocked, island developing countries, and economies in transition.

[14] Centre for Space Science and Technology Education in Asia and the Pacific, *10 years of CSSTEAP 1995-2005* (CSSTEAP Dehradun, India, 2005).

1. Development of space infrastructure

45. Development of space infrastructure has been the focus of space activities of many Asia-Pacific countries. China, India, Japan and the Russian Federation, having end-to-end space system capabilities from design to launch, have developed comprehensive space application programmes, and have the capability to support regional cooperative mechanisms in all major space application fields. The same is true of non-regional members France and the United States of America, and to some extent, the Netherlands and the United Kingdom of Great Britain and Northern Ireland.

46. The Russian Federation has a rich history of space applications stretching back to the first space vehicle, Sputnik, the launch of which gave rise to the beginning of the Space Age 50 years ago. The country has extensive experience in all facets of space technology and their applications.

47. In addition to many operational Earth observation and communication satellite systems, on 15 October 2003, China became the third nation (after the Russian Federation and the United States) to launch a crewed vehicle into space and return it safely to Earth. The feat was repeated, with a crew of two, in 2005. China is now building its first two communication satellites for foreign customers.

48. Japan has launched many scientific and experimental satellites, and recently adjusted its space policy to emphasize practical uses of its space capability, including contributing to regional cooperation in the fields of disaster and environment management. It is developing a number of novel missions including high-bandwidth communication satellites, positioning systems and interplanetary probes.

49. India has displayed its indigenous capacity through the development and operation of two fleets of geo-stationary-orbit and low-Earth-orbit operational satellites, which help to meet its socio-economic development challenges. In 2005 it launched Edusat, the first satellite in the world dedicated to tele-education. The Indian space programme has been unique in its dedication to achieving development objectives through the application of advanced space technology to everyday life.

50. Many other countries in the Asian and Pacific region have recently expanded their space activities. Australia, China, Indonesia, the Islamic Republic of Iran, Japan, Kazakhstan, Malaysia, Mongolia, Pakistan, the Republic of Korea, Singapore and Thailand are engaged in small satellite programmes for engineering research, Earth observation, natural resource management, disaster monitoring or other purposes. The Republic of Korea has embarked on a long-term comprehensive space programme, including the development of 19 satellites and a launch vehicle. Malaysia, Thailand and Turkey are building operational Earth observation satellites, joining China, France, India, Japan, the Republic of Korea, the Russian Federation, the United Kingdom and the United States as ESCAP members with that capability.

51. Thailand has acquired a broadband communication satellite for direct Internet connection through satellite and Internet-protocol based applications. Member countries with communications satellites - in most cases owned or managed by the private sector - include Australia, China, India, Indonesia, Malaysia, Pakistan, the Philippines, the Republic of Korea, the Russian Federation, Singapore, and Thailand. The Islamic Republic of Iran and Viet Nam are in the process of acquiring communication satellites. Impressive investments on the ground component of space systems have been made in many countries, including facilities for receiving high-resolution remote sensing and meteorological data, and many communication satellite reception hubs and user terminals.

52. Most countries operating Earth observation satellites have expressed their intention to contribute to regional disaster management support systems, notably the Sentinel Asia project, by sharing their information resources. A satellite constellation dedicated to disaster management support is currently under development.

2. Progress in Minimum Common Programme

53. MCP activities have primarily been driven by operational needs, technical capacity, policies and institutional support available to members. RESAP played a catalytic role in terms of awareness building, human resources development, technology sharing and capacity-building. In order to examine the impact further, an analysis was carried out based on the proceedings of ICC meetings, statements from attendees at regional working group meetings, reports of the coordination offices and other published reports and articles.

54. The effect of RESAP in 21 countries, comprising least developed, landlocked, and small island developing countries, along with economies in transition and developed countries, were examined. The results of the analysis are presented in table 4. Highlights are as follows:

- Considerable improvement in the operationalization of MCP-related activities, especially in Australia, China, India, Indonesia, the Islamic Republic of Iran, Malaysia and Thailand. Progress was primarily due to the indigenous efforts of the respective countries in harnessing the advances of space technology and applications, and the availability of trained personnel.

- A trend reflected in Pakistan, the Philippines, Viet Nam and Sri Lanka, indicating concerted efforts to develop operational capabilities and address applications identified under the MCP. Support from development agencies and donors (the World Bank, UNDP, the Asian Development Bank, etc) played a strong positive role.

- Problems in expanding space applications in Bangladesh, the Cook Islands, Fiji, Myanmar, Nepal, Solomon Islands, Tonga and Vanuatu – mostly least developed countries, island developing countries, landlocked countries and economies in transition. Reasons why this situation prevails are explored in section C below.

Table 4. Status of space applications in the region

Country	Environment & natural resources management	Food security	Capacity-building	Human Resource Develop-ment & education	Poverty alleviation	Natural disaster reduction	Health care and hygiene	Sustainable development planning
Australia	1	6	6	1	6	1	3	1
Bangladesh	2	3	4	5	4	3, 4	5	3, 4
China	1	1	1	1	1	1	2	2
Cook Islands	3	5	4	5	5	5	5	3
Fiji	2	3	4	3,4	5	4	5	4
Hong Kong, China	6	6	1	1	6	1	1	6
India	1	1	1	1	2	1	1	1
Indonesia	1	2	1	1	3,4	2,4	2	2
Iran (Islamic Republic of)	1	2	1	1	3	2	3	2
Japan	1	1	1	1	6	1	1	1
Lao People's Democratic Republic	4	3,4	4, 5	4,5	4	3,4	5	4,5
Malaysia	1	2	1	1	2	2	1	1
Myanmar	2,3	3,4	5	5	3,4	3	5	2,3
Nepal	3,4	3,4	5	2	3	3,4	3	2
Pakistan	2	2,3	2	2	3	2,3	3	2,3
Philippines	1	2	1	1	2,3	1	3	2,3
Sri Lanka	2	2,3	2, 4	2	4	3, 4	5	2,3
Thailand	1	1	1	1	1	1	2,3	1
Viet Nam	1,2	1,2,4	4,5	4,5	3, 4	2,3	5	3
Solomon Islands	3	3	5	4,5	3,4	3,4	5	3
Tonga	3	3	5	4,5	3,4	3,4	5	3
Vanuatu	3	3	5	4,5	3,4	3,4	5	3

Key: 1. Operational capability exists
2. Semi-operational stage
3. Pilot project level
4. Activities supported by International Agencies
5. Need but no capability exists
6. Capability exists but no demand

55. The status of the common denominator projects under RESAP II is illustrated in table 5. Although not all projects have been completed successfully, collectively they have helped to catalyze RESAP goals. For example, the project on rice crop monitoring, which was based on the best practices of India's operational Crop Acreage and Production Estimation project, helped many rice growing countries of the region to learn and replicate India's experiences. Similarly, best practices in China and Malaysia were showcased and concerted efforts were made to enable other countries to learn from the experience.

Table 5. Status of implementation of RESAP projects

Common Denominator Projects	RWG	Remarks	Status
Development and application of multi-purpose environmental and natural resources information base for food security and sustainable development	RSGIS[a]	Initial phase of Asiacover project, funded by FAO as Technical Cooperation Project	C
Poverty mapping	RSGIS	Integrated with inter-divisional ESCAP activities; Expert Group Meeting held	C
Integrated land and water resources management	RSGIS	Two projects: (a) Arid areas, supported by China; (b) soil erosion risk assessment in tropical environment, supported by China and Malaysia	C
Crop monitoring and agricultural production forecasting	RSGIS	Two projects: (a) rice crop, supported by India; (b) wheat and cotton, supported by China	C
Capacity-building for disaster management	RSGIS MetSat[b]	Three projects: (a) regional cooperative framework, supported by France; (b) Policy framework on products/services for floods/drought disasters, supported by Republic of Korea; (c) Regional cooperative mechanism on drought disaster management, supported by China	C U
Community-based communication facilities for accelerated rural development	SatCom[c]	Project on Pilot community e-centres in least developed areas project, implemented in China	U
Capacity-building in distance education for rural development	SatCom	(Merged with community e-centre activities) Project on strengthening rural family planning through satellite-based e-learning tools, supported by China	U
Telemedicine for rural population	SatCom	Regional telemedicine workshop organized by India for the benefits of least developed countries	C
Applications of meteorological satellite data and information products for sustainable development	MetSat	RWG joint study, led by China	U
Monitoring the Asian Monsoon and its impact using satellite data	MetSat	RWG joint research, co-led by China and the Philippines	P
Educational resources on space technology for development	SSTA[d]	RWG joint study, led by Australia	U
Low-cost infrastructure for high speed Internet access in rural areas	SSTA	RWG joint study, led by China	C
Sharing of space science data from space missions and ground networks	SSTA	RWG joint study, co-led by China and Indonesia	U
Electronic media for information exchange on space science and technologies	SSTA	RWG joint study, led by Thailand	C
Common simple payload for small satellite applications in sustainable development	SSTA	RWG joint study, led by Republic of Korea	C
Low cost ground station for small satellites	SSTA	RWG joint study, led by Singapore	C
Investigation of infrared technologies for fire detection	SSTA	RWG joint research, led by Singapore	U

[a] RSGIS - Regional Working Group on Remote Sensing and GIS
[b] MetSat - Regional Working Group on Meteorological Satellite Applications and Natural Hazards Monitoring
[c] SatCom - Regional Working Group on Satellite Communication Applications
[d] SSTA - Regional Working Group on Space Science and Technology Applications

Key: P: Proposed C: Completed U: Active

C. Implementation gaps

56. The experience of RESAP implementation since 1995 has disclosed several gaps and problem areas, analysed below.

57. On the economic and technical side, a perception sometimes encountered among Governments and agencies is that space technology applications may not be cost-effective, or may be difficult to employ in practice. However, over the lifetime of RESAP significant progress in space technology and related information and communication technology has reduced the cost of space-based products and services, making these products and services easier to access. At the same time much has been done to tailor value added products to customer requirements in order to enhance ease of use. Concerted efforts have also been made to enhance the compatibility between space-based and conventional information systems.

58. The absence of effective communication infrastructure is a major obstacle for many least developed countries, landlocked developing countries and Pacific island developing countries. As well as inhibiting access to markets and public goods, this deficiency precludes timely access to space information products and services, which is a serious impediment to preparedness and rapid response during major disasters. Though technically satellite communication could assist in resolving these difficulties, private companies, which operate most communication satellites, are hesitant to enter such small markets to provide infrastructure to remote, rural and geographically dispersed small communities, such as the Pacific islands. Individual countries in this position are not well-placed to negotiate with prospective service providers. A subregional, collective approach may result in an improved negotiating position. It may also serve to aggregate demand, making the value proposition more appealing to service providers. For this approach to be effective, special skills in partnership building, negotiating methods, governance and policy harmonization would need to be transferred. This has been beyond the ambit of RESAP.

59. In the operational arena, gaps have been seen mainly in institutional support mechanisms, capacity-building at the level of intermediary value added organizations providing appropriate products and services to local user communities. To facilitate the role of intermediary organizations in providing services that meet the needs of local end-users, major space-service providers should develop appropriate policy and interim products and services which could be processed with fewer resources. Another requirement is end-user training to enable the know-how and benefits from such services to be exploited. A weak institutional base has contributed significantly to the slow diffusion of technology, especially in least developed countries.

60. In some cases policy issues – particularly those relating to overregulation and artificially high prices in telecommunications, absence of effective policies for meeting universal service obligations in communications, and policy-based restrictions on disseminating digital and map-based

information – have impeded the adoption of space technology that would have otherwise had major technical, economic and social benefits.

61. Lack of expertise, limited financial resources, inappropriate coordinating and cooperation mechanisms and the absence of long-term national policies in support of the integration and operationalization of space technology applications for development have also been experienced in some cases in the course of RESAP implementation, especially in least developed countries. On a programme-wide basis, lack of funds has made difficult or has precluded institutional capacity-building. It has also prevented the scaling-up of proven pilot projects into ongoing operational services.

62. A critical impediment is the lack of skilled personnel, despite concerted efforts through RESAP over a number of years. Related issues include the migration of trained personnel to developed countries; the promotion of trained staff into management or other non-operational areas; and the lack of institutional resilience when faced with the loss of key personnel. Finally, where trained individuals are available, their effectiveness may be limited because their organization as a whole may not have the necessary infrastructure and may not have allocated sufficient resources to implement operational space applications.

63. Associate members, Pacific island countries, Central Asian members and least developed countries in general are underrepresented in RESAP activities and meetings, with the possible exception of regional training activities. This may be due to factors including (i) absence of or failure to correctly identify a suitable national focal point and coordinating agency (ii) lack of travel funds (iii) lack of institutional commitment or capability to implement best practices in operational space services.

64. In some cases, the national focal points of the ICC and the contact points of the RWGs, including the coordinators of the RWGs, have on occasion been unable to participate and influence RESAP implementation due to lack of travel funds.

65. Various regional training and educational institutions currently have surplus capacity, which could be better utilized. For example, had more travel funds been available, RESAP could have sponsored a larger number of training activities hosted by China, India and Indonesia under its education and training network. Similarly, the new Asian and Pacific Training Centre for Information and Communication Technology for Development (APCICT), dependent upon the resources made available, may be able to contribute to research and training in respect to specific ICT applications or policy problems in the region. Finally, the nature of digital information from satellites means that the same data or value added products can be reused by a spectrum of users at marginal incremental cost. In this regard, the full capacity of existing satellite systems is far from being exercised in the region.

IV. CONCLUSION

66. RESAP, in the last 12 years, through its networks and capacity-building initiatives, has made significant progress helping member and associate member countries derive benefit from advances in space technology applications in an affordable way. RESAP has responded to dynamic needs, making efforts in addressing the gaps in national capacities, and highlighting the contemporary technological, institutional and policy issues in support of members and associate members. While it remains a challenging task to fully harness space technology applications for sustainable development – especially in least developed, landlocked or small island developing countries, and economies in transition – much progress has been made. RESAP has provided a platform for this progress and has emerged as a viable institutional mechanism at the regional level.

67. The status of the RESAP clearly brings out the continuing need for capacity-building activities in the region, especially in the least developed countries and Pacific island developing countries, where the creation of a critical mass of specialized personnel is an urgent need. Furthermore, to resolve the implementation gaps referred to above, greater attention to institutional capacity-building may be necessary as part of a new strategy in space applications for regional development.

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