- Workshop "Photogrammetry, RS and SIS technologies for human settlements", Dar es Salaam, Tanzania, March, 2002 (in co-operation with WG VI/3 and a local host).
- Workshop within the frame of an Asian Conference on Remote Sensing possibly on RS, GIS and GPS technologies for environmental monitoring, agriculture and disaster management. Date and place have not been fixed yet.

ISPRS TECHNICAL COMMISSION VII
RESOURCE AND ENVIRONMENTAL MONITORING

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Gabor Remety-Fülöpp (Hungary)

Incoming President
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Peter Winkler (Hungary)
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Report of Outgoing President

Applied remote sensing became more and more inevitable technology tool contributing to human's progress toward sustainability by support solving environment-related tasks on local, regional and global level. Remote sensing became integrated part of the advanced Information Technology and Telecommunication infrastructure, basement for the information society. Topics include building spectral databases and large datasets (local, cross border, continental or global), enhancing validation and calibration procedures in multi-source, multi-temporal environment, which are some of the strategic imperatives of the application-oriented research and development initiatives. These activities support the introduction of operational utilisation of the technology.

WG VII/1 on Fundamental Physics and Modelling has covered topics which included endmember selection/spectral unmixing, extraction of plant parameters via model inversion and semi-analytical approach, modelling the surface temperature, combining spectral and spatial information for classification purposes, solar energy simulation for rainforest environments, geometric rectification of hyperspectral airborne pushbroom data. Applications were mainly focused on geoscience (exploration, mine tailings monitoring and assessment, soil erodibility, soil distribution, river morphology), water (quality, phytoplankton and wave height extraction), agriculture (classification, stress detection, and retrieval of soil moisture, biomass, LAI, etc.), and GIS applications (demining). Optical, radar, and thermal data acquired with airborne as well as with spaceborne sensors were utilised to extract the information products. In some cases, a fused data set, e.g. optical combined with radar data, was used to retrieve the desired information.

Thematic applications of High Spatial Resolution Satellite Imagery were covered by WG VII/3.
Some data integration for urban planning and management, applications for improved rural management including precision farming, as well as support of local environmental impact studies using high resolution imageries were demonstrated at the Congress, but fewer as expected.

WG VII/5 has worked on Global Monitoring and organised session related to the Kyoto Protocol at the ISPRS Congress jointly with ISPRS WG IV-6 (Global databases supporting environmental monitoring). It provided an opportunity for a larger number of EO scientists to participate and discuss the importance of Earth Observation technology in the context of global treaties. The session "Spaceborne Low Frequency Microwave sensors - assessing user needs and technical limitations for global biomass estimations" (jointly with ISPRS WG VII-6 Radar Applications) addressed particular issues related to a new generation of microwave systems for assessment of global terrestrial carbon stocks.

Members of the WG on Radar applications have been active in the organisation of PACRIM2 which will see the NASA-JPL Airborne SAR (AIRSAR) flown in sixteen countries in the Pacific, Australian and Asian region in the April-May 2000 time period. WG VII/6 conducted a Tutorial on 'Recent Developments in Radar Science and Applications' given by Dr. Tony Freeman from the Radar Sciences Group at JPL. This collaborative science research mission provides the opportunity for environmental scientists in the region to acquire multi-polarimetric and interferometric SAR. In addition the Modis-Aster simulator MASTER will also be flown on this mission to acquire imagery in the visible NIR, SWIR and thermal portions of the electromagnetic spectrum.

A major activity of the WG VII/7 (Non-Renewable Resources and Geotechnical Applications active participation of the 28th International Symposium on Remote Sensing of Environment and the 3rd African Association of Remote Sensing of the Environment (AARSE) on "Information for Sustainable Development". Cape Town, March 27-31, 2000. WG VII/7 was involved in TC VII-8, TU11 and WS5 of the ISPRS Congress in Amsterdam.

ISPRS Council and the Joint Council Technical Commission Presidents Meetings were hosted by the Hungarian Society of Surveying, Mapping and Remote

Sensing at FÖMI Remote Sensing Centre's premises on April 5-6 and April 11. Additionally, ISPRS Seminar entitled „Photogrammetry and Remote Sensing at the Millennium" was held in Budapest with the active participation of ISPRS officers on April 7, 2000.

Outlook by Incoming President

In a relatively short span of three decades since the launch of LANDSAT-I in 1972, space borne remote sensing has proved itself to be an indispensable tool for resource inventory and environmental monitoring at global, regional and local scales. Integrated use of RS and GIS techniques coupled with advancements in communication and information technologies are providing solutions to facilitate sustainable development of natural resources, environmental protection and disaster management. Launch of space missions carrying advanced sensors operating in very high spatial, spectral and temporal resolution mode both in optical and microwave regions provide additional dimensions to earth observation and demand better calibration, data analysis, fusion and integration techniques. While applications-oriented research in some of the countries has lead to operational and commercial use of this technology in many fields, many countries particularly in the developing world are yet to harness the benefit of technology fully. Major effort is required in development of international co-operation for promoting the use of RS & GIS in meeting challenges in the field of food security, environmental monitoring, urban sustainability, disaster mitigation, development of integrated monitoring systems for optimal management of resources, etc. Effective use of global data sets to understand geosphere –biosphere interaction and development of techniques to assimilate satellite derived parameters in models to understand global change need attention. The nine resolutions passed for Commission VII by the General Assembly in Amsterdam reflect these developments and provide directions to further work. Trends and challenges in some of these areas are briefly summarised.

Understanding and modelling spectral response of targets at different wavelengths and under different viewing geometry is basic to remote sensing. Development of methods for inverting spectral measurements to derive geophysical and biophysical parameters for their further use in process based models is needed. Some of the parameters are emissivity, aerosol optical depth profile, LAI, FAPAR, ocean colour etc. In view of the launch of many large swath sensors such as IRS-WiFS, SPOT-Vegetation, understanding effect of viewing geometry on spectral signatures will be important. Hyperspectral imaging data will contain the inherent problem of mixed classes because of low spatial resolution. Hence, extraction of end members from spectral mixtures using various methods like principal component analysis, fuzzy algorithms or parallel co-ordinate representation techniques will need attention. Increasing availability of multi-dimensional (multi-frequency, multi-polarised, multi-date, multi-look angles) digital radar data opens up many areas of research to understand microwave signatures. Availability of very high spatial resolution, hyperspectral, multi-temporal optical data along with thermal and microwave data is opening up new field of data fusion and integration techniques. Standardisation of various procedures for data fusion needs to be developed.

Sustainable agricultural production is of utmost importance in ensuring food security to the increasing population. It calls for identification of problems and optimal land use planning at watershed level, and adoption of proper soil and water conservation measures. RS and GIS have a major role to play in developing methods for ensuring sustainable development of renewable land and water resources. Study of cropping system which addresses crop-crop interaction, the long term effects of various cropping sequences on productivity, soil and environmental health is important. Research needs to be focused to identify indicators of sustainability, effect of green house gases on biomass production and carrying capacity. Application of high spatial resolution multi-spectral data for precision farming is another important area of research. While remotely sensed data has demonstrated its usefulness in crop monitoring and yield prediction, there is need for development of national level integrated systems for crop production forecasting and further research in improving yield models. FASAL (Forecasting Agricultural Output using Space, Agrometeorolgy and Land based Observation) programme being evolved in India is an interesting concept.

Advances made in the information and telecommunication technology have led to conceptualising resource monitoring systems by integrating remote sensing and in situ observations in GIS environment. Development of spatial information systems to support optimal resource management models and decision support to help e-governance should be gaining momentum. Standards for such databases and their inter-operability need to be identified. Availability of high spatial resolution optical as well as radar data, advances in GIS and GPS technology should provide impetus. Major research programmes need to be developed for environmental impact analysis, risk assessment, integrated coastal zone management, ecological assessment of reclamation, groundwater pollution, etc. Networking between information provider and end-user, standardisation of data-exchange format, etc. need to be developed.

A large number of cities all over the world are already using satellite and aerial data with GIS for preparation of development plans, transport network optimisation, utility management etc. Availability of high spatial resolution remote sensing data shall enhance one's ability to monitor urbanisation, study its impact on environment and to help planning rural infrastructure. Delineation and mon-

itoring of environmentally sensitive areas would require attention. Research will also be focused on the use of high resolution SAR data, and its DEM likely to available from RADARSAT-II, ENVISAT, SRTM etc. Recently, there has been emphasis on the conservation and management of natural heritage sites and cultural landscapes. The role of remote sensing (aerial photographs, high resolution multi-spectral data, radar data, etc.) in GIS environment for restoration of some such sites has been demonstrated. Standard procedures to routinely monitor such sites and conservation and preservation practices need to be evolved in close co-operation with CIPA and other international bodies.

Earthquakes, landslides, volcanic eruption, fires and floods are natural hazards that kill thousands of people and destroy billions of dollars of habitat and property each year. Floods are the most serious disasters followed by earthquakes, (man-made) accidents and landslides. Disaster management comprehends the aspects of risk analysis (assessing vulnerability or hazard analysis) and preparedness, prevention (disaster warning or early warning), disaster relief (rescue), and disaster mitigation and planning. Remote sensing has made significant contributions in identification of risk zones. However further efforts are required in providing warning and alert. Development of systems which integrate space observations, modelling and space communication are important. Post-disaster management comprises rescue, relief, and rehabilitation / reconstruction. Remote sensing play its most spectacular role in disaster damage assessment. The various technologies, which would be of significant use in disaster management, are rainfall measurement for flood and landslide warning, soil moisture measurements for flood, landslide and drought warning, application of high spatial resolution imagery for damage assessment, SAR data for timely damage assessment (in an operational phase, by using many satellites to enhance the repetition cycle), slope analysis for landslide vulnerability, determination of tectonic motion for earthquake prediction as a trigger for landslides.

SAR Interferometry technique shows promising results for topographic mapping and change detection, especially, where the detection of height differences in terrain is necessary, e.g., in risk analysis with respect to earthquakes, mass movement and volcanic outbreaks. Through use of differential SAR Interferometry (DInSAR) it is possible to monitor minute surface movements which accompany a range of natural disasters. This technique is in rapid development and operational applications are starting to emerge.

Space observations are an important step toward recording and under standing Earth changes, both natural and man-made. As remote sensing affords the opportunity to view the earth synoptically as an entity, it has been possible to create long-term data sets on various aspects of global change, such as, radiation budget, atmospheric chemistry, ocean surface topography and circulation, sea surface temperature, oceanic biological productivity, ocean/atmosphere coupling, global vegetation, desertification, coastal change, volcanoes, snow cover, human induced changes. Among the complications in producing time series of remotely sensed data for large areas are the problems of storing data and processing them in a consistent and timely fashion. Also, many of the derived data sets from remote sensing should be checked for consistency using physical principles. Complementing the advances made in the understanding of the Earth system from remote sensing has been the advances made from numerical models. Models of the Earth's atmosphere and oceans are being used to predict global changes and particularly the likelihood of global warming and its consequences. Efforts are put into modifying or designing these models to be able to accept remote sensing data as inputs. Considering the huge nature of this data and the analysis methodologies, there is strong need for international co-operation among the space technology providing countries for creating global database and co-operating in the large scale validation of numerical predictions. Organisations like IGBP and CEOS are a step towards that. Close co-operation with TC-IV is envisaged.

Working Groups of Technical Commission VII for 2000-2004

WG VII/1 Fundamental Physics and Modelling

Chair: Karl Staenz (Canada)
Co-chair: Marc Leroy (France)

WG VII/1 Terms of Reference

- Study of spectral, spatial and temporal signatures of various earth surface features (land and ocean) with special reference to hyper spectral and microwave aspects
- Studies to understand view angle effects on spectral signatures
- System studies to define a set of sensors / constellation of satellites for theme applications and radiometric and geometric calibration requirements; in conjunction with WG I / 2
- Investigations in the area of retrieval of geophysical parameters
- Co-operation with WG III/5 on advance information extraction techniques : classifiers, data fusion techniques
- Co-operation with institutions maintaining data bases on spectral signatures, CEOS CalVal WG and EARSeL SIG on Imaging Spectrometry

WG VII/2 Sustainable Agriculture & Eco-system Approach

Chair: Andrew K. Skidmore (The Netherlands)
Co-chair: Lei F. Tian (USA)

WG VII/2 Terms of Reference
- Improve crop monitoring and yield modelling methodology with synergistic use of space, agrometeorology and in-situ observations in GIS environment
- Investigate the interaction of agriculture with ecosystems, especially management that reduces agricultural impacts on the environment
- Geo-information and management requirements for the ecosystem approach
- Ensure optimal use of agriculture inputs for precision farming employing high spatial and spectral resolution and other data
- Improve models for assessment, efficient utilisation and conservation of water resources for agriculture using optical, thermal and microwave data with other data
- Integrated studies for cropping systems in various regional set-ups for attaining sustainable agriculture

WG VII/3 Integrated Monitoring Systems for Resource Management
Chair: Sandra Maria Fonseca da Costa (Brazil)
Co-chair: Li Yingcheng (China)

WG VII/3 Terms of Reference
- Modelling and management of natural resources using integration of RS, in-situ measurements and other data in GIS environment
- Use of spatial information systems for generating alternate scenarios to facilitate monitoring and optimal management : forestry, geology, hydrology, coastal zones, snow and ice
- Contribute to the establishment of reliable indicators of sustainability
- Co-operation with international environmental programmes such as IGBP and ICORSE for development of process-based models to sustainability

WG VII/4 Human Settlement and Impact Analysis
Chair: Gabor Remetey-Fulopp (Hungary)
Co-chair: Carsten Juergens (Germany)

WG VII/4 Terms of Reference
- Data analysis for urban land use studies and for improved urban planning using aerial and high spatial resolution space borne data
- Remote observations for monitoring urban environment and change detection
- Use of Remote Sensing & GIS for infrastructure development for rural settlements
- Study impact of urbanisation, industrial growth, mega engineering structures on ecological and social environment, urban sustainability; tracking of disease vectors
- Documentation, conservation and management of natural heritage and cultural landscapes in co-operation with UNESCO / ICOMOS / CIPA
- Interface with IHDP

WG VII/5 Disaster Monitoring, Mitigation and Damage Assessment
Chair: H. Singhroy (Canada)
Co-chair: Michael Abrams (USA)

WG VII/5 Terms of Reference
- Identification of potential risk zones for different type of disasters such as forest fire, cyclone, floods, volcanoes, earthquake, land slides etc.;
- Integrated observation and communication strategies for disaster detection, monitoring and damage assessment in co-operation with CEOS and IGOS;
- Enhance predictive modelling capabilities;
- Development of disaster management plans for pre, during and post disaster situations;
- Foster the creation of more effective information systems to support disaster management activities

WG VII/6 Monitoring and Modelling Global Change
Chair: Yoshifumi Yasuoka (Japan)
Co-chair: Mark Imhoff (USA)

WG VII/6 Terms of Reference
- Use of long term regional and global data bases using historical and satellite data over terrestrial eco-systems, snow and glaciers, atmosphere, oceans to monitor and model global change in co-operation with WG IV/8
- Evolve standards for data exchange and quality evaluation of satellite derived bio-geophysical parameters
- Develop strategies and algorithms for assimilating remotely sensed data in global change models
- Co-operation with international programmes, e.g. International Global Change Atmospheric Chemistry (IGAC), to support implementation of international policies and treaties

Plans of Commission VII
Two international workshops on Physical Measurement and Signatures in Remote Sensing (January 8-12, 2001, Aussois, France) and on Spectral Sensing Research (June 10-15, 2001, Quebec, Canada) are planned.
A close interaction with the CEOS Cal/Val group and TC I is planned.