# Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space

## Workshop on Remote Sensing for the Detection, Monitoring and Mitigation of Natural Disasters

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Original: English

Vienna
19-30 July 1999
**Committee II**
Agenda item 8
**Status and applications of space science and technology**

**Technical Forum**

Conclusions and proposals of the Workshop on Remote Sensing for the Detection, Monitoring and Mitigation of Natural Disasters, organized by the International Society for Photogrammetry and Remote Sensing and the European Association of Remote Sensing Laboratories

1. The conclusions and proposals below concern paragraphs 34, 41, 42, 44, 69, 74, 75, 79, 80, 82, 86, 90, 91, 94-99, 102, 106-119, 127, 136-139, 301, 302 and 339 of the draft report of the Third United Nations Conference on the Peaceful Uses of Outer Space (UNISPACE III) (A/CONF.184/3 and Corr.1 and 2).

2. Remote sensing provides scientists with the data needed for predictive modelling of natural disasters, for appraisal of the damage caused and for mitigation of the deleterious effects that precede or accompany the disaster. Remote sensing is also recognized as an essential source of information in the initial detection and near real-time observation of the effects of search, rescue and assistance efforts. Many international cooperative activities are now being developed through the efforts of organizations such as the Committee on Earth Observation Satellites and through international bilateral arrangements. The Workshop on Remote Sensing for the Detection, Monitoring and Mitigation of Natural Disasters reviewed the status of those international efforts and offered the following conclusions:
   (a) In order to use remotely sensed data effectively in relation to natural disasters, crisis management systems must be in place. That would allow for planning and collaboration between relevant agencies and rapid response to emergencies;
   (b) Considerable international cooperative efforts are needed to use remote sensing data and other information to develop indicators of disaster-prone areas and mitigation strategies and scenarios;
   (c) Space-imaging, communication and positioning systems can be effective tools for the management of earthquake hazards. Space-borne imaging systems can provide indicators, maps and measurements of quake-prone areas that can be used for evacuation routing, urban planning and vulnerability statistics;
   (d) More research is needed on the potential advantages of new Earth observing remote sensing systems with higher resolution, more spectral bands or active sensors (interferometric synthetic aperture radar and light radar (lidar);
   (e) Space-borne synthetic aperture radars have demonstrated their effectiveness in producing all-weather remote sensing imagery of oil pollution effects, especially for the detection of oil pollutants, in measuring extent, direction and growth and in identifying pollutant sources in international waters;
   (f) Many remote sensing methods have been developed to assess the potential of geological hazards and to appraise the damage caused. They include methods for the integration of multi-sensor data to improve lithological mapping in tropical environments, landslide mapping and analysis of volcanic and associated hazards;
   (g) Satellite remote sensing has been shown to be beneficial in identifying environmental indicators to produce risk maps of desertification, soil erosion and desalinization, deforestation, overgrazing and overdevelopment;
   (h) Early warning systems rely on satellite imaging systems for the detection of early stages of flooding, forest fires, volcanic eruptions and the effects of certain pollutants;
   (i) The detection and characterization of hazardous waste sites require high spatial and spectral resolution remote sensing from visible, infra-red and radar satellite images.

3. Satellite data are used operationally to lessen the impact of natural disasters such as tropical cyclones, flash floods, heavy snowstorms, volcanic ash clouds, sea ice, toxic effects on coastal waters and harmful algal blooms.
4. In conclusion it can be stated that many techniques using Earth observation data are being used effectively to manage natural disasters, but more effort is needed to make disaster prediction a reality and to plan responses. More research is needed to integrate new data sources and to exploit them effectively.

# Seminar on Environment and Remote Sensing for Sustainable Development

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Conclusions and proposals of the Seminar on Environment and Remote Sensing for Sustainable Development.

1. The Seminar on Environment and Remote Sensing for Sustainable Development focused on the application of space remote sensing science and technology to issues of importance to developing countries, such as agriculture, infrastructure, environment and decision-making, from the perspective of Governments and private space technology providers, as well as from that of regional representatives of the user community.

2. During the Seminar eight panel members made presentations describing existing programmes and future missions planned with a view to providing data and information products and the potential value of those products to developing countries. Subsequently, participants discussed with members of the panel issues concerning remote sensing and sustainable development.

3. Both the presentations and the subsequent discussion revolved around issues that condition the ability of developing countries to make full use of remote sensing data and information products. Those issues were as follows:
   (a) Limitations in the capacity available in developing countries in terms of hardware, software and human resources;
   (b) Problems of data pricing, access and standards;
   (c) New missions by “space-faring” nations that were likely to have an adverse effect on both of the above factors;
   (d) New models for the exploitation of remote sensing that had emerged in Brazil and India.
4. The Seminar made the following recommendations for incorporation in the text of the draft report of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III) (A/CONF.184/3 and Corr.1 and 2):

**Paragraph 139**

(a) Insert a new paragraph 139 bis to read:
“The questions of access, dissemination and archiving of Earth observation data are growing in importance. Because issues of data policy, and in particular pricing policy, present obstacles to the effective utilization of Earth observation data, a greater clarity in statements of data policy by the supplier organizations would be helpful to the development of the Earth observation sector. The advantages and disadvantages of different pricing models should be explored and assessed against the opportunities to use Earth observation data for specific applications, including disaster management and global observations. The experience of those organizations which have already established Earth observation data policies, such as the National Space Development Agency of Japan and the European Space Agency, should be harnessed by national and international Earth observation programmes”;

**Paragraph 140**

(b) Insert a new paragraph 140 bis to read:
“To provide a venue for the discussion and resolution of technical and policy matters among data and information users and providers, both public and private, a series of regional forums should be held. To ensure their transparency and credibility, those forums should be organized and hosted by a non-governmental organization such as the International Society for Photogrammetry and Remote Sensing”;

**Paragraph 142**

(c) Insert a new paragraph 142 bis to read:
“The work of the Food and Agriculture Organization of the United Nations in using geographic information

systems to analyse Earth observation and other environmental data to assist policy and decision makers should be communicated more fully to developing countries through literature, pilot project descriptions, data sets on CD-ROMs and the World Wide Web";

**Paragraph 144**

(d) Add the following sentence at the end of paragraph 144:
"There should be a wider and more effective communication of lessons learned on the use of Earth observation for sustainable development in developing countries, including India's Integrated Mission for Sustainable Development and the cooperation between Brazil and China to launch their own Earth observation satellite, the China-Brazil Earth Resources Satellite (CBERS)";

**Paragraph 218**

(e) Add a new subparagraph (e) to read:
"(e) Assisting the centres in developing strategies that would help administrators and managers to understand better the benefits available from the use of remote sensing in sustaining and enhancing the quality of life in developing countries";

**Paragraph 283**

(f) Add the following sentence at the end of paragraph 283:
"Such cooperation will benefit from public/private partnerships, in appropriate circumstances, with suitable arrangements being made for risk-sharing and for developing operational systems that build on successful research and development activities";

**Paragraph 321**

(g) Add a new section after paragraph 321 to read:
"(c)Specific action programmes
"Open access to space is essential to the widest possible utilization of all applications that bring benefits to humankind, including sustainable development. Full participation in the information society of the twenty-first century requires that all nations have open access to environmental information gathered by Earth observation platforms. The principle of non-discriminatory access to Earth observation data contained in the Principles Relating to Remote Sensing of the Earth from Outer Space (General Assembly resolution 41/65, annex), in particular principle XII, should continue to be safeguarded and should be enhanced by a clearer definition of its meaning. The United Nations and its Committee on the Peaceful Uses of Outer Space should work with experts in international space law and space policy to define more precisely the issues of practical implementation behind the term 'non-discriminatory access'. That work should include an assessment of how developing countries can put the principle of non-discriminatory access into practice and thereby gain maximum benefits from space-based Earth observation".

# Workshop on Resource Mapping from Space

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**Status and applications of space science and technology**

**Technical Forum**

Conclusions and proposals of the Workshop on Resource Mapping from Space

1. The conclusions and proposals below concern paragraphs 102-115 and 119-127 of the draft report of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III) (A/CONF.184/3 and Corr.1 and 2).

**A. New global developments in technology**

2. In the last 100 years, natural resource industries have developed from an economy based on access to land and labour into industries where capital (i.e. investment in equipment) dominates. Today, the most rapidly growing segment of the economy is "information": spatial information derived from remote sensing and geographic information systems can help natural resource mangers, in both developed and developing countries, to improve food production and water management, decrease costs or reduce environmental degradation.

**B. Resource issues**

3. Agricultural statistics clearly show that the world food balance is becoming more and more fragile. Since the mid-1980s per capita food production at the global level has decreased steadily.

4. There will be a considerable shortage of water for drinking, for sanitation and, most importantly, for growing crops in the twenty-first century. Water as a scarce commodity needs to be properly managed.

5. The degradation of limited arable land by various processes, namely, soil erosion by water and wind, salinization and alkalinization, waterlogging, shifting cultivation, mining and so on, resulting from over-exploitation has resulted in the significant decrease in per capita arable land.

**C. Conclusions**

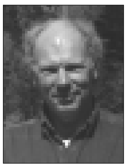
6. Our ability to monitor changes in vegetation and land use in the major production regions of the world is important and remote sensing is the only technique offering such a capability.

7. New satellite remote sensing systems are being launched that will be of use at both local and regional levels for natural resource managers. Those systems offer improvements in spatial, spectral or temporal accuracy. As more satellites are placed in orbit, imagery over a geographical location will be accessible at shorter time periods.

8. Operational low-cost satellites, such as the advanced very high resolution radiometer of the National Oceanic and Atmospheric Administration of the United States of America (NOAA-AVHRR), create the possibility to monitor on a daily basis the status of land and water resources and crop performance.
9. With the advantage of providing synoptic coverage of large areas at regular intervals, coupled with the advances made in computer-aided digital analysis and data fusion, spaceborne multi-spectral measurements made by Earth observation satellites offer an immense potential for generating reliable, timely and cost-effective information on natural resources.

10. A judicious use of the full capabilities of Earth observation missions and data should lead to an increase in the quality of remote sensing products, in the information delivered to the customer and in decisions taken by the customer.

11. The continuous availability of free or low-cost data for resource mapping on a global scale (e.g. NOAA-AVHRR, and the Satellite pour l'observation de la Terre (SPOT) vegetation mapper) is an urgent priority for environmental monitoring.



# Summary of Conclusions

***UNISPACE III - ISPRS/EARSeL Workshop***
***Remote Sensing for the Detection, Monitoring and Mitigation of Natural Disasters***

***By Prof. Ian Dowman (UCL, United Kingdom) and Dr. Lucien Wald (Ecole des Mines de Paris, France)***

The papers and discussion in this workshop have shown that remote sensing provides scientists the data needed for predictive modelling of natural disasters, appraisal of the damages, and for mitigating the deleterious effects which precede or accompany the disaster. Remote sensing is also recognised as an essential information source for the initial detection, near real-time observation of the effects, and support of search, rescue and assistance efforts. Many international co-operative activities are now being developed through the efforts of organisations such as CEOS and through international bilateral arrangements. The Workshop reviewed the status of these international efforts to use remotely sensed data for Monitoring and Mitigation of Natural Disasters and offers the following conclusions:

- In order to effectively use remotely sensed data for dealing with natural disasters, crisis management systems must be in place. This allows planning and collaboration between relevant agencies and rapid response to emergencies.
- Considerable international co-operative efforts are needed to use remote sensing data and information to develop indicators of disaster prone areas and mitigation strategies/scenarios.
- Integration of all available remotely sensed data and other types of data will greatly add to the value of all such data. Data integration techniques are being developed but further research into this is essential.
- Space imaging, communication and positioning systems can be effective tools for management of earthquake hazards. Space borne imaging systems can provide the indicators, maps and measurements of quake prone areas which can be used for evacuation routing, urban planning and vulnerability statistics.
- More research is encouraged to explore the potential advantages of new Earth observing remote sensing systems which have higher resolution, more spectral bands or use active sensors (interferometric SAR, Lidar).
- Spaceborne Synthetic Aperture Radars have demon-

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strated to be effective all-weather remote sensing imagers for oil pollution effects, especially for the detection of oil pollutants; measurement of their areal extent, direction and growth; and for identification of the pollutant sources in international waters.

- Many remote sensing methods have been developed to assess the potential of geological hazards and to appraise the damages. These include methods for the integration of multi-sensor data to improve lithologic mapping in tropical environments, landslide mapping and analysis of volcanic and associated hazards.
- Satellite remote sensing has been demonstrated to be beneficial for identifying environmental indicators for producing risk maps of desertification, soil erosion and desalinisation, deforestation, overgrazing and over-development.
- Early warning systems rely on satellite imaging systems for detecting early stages of flooding, forest fires, volcanic eruptions and some pollutants.
- The detection, effects and characterisation of hazardous waste sites requires high spatial and spectral resolution remote sensing from visible, infrared and radar satellite images.
- Satellite data are used operationally to lessen the impacts of natural disasters such as tropical cyclones, flash floods, heavy snowstorms, volcanic ash clouds, sea ice, coastal water toxic effects and harmful algal blooms.

Many techniques using Earth observation data are being used effectively to manage natural disasters but more effort is needed to make disaster prediction a reality and to plan responses. More research is needed to integrate and effectively exploit new data sources.

(Relevant Paragraphs in UNISPACE III Draft Report A/CONF.184.3 are 34, 41-42, 44, 69, 74-75, 79-80, 82, 86, 90-91, 94-99, 102, 106-119, 127, 136-139, 301, 302, 339)