

# ISPRS TECHNICAL COMMISSION VII

## **”RESOURCES AND ENVIRONMENT MONITORING”**

### REPORT 1996 - 2000



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(HUNGARY)*

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#### **Terms of Reference for the period 1996-2000**

Methodology of visual image interpretation. Computer- aided interpretation and analysis of sensor data. Spectral, spatial and temporal radiation properties of objects. Environmental studies, resources inventories and interpretative aspects of thematic mapping as applied in studies of vegetation, forestry, agriculture, soils, land and water use, geology, geomorphology, hydrology, oceanography, coastal zones, snow and ice, atmospheric sciences, archeology, human settlements and engineering. Integration of remote sensing and GIS techniques for the monitoring of resources and environment.

*Site of the XVIIIth ISPRS Congress in Vienna*



*Site of the XIXth ISPRS Congress in Amsterdam*



## STATE OF SCIENCE AND TECHNOLOGY OF COMMISSION VII TOPICS

### Remote sensing became inevitable technology tool for science and for society

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. Major challenges are the exploitation of the research and the global co-operation, where the application potential brings direct benefits in climate change research, agriculture, environmental monitoring, cartography and natural resources management. It helps policy decision making to reduce negative societal-economic impacts and assist to ensure sustainable development on the long run. Prof. Hiroyuki Yoshikawa, President of ICSU<sup>1</sup> wrote (in Science International, December, 1999): "Because technology is always a part of the society, we might say, that engineering is a mapping of science into society. Consider any relationship between science and society, and engineering will be necessary." Today, remote sensing will be integrated part of the advanced Information Technology and Telecommunication infrastructure, basement of the information society. Building spectral databases and cross border, continental or global large datasets, refining validation, calibration procedures in multi-source, multi-temporal environment, and paving the way for standardisation are some of the strategic imperatives of the application-oriented research and development initiatives, which support the daily, operational utilisation of the technology.

### Major improvements

Major improvements are especially in the hyperspectral opportunities, data fusion experiences, storage, management and retrieval of large datasets. The accelerating impact of the available enabling technologies (computers, Internet and NGI, high-speed communication, mobile environment) should be also emphasized. Important is the timely use of data in extraction and interpretation by digital image processing, pattern recognition and feature identification. Data quality issue plays an important role: how accurate the results are? Satellite segment, extensive ground segment for processing, archival and distribution as well as data readily available to general scientific users have been realised (e.g. in the Earth Observing System of NASA). Facilities (such as the Eros Data Center's DAAC) provide extensive Internet data access (e.g. AVHRR, DEM, Landsat, radar) for the interdisciplinary user community helping also for a better understanding the Earth as a total system. NASA's major scientific priorities in spectral sensing research applications focuses for the next 10 years on atmospheric chemistry and ozone, seasonal and annual climate variability, long term climate change, land cover/use change and global productivity and natural hazard mitigation by observation, understanding, building models and implement scientific assessments. Scenario according to *G. Asrar* as presented at the ISSSR conference in 1999, there is a need for a pathfinder for international policy decision making (e.g. monitoring and documenting the ozone hole). The present challenge: can we learn to predict regional climate variations from months to a year in advance? Next challenge: there is a need for a systematic, calibrated, long term data records, and their assimilation into already existing general circular models (including oceans, atmosphere, cryosphere, land and biosphere) under evolution. To do so, even more diverse data are required. Future challenge: we have only the beginning of an observational strategy for global assessment of the ecosystem behavior.

The integration of global-to-regional-to local scale observation is especially challenging. According to this strategy, a large number of mission is expected in the forthcoming years. The "*Digital Earth – Understanding our planet in the 21<sup>st</sup> Century*" is a vision closely related with the subject. The concept's document announced by *Al Gore* in February 1998 begins: "A new wave of technological innovation is allowing us to capture, store, process and display an unprecedented amount of information about our planet and a wide variety of environmental and cultural phenomena. Much of this information will be georeferenced. " Taking the list of the working group partners at the 8<sup>th</sup> Digital Earth meeting held in December 1999, the interdisciplinarity and the role and potentials of remote sensing is reflected by the co-operating agencies such as ACE, EPA, FGDC, NASA, NIMA, NOAA, NSF, USDA and USGS are the cooperative partners. Relevant international projects close to the subject include:

*Digital Earth Information Resources* (an index of online information resources)

*Analogs to Digital Earth* (a list of sites similar to the Digital Earth concept)

*Global Spatial Data Infrastructure* (GSDI, formed by linking of national and regional spatial data infrastructures is a global and open process for coordinating the organisation, management and use of spatial data and related activities)

*Global Mapping* (a group of globalgeographic data sets of known and verified quality, with consistent specifications which will be open to the public)

*DEVELOP* (the Digital Earth Virtual Environment and Learning Outreach Project of NASA Langley)

*Global Disaster Information Network* (GDIN, established to improve the effectiveness and interoperability of global systems for sharing natural disaster information especially maps and data generated by remote and land based sensors)

Similar way, the synergetic impact of remote sensing and the GI will be the major theme of the ISPRS Congress in Amsterdam selecting the motto "*Geoinformation for All*". Commission VII proposed its technical session related to this

<sup>1</sup> International Council for Science

Congress theme entitled “Resource and environmental monitoring – local, regional, global” with keywords data availability, accessibility, application-oriented data requirements, interoperability, spatial data infrastructures, remote sensing applications, Agenda 21, UN International Decade for Natural Disaster Mitigation.

### Fundamental research and development on physical measurements and signatures in remote sensing

The widest range of results in the fundamental research and development on physical measurements and signatures in remote sensing were highlighted and discussed under ISPRS logo at the last Courchevel international conference organised by CNES, and JRC SAI of the European Commission. The topics include physical modelling for data simulation and sensitivity studies (e.g. in agriculture, recovering surface temperature and emissivity from thermal infrared multispectral data), inversion methods (used e.g. in satellite measurements and vegetation models for carbon cycle studies). In data pre-processing mostly the AVHRR, SPOT, ERS data were handled, paying also attention to the atmospheric influences on field spectrometry (i.e. the observed relationship between spectral irradiance and the variance in spectral reflectance). The atmospheric correction for short-wave sensors (e.g. MODIS, POLDER, VEGETATION, MERIS) have been also investigated. The physical modelling using experimental test areas for calibration of satellite sensors were focusing on coupling ground, airborne and Earth observation data. Investigations were mostly related to agriculture, highlighted by leading laboratories such as INRA, USDA RSRL, JRC SAI and CESBIO. As example, assessment directional properties of emissivity and radiative temperature of vegetal covers, use of stochastic model for determination of leaf properties in the optical range, bi-directional measurements of leaf reflectance and transmittance as far as different land cover types and surface components to standardise vegetation indices or analysis of model sensitivity due to the impact of spatial and temporal variability of canopy and soil characteristics can be mentioned. The use of 3-D plant modelling and measurement in remote sensing was also introduced. The estimation of bio- and geo- physical/chemical variables was reviewed in depth. The application-oriented developments include land-use classification with the aid of neural networks, land subsidence mapping by differential SAR interferometry and modelling, characterisation of soil salinity in irrigation systems, as well as monitoring urbanisation and deforestation using remotely sensed data. Using AVIRIS data based algorithm, about 1 million reflectance spectra have been analysed, showing a range a range of spectral characteristic's indicative of vegetation species. The “leaf water parameter” has been derived, which is shown to be strong indicator of leaf thickness and canopy spectra. Due to the fact, monitoring agricultural crops and estimating yields has become an issue of great importance both for economic planners and for agribusiness, assimilation of satellite data in crop monitoring and yield prediction has been also targeted. The technology has been developed also in small countries (such as Hungary, where - based on a 20 years R+TD with 300 man-year investment at FÖMI RSC - crop monitoring and yield estimation by multiplatform satellite remote sensing is operationally used serving the decision makers since 1997).



*G. Csornai (l), Leader of the Hungarian operational remote sensing-based crop monitoring and yield estimation program (CROPMON) with Prof.J. Trinder, Secretary General of ISPRS at the 3<sup>rd</sup> UNISPACE Conference held in Vienna, 1999, and the team of the FÖMI Remote Sensing Centre, host of the Commission VII's Secretariat*



The opportunities and limitations for remote sensing in precision farming were recalled by *S. Moran* et al describing four major requirements as follow:

- Real-time information for on-the-go management
- Information on seasonally stable conditions (mapping long term variability)
- Information on seasonally variable conditions (mapping short-term variability), and
- Information required to determine cause of variability and develop management strategy.

Another field of investigations was the remote sensing based impact assessments of environmental change, with targets estimating the status of terrestrial vegetation with special emphasis on the tropical forests, the monitoring of the urbanisation and the analysis of the enhanced plant growth in the high latitudes of the Northern Hemisphere. The VEGETATION potentials for desertification monitoring, simulation of sand movement detection in Northern Africa, synergistic use of passive and active microwaves using over semi arid and periarctic regions, as well as discrimination of wetland and non-wetland community types with multi-spectral, multi-angle polarised POLDER data were highlighted and discussed.

### **Instruments introduced in application-oriented environment at ISPRS Commission VII related conferences and symposia**

The most widely used sensors include AVHRR, Landsat, SPOT, IRS, ERS, JERS, METEOSAT, RADARSAT, MOMS-Priroda, KVR-1000 and SPIN-2. The ISPRS-CNES-JRC Courchevel conference and ISPRS-ISSSR symposia highlighted the following airborne or space remote sensing instruments:

AVIRIS NASA's airborne visible/infrared imaging spectrometer (used in spectral reflectance studies by R.Green of NASA JPL and D.Roberts of UCSB)

IRSUTE – a minisatellite project for land surface fluxes estimation using hi-spatial resolution thermal infrared (introduced by B.Seguin et al, of INRA, LSIT-ENSPS and CNES)

MERIS - medium resolution imaging spectrometer (introduced by ESA HQ and ESA/ESTEC, as well as by *Jan G.P.W.Clevers* of Wageningen University, Co-chair of ISPRS WG VII/1)

SAR interferometry and its use (M.Zink et al of DLR)

HSSL (Hot-Spot Search Light) using active illumination and multi-directional detection that would allow hotspot angular distribution measurements from space in a search light mode in order to retrieve leaf size and canopy height (introduced by *A.Gerstl* of Los Alamos Nat.Lab.)

Positive Systems's HYDICE hyperspectral pushbroom sensor (introduced by R.Pollina et al of Bechtel Nevada)

Operational Hyperspectral Imager (introduced by Dornier-GeoFZ-CCRS)

COIS (NEMO) and Warfighter (OrbView-4) and Hyperion (EO-1) (introduced e.g. by S.Blonski et al of Lockheed Martin and NASA CRSP in relation of the satellite hyperspectral imaging simulation)

HYPERION (EO-1, introduced by *J.Pearlman* et al of NASA CRSP)

Litton Emerge's airborne digital imaging system (using 6 Mpixel Kodak 640 DCS with GPS and INU)

APEX (Airborne PRISM experiment – a new airborne hyperspectral imager for the simulation of ESA's Land Surface Processes and Interactive Missions, as introduced by *M.Shaepman* et al)

IFSAR (interferometric SAR, introduced by *B.Housmand*, JPL CALTECH in sensor integration with AVISIRIS for urban analysis)

CASI compact airborne spectrographic imager (introduced by *M.R.Davenport* developing practical tools for shadow removal and also by *K.Staenz* of CCRS, Chair of the ISPRS WG VII/1 in classification of hyperspectral agricultural data with spectral matching techniques)

LWIR AIRIS multispectral infrared imaging chemical sensor (introduced by *C.Gittins* of Physical Sciences Inc) also referred as Adaptive Infrared Imaging Spectroradiometer

ASAS advanced solid state array spectroradiometer as used in the impact analysis of the 100-year event ice storm in US/Canada in January 1998.

### **Participation at the UNISPACE III, Vienna**

*Dr.D.P.Rao* of NRSA, Chair of the ISPRS WG VII/2 has delivered a lecture on "Sustainable development and remote sensing" at the ISPRS Workshop chaired by *John Trinder* (UNSW) and *Klaas Jan Beek* (ITC) devoted to "Resource Mapping from Space" on 10 June, 1999. The contribution of *G.Csornai* et al of FÖMI RSC, core member of WG VII/2 gave an in-depth overview on the operational crop monitoring and production forecast by remote sensing in Hungary. The papers can be found in the ISPRS International Archives Vol XXXII Part 7C2

"The Special UNISPACE III Volume" published in July, 1999. The volume contains the papers of the ISPRS-EARSeL Workshop devoted to "Remote sensing for the detection, monitoring and mitigation of natural disasters as well as the ISPRS –NASA Seminar on "Environment and Remote Sensing for Sustainable Development".



### **Goal: supporting information requirements posed by the Kyoto Protocol**

In 1999, the ISPRS VII/5 Working Group activities lead by *Ake Rosenqvist* have been focused on the potentials of remote sensing in the context of the 1997 Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC). The Kyoto Protocol stipulates quantified and legally binding national commitments on greenhouse gas emissions, and a principal aim of the working group has been to assess the potential and limitations of global scale remote sensing in the context of the Protocol, with particular emphasis on forest inventories and change monitoring of global carbon stocks. The review of available and future technology for monitoring treaty compliance was the subject of the meeting organised as shared team effort by *Ake Rosenqvist* of DG JRC SAI, *Marc Imhoff* of NASA GSFC, *Tony Milne* of UNSW and *Craig Dobson* of UoM, as joint action of the ISPRS VII/5 (Global monitoring) and VII/6 (Radar applications) working groups in-close co-operation with the hosting University of Michigan (Dept. of Electrical Engineering and Computer Science, EECS) in Ann Arbor, October 20-22, 1999. The Protocol requirements on biomass monitoring were assessed, and the capabilities of current and future RS sensors to meet those requirements were addressed. Particular emphasis was put on the potential of low frequency SAR sensor technology to improving the current capacity to perform quantitative biomass assessment from space, in service of the Kyoto Protocol. Meantime the Report has been published entitled: *Remote Sensing and the Kyoto Protocol: a review of available and future Technology for Monitoring Treaty Compliance*". I would emphasise two of the recommendations of the authors made in the Report:

"Although political in nature, the global impact of the Kyoto Protocol on technical and scientific issues of relevance to the remote sensing community is considerable and unprecedented. Issues related to the Protocol, in particular to afforestation, reforestation and deforestation (ARD) activities, will affect the work of the scientific community for years to come. Consequently, it is recommended that a considerable part of international remote sensing research activities be focused and aligned to fulfil the specific information needs posed by the Kyoto Protocol and in a broader context, the needs relating to full carbon accounting and an improved understanding of the terrestrial carbon budget. Research topics of specific relevance, not only relate directly to remote sensing but also to the need for adequate in-situ information, have been identified above", and

"The ISPRS, being an international organisation without national bias, can play a significant role in this context. It is therefore proposed that the ISPRS, in particular Commission VII (Resource and Environmental Monitoring), for its next mandate period, 2000-2004, forms a dedicated *Kyoto Task Force* with the aim promoting and stimulating remote sensing research and development aligned with the topics identified above".

### **Some of the recent, significant technical breakthroughs include:**

- After the successful launch of Ikonos 2, the era of the very high resolution satellite remote sensing has come true having positive impact on the application oriented R+D activities and it is anticipated, the commercial market will be increased significantly especially, if competition will be start. In the mid run, imagery will become one of the base data of many of public inventories and registers having geospatial referencing possibility or requirement. Improved EO systems and knowledge based information systems will facilitate the contribution of science to problem solving of burning issues related to environment and resource monitoring.
- The development of virtual laboratories enabling knowledge based effective design, analysis, simulation, optimisation and verification of application tailored RS systems within pure software environment.
- According to the Landsat Remote Sensing Policy Act of 1992, NASA is charged to ensure Landsat data continuity through the use of advanced technology. Such a service ensure long term stability operational applications in environmental and resource monitoring in local, regional and global level. Final preparation of the NASA's New Millennium program Earth Observing-1 should be mentioned having revolutionary land imaging instruments all in line with the Landsat 7 ETM+ (ALI, the advanced land imager, Hyperion, the imaging spectrometer and AC, the atmospheric corrector). Similar Earth-observation oriented R+D achievements can be reported at ESA, NASDA, ISRO, and other programme implementation. Nodal points of the institutional network (JRC SAI, CNES, DLR, CCRS, NASA, NRSA, SAC, AUSLIG, INPE etc) have become inevitable fundamentals for the wider global spatial data infrastructure.
- Advances in hyperspectral imagery (HSI) exploitation and field spectroscopy instrumentation using standardised spectral library. Achievements in this field were presented at numerous conferences, most notably at NASA's Annual AVIRIS Earth Sciences and Applications Workshop (Pasadena, 1999, 2000), the International SPIE Conference on Imaging Spectrometry (Denver, July 1999) as well as at the ISPRS Working Group VII/1 supported ISSSR symposia (San Diego, December 1997 and Las Vegas, November 1999).

### ACCOMPLISHMENT OF COMMISSION VII (1996-2000)

For the years 1996-2000 a **new Working Group structure** was set up as follows:

- WG VII/1 Fundamental Physics and Modeling
- WG VII/2 Application of Remote Sensing and GIS for Sustainable Development
- WG VII/3 Application of High Resolution Satellite Imagery
- WG VII/4 Automated Image Interpretation and Analysis
- WG VII/5 Global Monitoring
- WG VII/6 Radar Applications

WG VII/7 devoted to "Non-renewal resources and geotechnical applications"

In Vienna, a co-operation between WG VII/5 and WG IV/4 on large/global dataset managements were suggested and accepted. Invited Advisory Board members of the Commission VII were serving as rapporteurs:

Sergio Camacho (OOSA, United Nations, AUSTRIA), Simonetta Cheli (ESA, FRANCE), Roberto Pereira da Cunha(†) and Thelma Krug (INPE, BRAZIL), Ake Rosenqvist (NASDA, JAPAN, later DG JRC SAI) and Charles T. Wooldridge (NOAA, USA).

#### Dissemination of Commission VII related information

The Internet webpages of the Commission VII were maintained by H.Goodenough and Paul Pilon in Victoria, Canada (<http://www.hegyi.com/isprsc7>). Mirrored webpages can be accessed also at the Budapest Technical University mastered by István Sándor (<http://mhsz.bme.hu/>).

#### Relevant workshops and seminars with active participation by ISPRS Commission VII

The actual scientific work of the Technical Commission were done in the seven Working Groups. However, some activities of the Commission officers are summarised as follow:

***MERA 92 International Workshop on Soil Degradation Assessment*** with the application of GIS and remote sensing. Budapest, September, 1996. Topics: Regional crop/land use inventory, Crop yield modeling, Forest ecosystem mapping, Land degradation assessment and related issues.

Participation of the ***Joint ISPRS Council and Technical Presidents' Mmeeting*** in Tokyo. Delivering a lecture on the European remote sensing based agricultural monitoring programmes at the Tokyo Technical University.



*Moment of the Japanese break: Profs Armin Grün, Dieter Fritsch, Toni Schenk*



*ISPRS Commission VII President gave his presentation for the Seminar participants organised by the Japanese Society for Photogrammetry and Remote Sensing*

***International Seminar Series - Land use from research to Teaching*** held at the Agricultural University, Debrecen Hungary December 1996. Topics: land use, rural development and land consolidation, use remote sensing, aerial survey for sustainable agriculture.

***Conference "Emerging Global Spatial Data Infrastructure"*** Bonn-Königswinter, September, 1996. Organised by DDGI, AI, ILI, FIG Com.III, EUROGI. ISPRS was represented by Commission III and VII (Prof.Fritsch and Remetej-Fülöpp respectively)

***ECO-INFORMA'96 Global Network for Environmental Information*** Lake Buena Vista, Florida USA November, 1996 Organised by ERIM, NOAA-NESDIS, USDE, and others. Session Co-chair and lecturer was Dr.V.H.Shingroy, Co-chair of ISPRS WG VII/2.

and Forestry. *Attendance and active participation at the Sec Conference* in the Czech Republic, February, 1997

*Left: Member of the Bureau of the European Association of Remote Sensing Laboratories, Dr. Benes (r.) one of the Conference organisers.*



**EURISY Colloquium: Earth Observation and the Environment: Benefits for the Central and Eastern European Countries.** Budapest, May, 1997 in presence of Hubert Curien Founder president of EURISY, chaired by G. Duchossois of ESA, V. Perdigao of DG JRC, Gottfried Konecny of IPI/ISPRS, H. Curien of EURISY as



well as G. Remetey-Fülöpp of ISPRS Commission VII. Presentations included land cover project (Gy. Büttner), crop monitoring (G. Csornai), European Forest Inventory (S. Folving), satellite data for map updating (P. Winkler).

*Left bottom: Mr. Guy Dussochois, representative of the Earth Observation Programmes of ESA, at the EURISY Conference in Budapest, attended also by Mr. Herbert Curien, former Minister for Science and Technology in France*



*Below: EURISY break with Peter Winkler of FÖMI RSC and Geza Apagyi, former Director of FÖMI with representative of the Ministry of Communication, Transportation and Water*

Remote Sensing and GIS – tools for solving tasks in Agriculture



**Participation of the Joint Meeting of ISPRS Council and TCPS in Rio de Janeiro, September, 1997**

**TCP has participated the 2<sup>nd</sup> world conference on "Global Spatial Data Infrastructure for Sustainable Development** October, 1997, Chapel Hill NC, USA

Education, training and knowledge management – inevitable tool for raising awareness for widening photogrammetry and remote sensing applications. Participating the **third European GIS Conference** in Vienna and by invitation, the first exams of the **International Course of UNIGIS** arranged by CSLM UWH in Székesfehérvár.



The Pan-Europea knowledge transfer program includes Remote Segment Application segment maintained by DG JRC SAI. (G.Saio GISIG, U.Boes EC, Sz.Mihály FÖMI, R.Pavlova, Sofia TU and R.Peckham of DG JRC)



UNIGIS President Prof. Jim Petch (center) with Profs. M. Ágfalvi (l.) and B. Márkus (r.) of the College of Surveying and Mapping of the University of West-Hungary at Székesfehérvár

**International Symposium of Spectral Sensing Research**, San Diego, December, 1997



**Inter-commission Workshop was prepared on GIS, Airborne Remote Sensing and Geospatial Data Clearinghouse** Budapest, February, 1998 with ISPRS Commission III with direct involvement of President *Toni Shenk*, WG III/3 Co-chair *Beáta Csathó* (Ohio State University, Columbus) and Secretary *Erzsébet Merényi* (Arizona University, Tucson). Topics included geospatial databases, state-of-the-art of tools and methods including photogrammetry, remote sensing, airborne geophysics, multispectral, hyperspectral sensors and methods, geophysical and geological interpretation methods as well as multiple sensor integration.

**ISPRS Council Strategic Planning Meeting** Silver Spring, March 1998 Written contribution based completed questionnaire, sharing the views on ISPRS' long-range strategic planning.

**On accessibility of remotely sensed data – a vision**

Edited by Alison Munro of the Space Application Institute of the Joint Research Centre and contributed by *G. Remetey-Fülöpp*, the document entitled "A strategic view of GIS Research and Technology Development for Europe", has been published. by the European Union.

**The mid-term Symposium of the Commission VII (ECO BP'98) on Resources and Environmental Monitoring** Budapest, September 1998. The event attracted 196 registered participants (including many of the ISPRS Council members) from 33 countries of 5 continents (35 from Hungary). Moreover 62 invited Hungarian senior decision makers and additional 59 professional visitors were attended the open day devoted to commercial exhibitions and presentations. From the scientific point of view ECO BP'98 was a great success. Major application areas where novel research and technology development methodology were applied include hyperspectral sensing, environmental risk and/or site analysis, global, regional and local monitoring as well as assessments related to sustainable developments.



The synergetic integrated use of RS and GIS technologies was the case in the majority of applications. By recommendation of the TCP, Peter Winkler, Secretary of the Commission VII was invited by the Editor-in-Chief *Dr.Emmanuel Baltsavias* to serve the Editorial Board of *ISPRS Journal*.



*The classical building of the Hungarian Academy of Sciences, the site of the Mid-term Symposium of the Commission VII in Budapest*



*ISPRS Council members and EARSel President's visit at President of the Hungarian Society of Surveying, Mapping and Remote Sensing Prof.Ákos Detrekői (l.) Guests: (l. to r.) L.Fritz, T.Klug, Prof.J.Trinder, Prof.Waughan., G.Remetey-Fülöpp, G.Mélykúti, P.Winkler and Prof.G.Konecny.*

*Prof.R.Wauhghan, President of EARSeL, Prof.G.Konecny and Mr. Lawrence Fritz, President of ISPRS at the visit of the Rector of the Budapest Technical University, Prof.Ákos Detrekői*

*ECO-BP'98 VIPS at the social evening – Mrs. and Mr. Fritz with Secretary General Prof.John Trinder and Prof. Karl Krauss*



**Information distribution related to ISPRS Commission VII activities.** The early results of the ECO BP'98 were presented for the audience of the Annual GIS Workshop held in Cluj, Romania by *dr.Gábor Remetey-Fülöpp* in October, 1998. The event was organised third times by the Dennis Gábor Foundation with the main objectives to make promotion for the application of IT based technologies with special emphasis on spatial data handling and analysis.



*Above: Dr.R.Berencai, Director of HUNGIS Foundation (L.) and Mr.M.Havass, Former President of the Hungarian Association for Geo-Information HUNAGI (r.) with the organiser of the GIS Workshop Prof.S.Selinger.,*

*Below left: Denny Kalesky, former Head of the United Nations Food and Agriculture Organisation's Remote Sensing Centre in Rome (center) with colleagues from the Czech Republic and Hungary during the Sec Conference*

*Below right: Mr:Zsolt Nagy, GI expert of the State Administration in North Carolina (l.), Colonel Bertalan Farkas, Hungarian Astronaut (center) and ISPRS Commission VII President at the reception given by the Ministry of Agriculture and Regional Development, Republic of Hungary at the ECO BP'98.*



**ISPRS on the agenda of the Annual Space Day attended by COSPAR’s President**

The Annual Space Day was held in Budapest on October 20, 1998 in presence of *Dr. Gerhard Haerendel*, President of COSPAR, Director of the Max Planck Institut für Extraterrestrische Physik. Based on the presentation material compiled by the Technical Commission President, *Peter Winkler* delivered a lecture on the ISPRS Symposium. The event was hosted by the Hungarian Space Research Office directed by *dr. Előd Both*, and the Hungarian Astronautical Society under the presidency of *dr. Iván Almár*. It should be mentioned, the Committee on Space Research (COSPAR) celebrated its 40<sup>th</sup> year in 1998.

**Remote sensing content in applications related to the European integration**

On the Database Service Providers’ Annual Conference the use GIS/RS as tools in the European integration-related tasks have been discussed in Budapest, in November, 1998. Four presentation were in line with the Commission VII activities: “CORINE Land Cover” (*Gy. Büttner*), “GEIX the European Geological Information eXchange System” (*G. Erdélyi*), “UNDP project on the applicability of DAIS for hyperspectral survey of Hungary” (*P. Kardeván*) and the “Multipurpose parcel-based information system” (*A. Podolcsak et al*).

**3<sup>rd</sup> Conference on the Global Spatial Data Infrastructure**

According to the recommendation of the 3<sup>rd</sup> Global Spatial Data Infrastructure (GSDI) Conference, “The organisational model recommended for the GSDI in the long run is the umbrella organisation, which brings together regional committees, national committees, and other relevant international institutions e.g. ISO, OGC, ISCGM, ISPRS, ICA, etc in the context of action-oriented principles of flexibility, inclusivity and simplicity. As member of the GSDI Steering Committee, *G. Remetey-Fülöpp* attended the event hosted by AUSLIG in Canberra, between 17-19 November 1998. Before the conference, he had the opportunity to held a two days consultancy on the workplan and follow-on



actions at UNSW with ISPRS Secretary General *Prof. John Trinder*, *Prof. Tony Milne* and *Prof. Bruce Forster*.



Canberra Hilton, site of the 3<sup>rd</sup> Global Spatial Data Infrastructure, having over 100 invited experts and GI policy makers from five continents organised by AUSLIG

### **UN ECE MOLA Workshop on Land Market**

Administrations hosted by the Ministry of Agriculture and Regional Development of the Republic of Hungary under the auspices of the United Nations Economic Council for Europe. The Workshop held in Budapest, December 1998, highlighted and discussed the technological aspects and tools with special emphasis on photogrammetry, remote sensing and GIS.



*Dr. Badea of Romania talks on Crop Monitoring System*



*Participants of the ESMI Workshop hosted by HUNAGI*

### **European Spatial Metadata Infrastructure (ESMI) Workshop.**

Three countries have been selected (Netherlands, Portugal and Hungary) to ensure direct feedback from the data provider, data broker and data user communities on national level. The full day international meeting devoted to the metadata standards and services was held in Budapest. Relevant ISO, FGDC, CEN, OGC standards were deeply discussed. ESMI project is part of the INFO2000 Program of the European Union, participated also by the Space Application Institute of the Directorate General JRC of the European Commission, providing expertise in cataloging and servicing remotely sensed data.

### **Remote Sensing for the sustainable agriculture and rural development**

The early results of the German-Hungarian pilot project on land consolidation called TAMA, as well as the applicability of the by-products of the remote sensing based Hungarian Crop Monitoring Program were demonstrated and discussed at the Dutch-Hungarian expert meeting. TAMA Project, lead by *Dr. W.D. Kneib* utilized merged SPOT panchromatic and multispectral imageries for site assessments and landscape planning in 5 pilot areas, while the Crop Monitoring Program lead by *Gábor Csornai* of FÖMI RSC uses AVHRR, Landsat, SPOT and IRS data.

### **ISPRS Council and Technical Commission Presidents' Joint Meeting**

Commission VII was represented at the ISPRS Council and Technical Commission Presidents' Joint Meeting held in Stuttgart and Bad Wildbad in September, 1998.

### **Conference on structural change in the farming sector in Central and Eastern Europe.**

Organised by FAO, European Commission and the World Bank in Warsaw, in June 1999, the conference was devoted to the structural change in the farming sector in Central and Eastern Europe. The Hungarian approach using remote sensing in the monitoring was presented by *G. Remetey-Fülöpp*.

*Below: Fritz Rembold land tenure and regional development expert of the FAO SEUR and Jim Riddell of UN FAO HQ at the Warsaw Conference.*



***EARSel/ISPRS workshop*** on „Fusion Sensor Data, Knowledge Resources and Algorithms for Extraction and Classification of Topographic Objects“ took place in June, 1999 in Valladolid, Spain. The workshop was organised from ISPR WG III/5 „Remote Sensing and Vision Theories for Automatic Scene Interpretation“, WG IV/3 „Integration of Image Analysis and GIS“ and WG VII/4 „Computer Assisted Image Interpretation and Analysis“ together with EARSel SIG. The Valladolid symposium also an ***inter-commission action*** had been very successful and that the income generated had been allocated to award travel grants to some students to attend the ISPRS Congress in Amsterdam in July 2000.

***GSDI Steering Committee meeting***

The meeting held in the St.John's College, University of Cambridge in July, 1999, *Tim Foresman*, leader of NASA 's Digital Earth Concept was invited to deliver a presentation for Commission VII flagship session in Amsterdam.



*EU Commission Advisor Roger Longhorn, Tim Foresman of NASA and Peter Holland, General Director of AUSLIG and Chairman of GSDI at the Advisory and Steering Committee Meeting participated also by ISPRS Commission VII President held in Cambridge*

***Workshop on Modern Cadastre and Land Registration Systems***

Active participation of the meeting organised by the United Nations Economic Commission for Europe, Committee on Human Settlements, Meeting of Officials on Land Administration in Bonn, 11-12 March, 1999

***Below: Participants of the Workshop, where Photogrammetry and Remote Sensing was also discussed at the UNECE MOLA Meeting devoted to advanced technologies in cadastre.***





**The UNISPACE III Conference and Exhibition** held in Vienna in July 1999 was actively participated in the Earth Observation session by WG VII/2 Chair *Dasika.P.Rao*, WG VII/2 Co-chair *Vernon Singhroy*, the TCP and both Commission Secretaries (*Peter Winkler* and *Frank Hegyi*). In Vienna, lecturers have been selected and invited for the ISPRS Congress session TC VII-1 devoted to the event's topics: "Geo-information for All". The personalised invitation was accepted by *Prof.Gottfried Konecny*, *He Changchui* of FAO, *Gábor Csornai* of FÖMI RSC and *D.P.Rao* of NRSA.

*Above: ISPRS Congress Director Klaas Jan Beek chairs the Session . Above right: Dasika P. Rao delivers his lecture*

**ISPRS Council and Technical Commission Presidents' Meeting**

In September 1999, *G.Remetey-Fülöpp* attended the ISPRS Council and TCPs joint meeting held in Enschede and Delft having also the opportunity to make site inspection at the RAI in Amsterdam, venue of the Congress.



*Weekend break in one of the ITC workshops*



*Participants of the ISPRS Joint Meeting visiting the superb facilities of ITC in Enschede, the Netherland.*

**The International Symposium on Spectral Sensing Research (ISSSR)** was second time organised by the US Army Topographic Engineering Center's GIS/Remote Sensing Center in co-operation with ISPRS Working Group VII/1 with personal active involvement of Chair *Karl Staenz*. TEC Director *Dr. William E. Roper* and ISPRS Commission VII President *G. Remetey-Fülöpp* opened the event, in the Tropicana Hotel of Las Vegas, on November 1, 1999. *Jan Clevers*, Secretary of WG VII/1 and liaison officer of the ISPRS Congress to the Commission VII as well as *Prof. James Taranik* Co-chair of WG VII/7 took part on the event having the motto "Systems and sensors for the New Millennium". The Symposium was participated by 117 experts of 11 countries. The 27 exhibited posters included two last minute contributions from Europe highlighting applications in *operational countryside crop monitoring and yield estimation*, as well as *the waterlog monitoring* featuring integrated use of remote sensing and GIS. (both prepared by *Gábor Csornai et al* of FÖMI RSC).



USATEC Director *Dr. William E. Roper* at the Exhibition poster of FÖMI RSC  
Introducing the Waterlog monitoring in the Tisza River basin using Satellite Remote Sensing

#### **Workshop on Geographic Information Management**

Using the Space Imaging electronic press release, the first Ikonos digital, high resolution satellite imagery was introduced first time in Hungary for the wider professional community at the FIG Commission 3 International Workshop on Geographic Information Management in a lecture delivered on the knowledge transfer project called PANEL-GI in Budapest in October, 1999.

#### **Workshop on Data Policy**

Participated by invited experts from 10 countries, an EUROGI-European Commission Data Policy Workshop was held in Amersfoort, the Netherland on 15<sup>th</sup> November, 1999. National and Regional Perspectives were highlighted and discussed. *G. Remetey-Fülöpp* used the occasion to underline the emerging importance of "imaging". Attention was called on recent, related policy actions can be found in the most recent following references: ASPRS policy on Earth



Observation data acquisition and distribution policy with special emphasis on the advancement in imaging and geospatial information related technology (Published in: Photogrammetric Engineering and Remote Sensing, November, 1999) and “Earth Observation Data Policy and Europe” (EOPOLE) Newsletter Issue 1-4, 1999 with information on data volume, ground infrastructures and distribution technologies, e-commerce, metadata, property rights, data policy etc.) More information: *Prof Ray Harris* of ISPRS Commission II (rharris@geog.ucl.ac.uk).

The Newsletter summarizes the output of the workshop held in the subject in Oberpfaffenhofen 7-9 July 1999. Also the CEOS WGISS 8 Pre-workshop on EO data policy /intellectual rights 11 May 1999 are described IACGEC - the Framework Principles on Data Policy agreed by the UK Inter Agency Committee on Global Environmental Change. The framework principles are introduced in the UNISPACE III Folder presented by University College London (same source as above).

The edited proceedings prepared by *Prof.Max Craglia* has been published by the Space Application Institute of DG JRC.

#### **5<sup>th</sup> Conference on the use of remote sensing in the control of agricultural area-based subsidies**

The operational use of remote sensing in the agriculture is more and more inevitable. The 5<sup>th</sup> Conference on the use of remote sensing in the control of agricultural area-based subsidies chaired by *Olivier Leo* of SAI JRC was held in Stresa in November 1999. The appearance of the new very high resolution satellites will open a new line for cost-benefit analysis and pilot applications.



#### **3<sup>rd</sup> GEIXS (ESPRIT) Workshop**

The Workshop held in Budapest in December 1999 was devoted to “The future of geo-referenced information exchange in Eastern Europe and the NIS area”. About 70 participants from more than 30 countries (mainly representatives of national Geological Surveys) were present incl. president of ISPRS Commission VII. Established by EuroGeoSurveys, GEIXS has set up a new, harmonised metadata architecture for European environmental and natural resource information. The follow-on actions (year 2000-2002) focus on environmental data such as natural hazards, pollution and contaminated land. GEIXS put the weight on public-access one-stop shop of interlinked information catalogues and indexes, which are accessible on-line and based on a pan-European GIS and a multilingual keyword index ([www.eurogeosurveys.org/en/geodata](http://www.eurogeosurveys.org/en/geodata)). The geoscience community now uses the momentum that the EU supports the topic: Remote Sensing of Environment. Main conclusion was the call for co-operation, standardisation and patience.

#### **Preparation for the ISPRS Congress**

The officers of Commission VII have evaluated more than 300 incoming proposals for the ISPRS Congress 2000. The well organised schemes and procedures applied by Congrex and the Internet worldwide communication enabled to fulfill the enormous task in due time.

#### **ISPRS Council Meeting**

Budapest, Hosted by the Hungarian Society of Surveying, Mapping and Remote Sensing  
Conference venue: FÖMI RSC, April 5-6 and 11, 2000





Ministry of Agriculture and Regional Development in Budapest, site of the one-day Seminar on advances in photogrammetry and remote sensing, a voluntary knowledge transfer provided by the ISPRS Council and TCP members to the Hungarian RS user and development community.

*Below right: Prof D.Fritsch on the Seminar.*

*Left: Joint meeting in work at the FÖMI RSC premises*



***ISPRS Seminar on Photogrammetry and Remote Sensing at the Millennium.***

Held in Budapest, on April 7, 2000. Council and Technical Commission Presidents delivered lectures for the audience, mainly representatives of the Hungarian remote sensing community.

*Visiting Eger, reception of the Deputy Mayor at the Town Hall*





*Dr. Rainer Muthmann (left), Chairman of the Land Use/Land Cover Working Group of the European Commission's EUROSTAT a major driver for technology development and harmonisation of national inventories and databases at the meeting held in Luxembourg May, 2000.*

#### ***Links with regional organisations***

Commission VII Secretary *Peter Winkler*, as member of the EARSeL Bureau, keeps daily contact with the European Association of Remote Sensing Laboratories. Commission VII President *Gabor Remetey-Fülöpp*, as member of the Executive Committee of EUROGI, ensures link with the European Umbrella Organisation of Geographical-Information, which plays leading role in the European GI policy making.



*Meeting of the Executive Committee of EUROGI at the DG Infso of the European Commission in Luxembourg*



## Working Group VII/1 - Fundamental Physics and Modelling

Chairman	Dr.Karl Staenz (since 1997), (Former: Dr.Gerald Guyot, INRA, FRANCE )
Co-Chair	Dr.Jan G.P.W.Clevers, AUW, The NETHERLANDS (since 1997) (Former: Dr.Thierry Phulpin, FRANCE)
Secretary:	Dr.Phil Teillet, CCRS,CANADA (since 1997)



Jan G.P.W.Clevers

### Terms of Reference

- Physical measurements and modelling related to remote sensing
- Studies of spectral measurements and calibration at different spatial scales
- Standardisation and harmonisation of experimental methods and procedures in remote sensing
- Remote sensing of minor constituents of the atmosphere
- Spectral, spatial and temporal radiation and polarisation properties of objects

### Accomplishments of ISPRS WG VII/1 1996-2000

- The 7<sup>th</sup> *International Symposium on Physical Measurements and Signatures in Remote Sensing* took place in Courchevel from 7 to 11 April 1997. It was organized by the French Space Agency (CNES) and the Joint Research Centre (JRC/SAI) of the European Commission under the auspice of ISPRS, with the support of NASA, CNRS, INRA, DLR, ESA and NERC. The Symposium was also sponsored by the following scientific societies: European Association of Remote Sensing Laboratories (EARSeL), Association Quebecoise de Télédétection (AQT), Canadian Remote Sensing Society (CRSS), The Remote Sensing Society (RSS) and the Société Française de Photogrammétrie et de Télédétection (SFPT).

This symposium was a continuation of the series of 6 symposia organised since 1981 by the Working Group VII/1. It focused on the following topics: analysis of the relationships between the specific properties of a target (plant canopies, soils, rocks, water bodies, snow, ice) and its spectral characteristics in different spectral domains (from ultraviolet to microwaves), and determination of the factors affecting the spectral response of an object (atmospheric effects), measuring techniques, development of interpretation models. The success of these symposia was reflected by the gradual growth of the number of submitted papers, (more than 40 % of the papers were rejected for the last symposium held in Val d'Isère), while the number of participants increased from 220 to 316 (represented 24 countries). This Symposium has become during the past years one of the major international scientific meeting in the domain of the research in remote sensing and it provides a valuable overview of current research on earth resources and environmental monitoring. However, the increasing audience was seen as limiting one of the specific character of the first meetings, that was to facilitate exchanges and discussions among participants. Therefore, it has been decided to limit the number of participants to about 200, presumably, leading to a more severe selection of the submitted papers. About 220 abstracts have been received and selected by the International Scientific Committee. The number of participants was around 240. Publication: Abstracts of the 7<sup>th</sup> International Symposium on Physical Measurements and Signatures in Remote Sensing, 7-11 April 1997, Courchevel (France), G. Guyot Ed. CNES Toulouse (France), 434 pp. Chair *Karl Staenz* was personally participated the preparation of the *International Symposium on Spectral Sensing Research* held in San Diego. A special issue of the journal *Remote Sensing of Environment* with refereed papers arising from this symposium went to the press. Emphasis in the future will be on the development of hyperspectral remote sensing with spaceborne sensors under construction, such as US Navy's Naval Earth Map Observer (NEMO) and Orbimage's Warfighter, as well as sensor systems in a planning stage such as the Australian Resource Information and Environment Satellite (ARIES) and the German Smart SPECTRAL imaging spectrometer. The synergistic use of data from these sensors with other optical instruments and SAR is another WG priority. Other objectives include the validation and use of parameters derived from calibrated satellite sensor data in land process models as well as the utilization of the BRDF effect for the extraction of information as stipulated in ESA's Land-Surface Interactions Mission (LSPIM).

The major activity of WG VII/1 was the organization of *two sessions at the ISPRS VII mid-term symposium "ECO BP'98 - International Symposium on Resource and Environmental Monitoring"* held in Budapest, September 1998. The topics of the sessions were as follows:

- Towards improved geometry and radiometry of remotely sensed data;
- Experimental methods and procedures in remote sensing.

Nine papers were presented during the sessions. Highlights included surface reflectance retrieval incorporating linear polarization and georadiometric effects, stereo matching using neural networks, and signal-to-noise improvements involving multiple linear array CCDs. Additional topics covered the correction of airborne and satellite attitude platform fluctuation. A new hyperspectral airborne sensor system, APEX (Airborne PRISM Experiment), was presented. This system is currently under development by ESA for use with its spaceborne PRISM (Processes Research for Imaging Spectrometry Mission). Experimental results were presented on the retrieval of leaf area index (LAI) extracted from end-member fraction images with a new method.

Much of the research and development related to the WG topic has been reported in recent workshops and conferences. Progress in the fundamental development of imaging spectrometry (hyperspectral remote sensing) has been presented at NASA's 6th Annual Geoscience and Airborne Workshop (Pasadena, January 1998), the International SPIE Conference on Imaging Spectrometry III (San Diego, July 1998), and the 1st EARSeL Workshop on Imaging Spectroscopy (Zurich, October 1998).

The main event in 1999 for the WG VII/1 was the involvement in the organization of the *International Symposium on Spectral Sensing Research (ISSSR)* together with the US Army Topographic Engineering Center (TEC) held in Las Vegas in October. The theme of the symposium, was "Systems and Sensors for the New Millennium", emphasising the next generation of capability in data acquisition, analysis and product generation. This was the fifth symposium in a series of outstanding events covering both military and civilian research in the field of spectroscopy. Hyperspectral image simulation and the design of spectral libraries were featured at the symposium. There was also a mix of military and civilian applications, including minefield detection (including the detection of disturbed soils), military target detection, chemical and biological agent, and disaster mapping and monitoring. Special attention was paid to spectral mixture analysis (both linear and non-linear) and spectral matching techniques. Use is not only made of the reflective, optical part of the spectrum, but also of the thermal infrared and microwave parts.

ISPRS is now a CEOS affiliate. At the *14<sup>th</sup> meeting of the CEOS Working Group on Calibration and Validation (WGCV)*, Tokyo, July 1998, it was recommended that a special session on CEOS Cal/Val be proposed for the next ISPRS Congress in Amsterdam in 2000; the four most relevant ISPRS Working Groups, including WG VII/1, will be invited to help coordinate and participate in this session

The main WG VII/1 activity for 2000 will be involvement in the ISPRS Congress to be held in Amsterdam in July. Imaging spectrometry will continue to be of special interest to the WG. Apart from the ISPRS Congress, this topic will be featured at many conferences in 2000, most notably at NASA's 9<sup>th</sup> Annual AVIRIS Earth Sciences and Applications Workshop (Pasadena, February), the International SPIE Conference on Algorithms for Multispectral, Hyperspectral, and Ultraspectral Imagery VI (Orlando, April), and the International SPIE Conference on Imaging Spectrometry VI (San Diego, August).

Successful negotiations continued and concluded with CNES regarding the possibility of holding the 8<sup>th</sup> International Symposium on Physical Measurements and Signatures in Remote Sensing, which has traditionally been the main event of WG VII/1, in the beginning of 2001 in the French Alps. The ISPRS Commission VII Colloquium on "spectral signatures" organised by CNES will take place in Aussois, from January 8<sup>th</sup> to 12<sup>th</sup> and will be hosted in Paul Langevin centre.

### **WorkingGroup VII/2 - Application of Remote Sensing and GIS for Sustainable Development**

Chair: Dr.Dasika P.Rao, NRSA, INDIA (Since 1996)  
Co-Chair: Dr.Vernon Shingroy, CCRS, CANADA (Since 1996)

#### **Terms of Reference**

- Development of concepts for sustainability indicators
- Promotion of applications in environmental and natural resource management
- Monitoring and assessment of environmental hazards and disasters
- Monitoring environmental changes including socio-economic factors

#### **State of Science and Technology of WG VII/2 Topics**

The Rio Summit 1992 envisaged that Remote Sensing and GIS have a prominent role in promoting efforts for sustainable development. The agricultural production in the Third World countries is not able to meet the needs of the growing population in these countries. This is because of the advantages acquiring from science and technology are not fully exploited and that a holistic approach for development needs to be exercised. If the development of rural area has to sustain a growing economy and ensure ecological balances, an integrated approach is required to make optimal use of land and water resources. The satellite remote sensing applications for agriculture, soil, water and land management have ample scope to prepare an integrated plan for an action programme for achieving the sustainable development of renewable natural resources. The data from Indian Remote Sensing Satellite series including the latest state-of-art technology satellites IRS 1C/1D which have 5.8 m resolution camera, 23.5 m multispectral camera and 188 m Wide

field Camera with a re-visit period of 5 days have provided valuable information at operational scale in this Project. This approach needs to be further refined taking into account the need to identify indicators for sustainability. The approach to improve the environmental conditions, monitoring of such improvements through remote sensing and the impact of the implementation activities on the social fabric at the grass root level will have a far reaching effect on the utility and acceptability of Remote Sensing and GIS techniques.

### **Activities and accomplishments of WG VII/2**

*An International Workshop on Sustainable Rural Development using integrated GIS/Remote Sensing* was conducted at the National Remote Sensing Agency, Hyderabad from 17-21, September 1996, where participants from 13 developing countries participated sponsored by UN-ESCAP. The Workshop unanimously resolved that the holistic approach to rural development using Remote Sensing and GIS is in the right direction and that it should be pursued in all developing countries where it is relevant.

The *Indian Society of Remote Sensing* (ISRS), which is a member of ISPRS, during its annual convention on 4<sup>th</sup> December, 1996 at Puna, India has organised a *Special Session on ISPRS WG VII/2* activities with the following topics: Application of Remote sensing in Sustainable Rural Development, Recent Advances in Remote Sensing Technology Data Processing and GIS, Short course on "Environmental Modelling and GIS" which may address the activities requested in the Agenda 21 including: Strengthening the basis for sustainable development, Building up scientific capacity and capability, Improving the analytical and predictive tools required to better understand the environmental impacts of development and Expand predictive modelling of the Earth systems.

Preparation of the International Conference on Remote Sensing and GIS/GPS (ICORG-97) by Prof. Muralikrishna, March, 1997 at the Jawaharlal Nehru Technological University, Hyderabad, India. Focal themes: GIS/GPS for micro level planning, additional topics: GIS/GPS technology and applications, *Applied Remote Sensing for Land Resources*, *Applied Remote Sensing for Water Resources*, *Applied Remote Sensing for Marine Resources*, *Integrated Surveys for Sustainable Development*, Digital Image Processing, Issues of Standardisation of Data, Data Formats and Business Geographics.

An *International Workshop on Applications of Remote Sensing and GIS for Sustainable Development* was organised by WG Chairman D.Rao in November 24-25, 1997, Hyderabad, India, sponsored by the Indian Space Research Organisation, Department of Space, Government of India. The Workshop was attended by Commission I President G.Joseph (SAC, Ahmedabad) and Commission VII Secretary P.Winkler (FÖMI RSC, Budapest).

The Workshop was attended by 125 experts of 8 countries. Substantial outcomes of the Workshop were identified as follow:

- There is a need for more training and awareness programmes for users to effectively take advantage of the remote sensing and GIS techniques.
- Need to work towards activities aimed at making the Sustainable Development process more effective.
- Dissemination of remote sensing and GIS technology upto end-user level is a critical need. Presently, it is not adequate. Algorithms and procedures / methodologies developed should be made available more openly to all the users.
- Functional relationships between CO<sub>2</sub> concentrations, photosynthesis and productivity levels need to be understood more thoroughly i.e., the studies related to the effect of green house gases on total biomass production needs to be carried out.
- Under IMSD substantial work has been done by Department of Space, Govt. of India with the utilisation of Remote Sensing & GIS in Natural Resources Management and dissemination of this information to the end users. This can serve as an example for other developing countries working in these areas.
- Detailed scientific investigations in evolving procedures for estimating carrying capacity of the land need to be carried out.
- Involvement of private entrepreneurs should be encouraged.

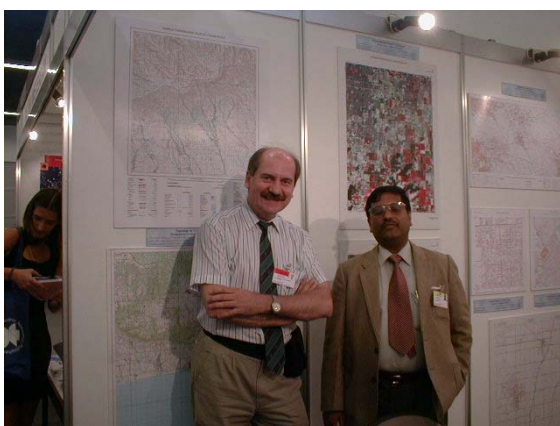
In the *ECO-BP 98 international symposium on Resource and Environmental Monitoring* held at Budapest, Hungary during 1-4 September, 1998, the Working Group-II made a substantial contribution. There were six sessions under Working Group-II during this period and 22 papers were presented covering various aspects of Sustainable Development, Environmental Hazards and Disasters including an Overview Paper on Remote Sensing & GIS for Sustainable Development by the Working Group Chairman for which he also received ISPRS Best Oral Presentation Award at the end of the session.

An *International Tutorial on Remote Sensing & GIS in Decision Making for Sustainable Rural Development* was conducted at Indian Institute of Remote Sensing (National Remote Sensing Agency), Dehradun, India during October 7-9, 1998. There was overwhelming response in attending the Tutorial by the experts from various developing countries including India. 17 number of scientists from various disciplines of scientific workers, academicians and scholars from 9 countries of Asia Pacific region viz. Bangladesh, Fiji, India, Indonesia, Myanmar, Nepal, Phillipines, Srilanka and Vietnam participated in the course programme. The tutorial course was suitably designed with 12 lectures and 5 demonstrations covering topics on technology, its progress and on application areas which have relevance to the needs of sustainable development. The course started with a Key Note Address on Space Technology and Sustainable Development by Dr.D.P.Rao, Chair, WG-VII/2. The Tutorial lectures were delivered by senior scientists of

Department of Space from various sub-units viz. Indian Space Research Organisation, Space Applications Centre, National Remote Sensing Agency, Regional Remote Sensing Service Centres, Advanced Data Processing Research Institute Indian Council of Agricultural Research. The Central Soil, Water Conservation and Research Institute as well as from Centre of Space Science Technology & Education for Asia-pacific Region affiliated to United Nations were also involved in delivering the lectures. The various topics covered are "Overview of Remote Sensing Technology", Profile of Indian Satellites catering to the Developmental needs", Satellite Data Products, Information Extraction Techniques, Application of Remote Sensing in Geoscientific studies, Land, Soil-Water, Vegetation Resources, Biodiversity and Environmental Aspects, as well as Socio-Economic Aspects. The demonstrations through computers, slides and LCD projector were used to cover the topics on satellite data products, digital image processing and analysis, ground water & mineral investigation and land hazard mapping. Hands on experience on use of software (Geosmart, GELAP, Decision Space etc.) and Watershed Development & Management were demonstrated. The course ended with distribution of certificates to course participants.

The major activity of WG VII/2 was the organization of a **Workshop on "Environmental Modelling using Remote Sensing and GIS for Sustainable Development"** at the Indian Institute of Remote Sensing (NRSA), Dehra Dun, India on March 11, 1999. The Workshop was organized as a part of post-International Conference on "Geoinformatics for Natural Resources Assessment, Monitoring and Management" titled "GEOINFORMATICS BEYOND 2000". While releasing the Abstract volume of the Workshop, Prof. Shunji Murai, 1<sup>st</sup> Vice President of ISPRS Council gave a brief account of the activities of ISPRS and Working Groups. He appreciated the work being done under ISPRS in India. There were 69 participants in the Workshop from different countries including The Netherlands, Sri Lanka, Belgium, USA, Nepal and Thailand apart from the host country, India. The Chair WG VII/2, Dr.D.P.Rao presented an overview of the applications of space technology for sustainable development including the next millenium's high resolution sensors like IRS-P5, Quickbird and IRS-P6. Other invited papers were presented by the senior scientists of various centres of the Dept. of Space, namely, Indian Space Research Organisation (ISRO), National Remote Sensing Agency (NRSA), Regional Remote Sensing Service Centres (RRSSCs), Indian Institute of Remote Sensing (IIRS), Space Applications Centre (SAC) and Advanced Date Processing Research Institute (ADRIN), and Indian Institute of Science. Workshop topics covered: Ecological analysis and modelling: Issues and challenges, present and alternate land use based on natural resource; National soil and land degradation mapping: Remote sensing perspective; Geoinformatics for forest ecosystem management: Remote sensing and GIS for modelling; Land degradation due to mining: Concepts and case studies; Remote sensing and GIS for agricultural crop acreage and yield estimation; Integrated watershed developmental planning using remote sensing and GIS; Ground water modelling for sustainable development using GIS techniques and hydrogeomorphic criteria in ground water modelling. The proceedings of the Workshop has been published as ISPRS Archive Vol. XXXII Part 7-W9.

Dr.D.P.Rao attended the **UNISPACE-III** at Vienna in September, 1999 and presented a paper on "**Sustainable Development and Remote Sensing**" in ISPRS Workshop on Resource Mapping from Space. He also discussed the future activities of the Working Group VII/2 with the Council President Prof.L.W.Fritz, Secretary General Prof. John C. Trinder and Commission President Gabor Remetey.



*Indian High-tech Enterprise exhibits at the UNISPACE III*

Commission VII has invited Dr.D.P.Rao to deliver a lecture in the "Flagship" session of the Commission VII on "**Role of Remote Sensing and Geographical Information System in Sustainable Development**" in the ISPRS Congress "Geoinformation for All". In addition to the above, the topics of Technical Session in ISPRS Congress 2000 in Amsterdam include "Remote Sensing and GIS techniques for sustainable development" (in two parts) and "Mapping and monitoring natural and environmental hazards". A pre-congress workshop is also planned on the theme "Disaster Mitigation".

**Working Group VII/3 - Thematic applications of High Spatial Resolution Satellite Imagery**

Chair: Prof. Bruce Forster, UNSW, AUSTRALIA (Since August 1996)

Co-Chair: vacant (Former: Dr. Tina K. Cary, EOSAT, USA till 1997)

*Prof. Dr. Bruce Forster***Terms of Reference**

- Data integration for urban planning and management
- Applications for improved rural management, including precision farming
- Support of local environmental impact studies

**Accomplishments of the WG VII/3**

This is a new Working Group for Commission VII and so has no history of previous activities. It was considered that the proposed launch, from 1997 and onwards, of a number of commercially operated satellite systems carrying sensors with resolutions of less than 1 metre would have a major impact on the spatial information sciences and industries, and it was critical that a new working group address the thematic applications of this new data. This was highlighted at the Vienna Congress in a paper by Dr Lawrence Fritz, the now President of ISPRS. It was anticipated, the first of several commercially owned and operated, very high resolution, digital Earth observing satellite systems will be launched into polar orbit in January 1997. It was considered, such event would initiate a new era of commercial Earth observation satellites which may well revolutionize the infrastructure, processes and products of the entire photogrammetric/remote sensing/GIS community. It was proposed that "high resolution" should encompass all satellite imagery of 30 metre or less resolution, although greatest. Resolution is taken to be the picture element (pixel) size and not the IFOV (instantaneous field of view) nor the EIFOV (effective IFOV).

It was intended that the working group provide a series of scientific forums to demonstrate the applicability of the data in urban planning, precision farming, rural development and thematic mapping. It was considered that water, forestry and civil engineering applications are also consistent with the terms of reference. In the first part of the period seven companies; Earth Watch, Space Imaging, Orbital Sciences, GDE, Resource 21 and Israeli Aircraft Industries have imaging systems under development and are establishing international strategic partnerships for reception, value-added processing, distribution and sales. In addition there are the existing 5 metre resolution Indian IRS-1 system, now providing data in association with EOSAT, Landsat TM (30 metre), SPOT P and XS (10 and 20 metres), and a number of other government proposed high resolution satellite systems planned by China, France, Germany, India, Japan, Russia, South Africa and Spain. The highest resolution systems which was proposed were by Earth Watch and GDE at 0.8 metres.

The Chair and Co-Chair of the working group proposed to contact a number of interested scientists, users and satellite operators to join the working group, to provide advice on possible research programs, potential applications, and technical advice and launch information. This matter is now being actively progressed. It was also proposed to hold three international seminars in association with planned remote sensing conferences.

The major activity of the WG VII/3, was the organisation and conduct of a special session on high spatial resolution data at the Asian Remote Sensing Conference, held in Kuala Lumpur, Malaysia, October 1997. Approximately 280 delegates were in attendance at the conference and 192 abstracts were submitted for presentation. Papers were presented in parallel and poster sessions. Session topics included agriculture/soils, water resources, disaster monitoring,

education and training, forestry, mapping from space, land use, coastal zone, oceanography and meteorology, digital image processing, geology, GIS, and global environments. In addition three special sessions were conducted under the auspices of the International Society for Photogrammetry and Remote Sensing as part of the activities of ISPRS Working Groups (WG). The special session for WG3 had the following program and was attended by approximately 50 persons. The agenda of the Special Session "**High Spatial Resolution Image Data**", under the auspices of ISPRS WG VII/3 Chaired by Prof. Bruce Forster (WG VII/3 Chairman) at the 18<sup>th</sup> Asian Conference on Remote Sensing was as follows: "Current and Future High Spatial Resolution Satellites." (Prof. Shunji Murai), "Earth Observation Programme - Indian Scenario" Representative of the Indian Space Research Organisation. "Future SPOT High Resolution Satellite Systems." ( Mr Yves Bechacq, Spot Asia). "Comparative Analysis of the Resolution of Air Photo and Satellite Digital Images." (Prof. Bruce Forster) "Space Imaging Satellite Systems and their Applications." Speaker: Susan Sinclair, Managing Director, Worldwide Distribution, Space Imaging EOSAT. "Earthwatch Satellite Systems and their Applications." ( Representative of Earthwatch Incorporated John Douglas) "Potential Market for High Spatial Resolution Data in the Asian Region." (Prof. Bruce Forster). The Session closed with Open Forum.

On December 24, 1997 Earthwatch launched the first of their high spatial resolution systems. Unfortunately it was understood that contact has not been made with the satellite, and according to a late January announcement, it has been lost.

The advent of high spatial resolution remote sensing image data from space, means that the fields of feature extraction from digitised air photos as undertaken by photogrammetrists, and that of image classification as carried out by remote sensing specialists, must increasingly be seen as the one activity, extraction of information from images. Both groups can learn from one another, and the Budapest conference in September 1998 has assisted in this process.

The major activities of WG VII/3 during 1998 were the organisation and conduct of a special workshop on high spatial resolution in collaboration with the **Australasian Conference on Remote Sensing and Photogrammetry**, held in Sydney, Australia in July 1998, and support of **Commission VII's Mid-term Symposium, ECO BP'98** held in Budapest in September, 1998. Professor Forster chaired the three sessions allocated to WG 3, and a number of excellent papers were presented. More details of the conference can be found in the Commission VII's Inter Congress Symposium Report published by the ISPRS Highlights Vol. 3, No 4 p-13-17, December, 1998. The major aim of the workshop was to increase both the scientific and user communities awareness of the new data and of both the potential and problems associated with it. This was a follow on to a similar workshop held in Association with the Asian Remote Sensing Conference in Kuala Lumpur, Malaysia, in 1997.

The themes of these workshops were directly related to the aims of the working group. Both workshops covered similar topic areas with speakers and representatives from most of the potential system operators. The program and speakers for the Sydney workshop were as follows :

Introduction, Professor Bruce Forster, School of Geomatic Engineering, University of New South Wales, Australia, "Current and future high spatial resolution satellites." Speaker: Larry Fritz, President, ISPRS. "Comparative analysis of the resolution of air photo and satellite digital images." Speaker: Professor Bruce Forster "Future Spot high resolution satellite systems." Speakers: Carl McMaster, Spot Imaging Services, Sydney, and Rob Lee, Spot Image..

"Bridging photogrammetric feature extraction and remote sensing image classification" Speaker: Professor Bruce Forster, "Urban and regional applications of high resolution imagery" Speaker: Professor Bruce Forster, "Space imaging satellite systems and their applications." Speaker: Mark Judd, Managing Director, Geomatics Technology, Melbourne, Australia. "Earthwatch satellite systems and their applications." Speaker: Larry Fritz, on behalf of Earthwatch Incorporated "Orbimage satellite systems and their applications." Speaker: Timothy Puckorius, Representative of Orbimage. "Analysis of market for high resolution image data" Speaker: Professor Bruce Forster

The presentations were followed by an open forum. One of the major questions asked related to data cost. It was generally agreed that the cost would be about the same as for acquisition of aerial photography. In addition, in Malaysia, a representative of the Indian Space Program also spoke to the applications of their current and future systems. Approximately 30 people attended the workshop.

It was proposed to conduct a workshop on specific applications of high spatial resolution data in late 1999. Application areas to be addressed was considered to include -

- \* precision farming and high value crop monitoring
- \* civil and other engineering applications
- \* detailed urban planning and monitoring
- \* tourism planning and products
- \* large scale thematic and topographic mapping
- \* environmental impact assessment
- \* innovative incorporation into secondary school education and training in biology, geography, history & sciences

While a range of workshops were organised in 1998 as Working Group activities to provide prior-launch-information , with a view to conducting further application workshops in 1999 with real data, these did not eventuate due to lack of data resulting from unsuccessful system launches. However the year was not without success for high spatial resolution image data, as the following highlights illustrate.

September 1999 saw the launch of the first commercial, high resolution imaging satellite - IKONOS. Space Imaging started already selling and distributing imagery to customers, after system testing and calibration have been taken place.



The system has 0.82 m panchromatic resolution, and 3.28 m multispectral resolution in blue, green, red and near infrared spectral bands. It also allows for both in and cross-track stereoscopic viewing. The IKONOS sensor revisit time is 3 days, with turnaround of product delivery of the order of 2 weeks. It is expected, that the high spatial resolution image data will open up a range of new applications for remote sensing. However it should be remembered that the highest spatial resolution satellite imagery commercially available approximately equivalent to a 1:100 000 aerial photograph and so potential users will need to weight up the benefits based on considerations of other factors such as cost, radiometric resolution, availability ease of digital processing. It is hoped that these issues will be raised in the papers presented to the Congress in Amsterdam.

So far, two papers of importance to the WG were published in the ISPRS Highlights, and are recommended reading for application scientists and potential users of high resolution image data. These were in the June and September, 1999 issues:

HIGH RESOLUTION COMMERCIAL REMOTE SENSING SATELLITES AND SPATIAL INFORMATION SYSTEMS by Lawrence W. Fritz (Vol 4, No. 2, pp 19-30, June 1999).

HIGH RESOLUTION EARTH IMAGING FROM SPACE by John Neer (Vol 4, No. 2, pp 20-27, September 1999).

These highlights illustrate the future strength of the "high resolution industry", and it is hoped that some papers relating to data from IKONOS and other systems that may be launched before the Congress date of July 2000, will be presented at the Congress. However one can be assured that there will be plenty of papers on high resolution applications for the 2004 Congress.

### **WorkingGroup VII/4 - Computer Assisted Image Interpretation and Analysis**

Chair: Prof.Dr.Barbara Koch, University of Freiburg, GERMANY (Since August 1996)

Co-Chair: Dr.Alois Sieber, EC JRC, ITALY (Since August 1996)

### **Terms of Reference**

- Integration of remote sensing with geospatial data
- Multi-spectral, multi-resolution, and multi-sensor data for image interpretation
- Knowledge encapsulation for purposes of automatic image analysis
- Investigation of performance of advanced classification techniques

### **Objectives**

The main field of interest of the WG VII/4 is the development of data fusion and combination techniques for multisensoral data analysis and the development of algorithms to analyse spatial structure diversity. With the availability of low to very high spatial resolution satellite data with different spectral characteristics and the disposition of several radar satellites, the use of information from different data types for a certain application becomes more and more attractive. In order to extract the needed information data fusion and combination techniques will be of increasing importance. The issue will undoubtedly continue to challenge researcher in years to come. Along with the disposition of many very high spatial resolution satellites within the next decade the structure information in satellite data will become most important for many applications. Even so there are some texture algorithms already available the development in this direction is still a challenge, especially for the very high resolution data sets which will have a different statistical behaviour as data with 20m and 30m spatial resolution. The subject provides a wide range of activities to be undertaken in different application fields or interrelated techniques like digital photogrammetry.

The main objective of the working group is to co-ordinate the efforts of researcher and developers in the aforementioned fields and support the interaction between algorithm developer and the application side. This should be supported by exchanging ideas in form of working group meeting and circular letters. It is also planned to co-ordinate meetings between working groups of different organisation like EARSeL and IUFRO.

The discussion during the *WG VII/3 Workshop 'Sensor fusion and advanced classification algorithms'* was focused mainly on the sensor fusion topic. After the DLR presentation entitled "Overview of DLR-forest projects and future perspectives" delivered by Wolfgang Steinborn, the following topics were discussed:

#### *Sensor Fusion:*

"Operational issues of multisensor data fusion for visual image exploitation" Werner Schneider, University of Vienna, Austria, "Image information fusion in remote sensing: towards a framework and a consistent terminology" Roland Fritz, FeLis, University of Freiburg, Germany, "Practical Application of Multisensor Data Fusion for Forest Inventory Mapping" Mathias Schardt, Joanneum Research, Austria, "Combining Satellite data and auxiliary GIS data"

*Advanced Classification Algorithms and Procedures* "Evaluation of the kNN method for combining NFI sample plot data and satellite data" Matthias Dees, FeLis, University of Freiburg, Germany, "Integrating satellite and GIS data into a large scale sample based forest inventory - the classical sample based approach" Klaus Steinnocher, Department of Environmental Planning, Austria, "Feature based image fusion" Alois J. Sieber, JRC, Italy, "Needs for data fusion in the area of landmine survey and detection" Silvana Dellepiane, University of Genova, Italy and Gianni Vernazza,

University of Cagliari, Italy and "Model regularization in remote-sensing image analysis" Tobias W. Kellenberger, RSL, Switzerland.

The discussion showed that all participants agreed that sensor/data fusion will be one of the important topics within the next years. According to the amount of earth observation satellites already in orbit and to the future satellite program the topic to fuse the information of different satellites will gain increasing relevance. It was agreed that until now the remote sensing society is missing a standardization of definitions in the field of data fusion. For example

- what kind of data are included in the topic data fusion,
- outline of the benefits of sensor and data fusion techniques
- outline of examples for educational purpose

It was pointed out that there is still a gap between developer of fusion algorithms and users. In order to improve the contact

- there should be more joint meetings between developer of fusion algorithms and users.
- new algorithms of the developer community should be implemented in standard software and be available as public domain software.

Only if the algorithms provided to the large group of users it will be used and verified. The algorithms must be transparent to the users to estimate the reliability of the results. The developer are the algorithm developer, the scientific user are defined as the scientists working in the field of remote sensing application and the end-user is from the application side, which wants to use the information from remote sensing without being involved in remote sensing. The final proposal of the working group meeting was:

- There is a need for the working group to address the topic data fusion also in future

The approach for the working group to the topic should be a scientific user stand point, complementary to the algorithm developer groups

The ISPRS WG VII/4 has participated *the ECO BP'98 Symposium* from 1<sup>st</sup> – 4<sup>th</sup> of September in Budapest. WG VII/4 had two sessions, one under the topic advanced classification techniques and one under the topic automatic image analysis. Altogether 9 proposals were submitted. There was to recognize some emphasis on presentations dealing with neural network classifiers and spectral unmixing. During the meeting the first call of the planned Joint ISPRS and EARSeL workshop taking place from the 3<sup>rd</sup> to 4<sup>th</sup> of June 98 in Valladolid, in Spain was presented.

The working group was active in setting up the above mentioned joint workshop on "*Fusion of sensor data, knowledge sources and algorithms for extraction and classification of topographic objects*". The program and content was circled around by e-mail and mail. The workshop is a cooperation with WG III/5, WG IV/III.2 and the EARSeL SIG Group on 'Data Fusion' which is a continuation of the workshop on '*New classification algorithms and data fusion*' which took place in Freiburg in 1997. This was a joint meeting between WG VII/4 and the EARSeL SIG group 'Forestry and Land use Planning'. The Proceedings are available at the Dept. of Remote Sensing and Landscape Information Systems, University Freiburg.

The *EARSeL/ISPRS workshop on „Fusion Sensor Data, Knowledge Resources and Algorithms for Extraction and Classification of Topographic Objects“* took place from 3-4<sup>th</sup> of June in Valladolid, Spain. The workshop was organised from ISPR WG III/5 „Remote Sensing and Vision Theories for Automatic Scene Interpretation“, WG IV/3 „Integration of Image Analysis and GIS“ and WG VII/4 „Computer Assisted Image Interpretation and Analysis“ together with EARSeL SIG „Data Fusion“. The workshop was sponsored by the Space Application Institute of JRC and the University of Valladolid. The workshop lasted two day and there were seven different technical sessions. The objectives were:

- overview of image, data, information fusion and integration
- prerequisites for fusion/integration: image to image/map registration
- object and image classification
- fusion of sensor derived products
- fusion of variable spatial/spectral resolution images
- integration of image analysis and GIS
- applications

There were provided presentations within the topic of data fusion from algorithm developing to applications. There were 30 presentations of very high quality. The workshop closed with an intensive discussion on data and sensor fusion and highlighted needed future developments. There was an excellent social program where the participants from different European countries and the States had the opportunity to enjoy Spanish live style and food. The printed publication of the presentations will be available within the next time. The papers and the conclusions are already presented on [www.datafusion.cma.fr/sig](http://www.datafusion.cma.fr/sig).

The *IUFRO/ISPRS/EARSeL workshop on Remote Sensing and Forest Monitoring* was held from 1-3 June 1999, Rogow, Poland. The Conference was organised under auspices of the Polish Minister of Environmental Protection, Natural Resources and Forestry. The objectives were to:

- Review the state-of-the-art of remote sensing as a tool of forest monitoring and inventory
- Review the research and application problems of the use of remote sensing in forestry
- Review the present and future remote sensing systems in relation to forestry oriented applications

- Discuss the recommendations concerning future activity of IUFRO remote sensing society in relation to IUFRO-2000 Congress
- Produce conference proceedings summarising the use of remote sensing in forestry

A total of 130 people from 19 countries (America, Asia, Australia, Europe) participated the Conference, where ISPRS WG VII/4 Chair Prof. Koch delivered a keynote speech on the subject "The contribution of Remote Sensing for Afforestation and Forest Biodiversity Studies. Another relevant paper on applied photogrammetry and remote sensing was delivered by *P.Adler* and *B.Koch* discussing the subject "Digital Photogrammetry for Forest Ecosystem Monitoring". The conference proceedings will be printed by Joint Research Centre in Ispra. Papers and conclusions are available at: <http://giswitch.sggw.waw.pl/rogow99>.

By personal guidance of WG Chair Prof.Koch the following fields of interest were investigated in 1999:

- Monitoring and Assessment of Resources in Europe-Forest (MARIE-F)
- Satellite based Environmental Monitoring of European Forests (SEMEFOR)
- Model for a monitoring system of the Alps (ALPMON)
- Thematic mapping using Smart SAR for regional or supraregional forest inventory (ZUFORST)
- 3D Landscape simulation for visual inspection of the environmental impact of high-voltage wires
- Development of a remote sensing aided area-based Agro-informationsystem (AGRO)
- Intensive observation of forest ecosystems
- Tree Resources Outside the Forest (TROF)
- Assessing forest stand attributes by integrated use of high-resolution satellite imagery and laserscanner (HIGH-SCAN)

The results of expert studies and projects have been and are to be utilised by supranational institutions (EU, FAO), space industry (Dornier), central government and utility companies.

#### **WorkingGroup VII.5 - Global Monitoring** In collaboration with WG IV/6 (Global Databases)

Chair: Dr.Ake Rosenqvist DG JRC SAI (Since 1998) (Former:Dr.Shintaro Goto, Kanazawa Institute of Technology, JAPAN)

Co-Chair: Dr.Mark Imhoff, NASA Goddard Space Flight Center, USA (Since August 1996)

Secretary: Dr.Shintaro Goto, Kanazawa Institute of Technology, JAPAN (Former: Dr.Ake Rosenqvist, NASDA, JAPAN)

*Dr.Marc Imhoff*



#### **Terms of Reference**

- Identification of the remote sensing data requirements for models to support global change studies.
- Seek affiliations with organisations and programs involved in global change studies such as the IGBP/HDP (International Geosphere Biosphere Program/Human Dimension Program) programs for: land use cover change (LUCC); biospheric aspects of the hydrological cycle (BAHC); global change and terrestrial ecosystems (GCTE); International global change atmospheric chemistry program (IGAC); global terrestrial observing system (GTOS); and global ocean observing system (GOOS).
- Modelling of global change processes from long term data and indicators

#### **Accomplishments of WG VII/5**

WG VII/5 Chairperson Dr.Goto attended *the PORSEC'96* in Victoria, Canada, from 12-17 August 1996 as well as the *International Geosphere-Biosphere Programme BAHC-LUCC Joint Inter-Core Projects Symposium* held in Kyoto, Japan

- Organizing *the session "Current, Waves and Nearshore Processes" in 4<sup>th</sup> International Conference on Remote Sensing for Marine and Coastal Environments*, Orlando, USA, 17-19 March 1997.
- Organizing the *"Research on RS and GIS for the Oil Spill Disaster"* after the Nakhodka oil spill accidents in JSPRS. And held two workshop, in Japan.
- Organizing an *International Workshop on "Remote Sensing and GIS in support of HDP (Human Dimensions Program)"*, IIASA, Laxenburg, Austria, in 13 June 1997. (Attendance: 25 participants from 10 countries.)

The contents of the the workshop and the session were as follow:

- The examples of the use of RS and GIS assimilation to socio-economical model for global environmental change were showed.
- The sensors were classified from the view point of the application to the global monitoring, especially on the LUCC(Land Use Cover Change), and showed the direction of the use RS data for HDP.
- The use of nighttime DMSP satellite data was showed and it can detect the urbanization on agriculture.
- Land cover mapping and monitoring of the whole Asia and the present status of development Global Data Base were given.

The results can be summarized as follow: RS and GIS is effective to analyze the global environmental change. Because RS and GIS comes to be used more on HDP, the polygon or mesh used in GIS should get to know the human Factor (Driving force on LUCC. etc) more. For example, if the socio-economist want to know the driving force on LUC, he must deal with many spatio-temporal LUC (Land Use Cover) data. In such case, GIS is sure to become the efficient tool. In order to include the human factor in GIS, RS, GIS and HDP scientist must cooperate each other.

Recognizing the significance of the 1997 Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) and the 1998 Buenos Aires Amendment, and the importance of remote sensing technology in this context, the WG has modified its Terms of References:

*WG VII/5 - revised terms of reference*

The Kyoto Protocol stipulates quantified and legally binding national commitments on greenhouse gas emissions. A principal aim of WG VII/5 is to assess the potential and limitations of global scale remote sensing in the context of the Protocol, with particular emphasis on inventories and change monitoring of global carbon stocks. Acknowledging the importance of microwave sensors and their inherent sensitivity to above ground biomass, the potential of Synthetic Aperture Radar for global scale biomass inventories should be investigated (joint activity with WG VII/6 Radar Applications)

WG VII/5 also aims to identify remote sensing sensor and data requirements to support retrieval of other parameters relevant to global change, by strengthening collaboration with organizations and programs involved in global change research. The significance of human activities and monitoring of such - in the global change context - will also be accounted for.

The availability of global scale data and the handling of global databases will be addressed as a joint activity with WG IV/6 (Global databases supporting environmental monitoring).

#### **Accomplishments of ISPRS WG VII/5 during 1998**

The activities of the WG were during 1998 focused on the *Commission VII Mid-term Symposium* in Budapest, where 5 sessions were arranged under the leadership of former Chair Dr.Shintaro Goto. Sessions on "Global change and monitoring" and "Regional monitoring" high-lighted global change issues and monitoring of related parameters at global and regional scales. A session on "Studies on urbanization" focused on the use of remote sensing techniques for monitoring of human activities, while a session on "Forestry and agriculture" presented on-going global/regional scale programs and projects (LBA, GRFM/GBFM, L-Pathfinder, TREES and SIBERIA) where remote sensing data constitute important sources of information.

After a change in the chairmanship, the work of WG VII-5 for Global Monitoring was focused on the organization of *the workshop "Remote Sensing and the Kyoto Protocol"*

In collaboration with WG VII/6 (Radar Applications) and the University of Michigan (MI, USA), a 3-day workshop was held in Ann Arbor, Michigan, October 20-22 1999, hosted by the University of Michigan. The objective of the workshop, *"Remote Sensing and the Kyoto Protocol: A Review of Available and Future Technology for Monitoring Treaty Compliance"*, was to examine how the remote sensing community can contribute to the information requirements raised by the implementation of - and compliance with - the Kyoto Protocol. The meeting featured invited panel speakers addressing three principal themes; remote sensing implications of the Kyoto Protocol, the potential of contemporary remote sensing platforms, and direct mapping of biomass by low frequency radar systems.

The program - opened by *Fawwaz Ulaby*, Vice President for Research, University of Michigan - featured the following presentation topics and panel speakers:

*Theme 1: "Remote Sensing Implications of the Kyoto Protocol"*

Global Land Cover and Biomass Assessment by Remote Sensing - Implications of the Kyoto Protocol *Alan Belward* (European Commission)

The Kyoto Protocol Viewed from the US signatory *Dan Reifsnnyder* (US State Department)

Biomass and The Kyoto Protocol: A Canadian Perspective *David Goodenough* (Natural Resources Canada)  
 Ground Measurements, Remote Sensing and Biomass Estimation in the Australian Context. *Richard Lucas* (Univ. of New South Wales)

International Legal Implications of Trans-border Monitoring of Kyoto Protocol Treaty Compliance Using Remote Sensing, *Steven Mirmina* (Office of General Council, NASA HQ)

The Integrated Global Observation Strategy – IGOS *John Townshend* (Univ. of Maryland)

The role of Spaceborne Low Frequency SAR in Providing Forest Biomass for the CEOS GOF C Project. *Frank Ahern* (Canadian Centre Remote Sensing)

Theme 2: "The Potential of Contemporary Platforms"

The Use of Optical Remote Sensing Systems for Monitoring Land Use and Biomass *Bill Salas* (Univ. of New Hampshire)

Capabilities of today's SAR Systems for Biomass Monitoring. *Craig Dobson* (Univ. of Michigan)

Potential of the NASA Vegetation Canopy LIDAR for Mapping Biomass Panel speaker: *Robert Knox* (NASA GSFC)

Future Platforms and Science Partnerships Relevant to the Kyoto Protocol: A NASA Perspective *Diane E. Wickland* (Manager Terrestrial Ecology, NASA HQ)

Theme 3: "Direct Mapping of Biomass - Airborne Low Frequency Radar Systems"

Monitoring Biomass by Airborne Polarimetric Multi-Frequency SAR –AIRSAR *Tony Milne* (Univ. of New South Wales)

The Vertical Structure of Vegetated Surfaces from Interferometric and Polarimetric Data. *Robert Treuhaft* (NASA JPL)

Penetration of Very Dense Forest Biomass Using VHF Airborne SAR systems: CARABAS and BioSAR Panel speakers: *Lars Ulander* (Swedish Defence Research Establ.)

*Marc Imhoff* (NASA GSFC)

Theme 4: "Spaceborne Low Frequency Radar Systems"

Space-Borne VHF SAR for Biomass Assessment: Challenges and Prospects *S. Carson* (SAIC)

Opportunities and Challenges associated with spaceborne Low-Frequency SAR systems. *Anthony Freeman* (NASA JPL)

The Need for a Spaceborne LF SAR - User Pull or Technology Push? *Bob Harriss* (Texas A&M University)

A selection of the major findings can be summarised very briefly as follows:

- Out of the six greenhouse gases covered by the Kyoto Protocol, it is recognised that the information Earth Observation can provide focuses on CO<sub>2</sub> and CH<sub>4</sub>.
- EO contributions can be made to provide systematic observations and data archives in order to reduce uncertainties in the global terrestrial carbon budget; supporting national and international networks and observation programs - especially for above-ground biomass and trends and shifts in land cover; as well as help support national accounting of Afforestation, Reforestation and Deforestation (A.R.D.).
- The review of state-of-the-art EO technology in the context of the Kyoto Protocol revealed the capabilities - but also the limitations - of each of today's operational optical and microwave sensors.
- Although direct measurements of biomass is possible by contemporary spaceborne microwave platforms, the limitation to shorter wavelength radars (C- and L-band) restricts the sensitivity to biomass levels of less than 100 tons/ha. The usefulness of orbital lower frequency microwave sensors (P-band, VHF) was acknowledged, however more research in this field was recommended. A detailed workshop report is available on the Internet at <http://www.hegyi.com/isprsc7/wgroup5.html>.

Relevant to the WG activities is the **4th Global Rain Forest Mapping (GRFM) Science Meeting** that was organised by the Institute for Space Research of Brazil (INPE) and the National Space Development Agency of Japan (NASDA) in São Jose dos Campos (Brazil) November 8-12 1999. The meeting demonstrated the usefulness of medium resolution (100 m) semi-continental scale (JERS-1) SAR mosaics for regional scale thematic analysis. It also showed how SAR data can constitute easy-to-use information also for users not usually accustomed to microwave data, if presented in a user-friendly way. More information about the meeting and GRFM mosaics (distributed free of charge for scientific use) is available at <http://www.eorc.nasda.go.jp/JERS-1/> and at <http://southport.jpl.nasa.gov/GRFM/>.

### **Working Group Program for 2000**

Maintaining the thematic focus, WG VII-5 will be organising two sessions related to the Kyoto Protocol at the ISPRS Congress in Amsterdam, between 16-23 July 2000. "*Global Remote Sensing and GIS in the service of the Kyoto protocol*" (jointly with ISPRS WG IV-6 (Global databases supporting environmental monitoring). It will provide an opportunity for a larger number of EO scientists to participate and discuss the importance of EO 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) will address particular issues related to a new generation of microwave systems for assessment of global terrestrial carbon stocks.

Recent publications and lectures of Chairperson Ake Rosenqvist are well representing the areas, where significant achievements are expected using remote sensing technology:

Rosenqvist A. Temporal and Spatial Characteristics of Irrigated Rice in JERS-1 L-band SAR Data. International Journal of Remote Sensing, 1999, Vol., 20, No. 8, pp. 1567-1587.

Rosenqvist A., Birkett C., Bartholomé E. and De Grandi G. Using Satellite Altimetry and Historical Gauge Data for Validation of the Hydrological significance of the JERS-1 SAR (GRFM) Mosaics in Central Africa. International Geoscience and Remote Sensing Symposium (IGARSS'99). Hamburg, Germany, 28 June - 2 July, 1999. Proceedings. IEEE Catalog No. 99CH36293C.

Rosenqvist A., Forsberg B.R., Pimentel T. and Richey J.E. GRFM Activities in the Jaú River Floodplain - Modeling of Methane Emissions and Flooding Dynamics. JERS-1 Science Program '99 - PI Reports, pp 118-122. National Space Development Agency of Japan, Earth Observation Research Center, March 1999.

### Working Group VII/6 - Radar Applications

Chair: Prof.Dr.Tony Milne UNSW,AUSTRALIA (Since August 1996)

Co-Chair: Dr.Jürg Lichtenegger, European Space Agency ESRIN, ITALY (Since August 1996)



*Prof.Dr.Tony Milne*

### Terms of Reference

To extend the use of multiwavelength and multipolarimetric radar data in investigations in earth surface characterisation and environmental analysis.

### Accomplishments of WG VII/6

In October/November 1996 a number of countries in the Asia-Pacific Region collaborated in the *NASA-Australia Asean Pacific Rim AIRSAR Radar Mission*. Data, both POLSAR and TOPSAR was collected from nine participating countries in the region.

The usefulness of radar in mapping land use land cover and in assessing environmental conditions depends on the optimisation of wavelength, polarisation and incidence angle combinations available within each of the sensor systems. Much of the research involving single band satellite data has been reported in recent conferences (Canadian Space Agency GER, Ottawa, May 1997, ERS-1 Florence Symposium April 1997) and is the result of the work of Principal Investigators associated with these particular assessment programs. The evaluation of multi-wavelength, multi-polarised radar imagery acquired from the SIR-C has also recently been published. Much of the work of this Working Group in Radar Applications has been involved with promoting radar technology and applications within the ASEAN region, thereby complementing the activities of ESA, (ERS 1/2), the Canadian Space Agency (GLOBESAR and RADARSAT) and NASDA CJERS-1 program, and has involved the Pacific Rim Deployment NASA airborne radar system (AIRSAR).

A *Science and Applications Workshop* was held in Pasadena, 24-28 March 1997, which brought together over 60 participants from the USA, Australia, New Zealand and several southeast asian countries. The focus of the workshop was the evaluation of AIRSAR data acquired during the Pacific Rim (PACRIM) Mission, October-December 1996 when some 126 sites throughout the Asia-Australia region were flown. The first two days of the meeting were taken up with the fundamentals of radar, AIRSAR standard data products, ordering procedures and data processing and analysis. The remainder of the workshop was concerned with reports on the objectives and planning for the various scientific applications of the data over the next two years.

A three day follow-up *PACRIM Applications Workshop* was held at the Malaysian Centre for Remote Sensing, Kuala Lumpur, 11-13 August 1997, in which delegates broke into six application groups namely, geology, vegetation, marine applications, interferometry and topography, regional analysis, and agriculture. These application groups were led by US and Australian investigators and sought to achieve an overview of the radar potential for the relative discipline area. Regional scientists also evaluated research objectives for individual projects and determined what was feasible from the

available data. Each group then outlined an optimal approach to data analysis, identified processing requirements, determined what field information was required and undertook hands on image processing to demonstrate various processing applications. Further *radar applications workshops* were held in Bangkok, Thailand 4-6 March 1998 and Manila, Philippines, 27-29 April 1998.

A *PACRIM Significant Results Workshop* was held in Sydney, Australia, 26-28 July 1998 in association with the *9th Australasian Remote Sensing and Photogrammetric Conference* ([www.geog.unsw.edu.au/arspc98](http://www.geog.unsw.edu.au/arspc98)).

Activities of the Working Group have been directed towards establishing effective networking between radar application scientists; conducting radar training workshops, particularly in the Asean-Pacific Region, and in providing input into developmental programs for the next generation of radar instruments and platforms.

Strong linkages have been established with the members of the *Global Rainforest Mapping Mission (GRFM)* sponsored by NASDA and using JERS-1 data; with *NASA and the Jet Propulsion Laboratory AIRSAR program* and with proposals related to *ESA's Earth Explorer Opportunity Mission*

*Five workshops have been held* in the Asian-Australian region in association with the NASA sponsored AIRSAR PACRIM Mission. These workshops were held in 1998 at, 4-6 March Bangkok, 27-29 April Manila, 26-27 July Sydney, 9-14 November Kuala Lumpur and 19-20 November Manila. Each workshop involved 'hands on' image processing and was designed to assist in sharing skills and techniques necessary to address research in seven application areas. These are forestry and vegetation, geology and tectonic processes, interferometry, disaster management, coastal analysis, agriculture, and urban and regional development.

PACRIM2, the proposed AIRSAR Mission to the Pacific Rim countries scheduled for March-May 2000, was launched at a special session of the Asian Remote Sensing Conference held in Manila, 16-20 November 1998.

Thirteen papers were presented by members of the Working Group at the *ISPRS Commission VII Symposium on Resource and Environmental Monitoring* held in Budapest, 1-4 September 1998. Major themes presented related to vegetation and biomass estimation procedures and thematic extraction from single and multi-band radar imagery.

Working Group VII/6 is organising a *tutorial on Recent Developments in Radar Science* and is participating with WG VII/2 in *Applications of Remote Sensing and GIS for Sustainable Development, Workshop on Disaster Monitoring*, in Amsterdam 2000. It is also co-sponsoring with WG VII/5 a *Workshop on Spaceborne Low Frequency Microwave Sensors for Global Biomass Estimation*. Technical Sessions at the main Congress will focus on radar applications in renewable resource monitoring.

This WG collaborated with WG VII/5 (Global Monitoring) and the University of Michigan in the conduct of a three-day workshop on *"Remote Sensing and the Kyoto Protocol: A Review of Available and Future Technology for Monitoring Treaty Compliance"* (see report WG VII-5) and participated in the *4<sup>th</sup> Global Rainforest Mapping GRFM Science Meeting* held in Brazil, November 8-12, 1999.

Members of this WG 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. 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.

The Working Group co-hosted a *Pacific-Rim Significant Results Workshop* in Maui, Hawaii from 24-26 August 1999 attended by 60 people. Papers and information on this meeting can be obtained from <http://Southport.jpl.nasa.gov/AIRSAR/>

#### **Working Group Program for 2000**

WG VII/6 will conduct a *Tutorial on 'Recent Developments in Radar Science and Applications'* given by Dr. Tony Freeman from the Radar Sciences Group at JPL. The WG will participate in an *Inter-Technical Commission, IC-22, on 'Global Remote Sensing and GIS in the Service of the Kyoto Protocol'*, in addition to organising two Technical Sessions. A *Workshop on Disaster Monitoring and Mitigation using remotely sensed data* is being co-hosted with WG VII/3.

**Working Group VII/7 - Non-Renewable Resources and Geotechnical Applications**

Chair: Dr.Tsehaie Woldai ITC, THE NETHERLANDS (Since August 1996)

Co-Chair: Dr.James V. Taranik Desert Research Institute, USA (Since August 1996)

*Dr.Tsehai Woldai***Terms of reference**

Application of remote sensing digital image processing and analysis techniques, to mineral and petroleum exploration, geotechnical and geological applications

High spectral resolution sensor data from aerial photography and satellite sensors for earth resources surveys, with special emphasis on mineral classification and geotechnical characterisation of rocks and soils

Multi data integration, including geophysical images.

**Accomplishments of ISPRS WG VII/7**

***A Scientific Workshop as joint action of the European Commission's European Scientific Research Network and ISPRS Working Group VII/7*** was held in the Netherlands on the 17 and 18<sup>th</sup> of February 1997.

Co-organized by J. L. van Genderen and T. Woldai, the sixth and final synergy of Remotely Sensed Data Network Workshop under the title of *Synergy of Remotely Sensed Data* took place at the Auditorium of the International Institute for Aerospace Survey and Earth Sciences (ITC), Enschede. The following scientific papers were presented under the chairmanship of Dr T. Woldai:

Forest Area Mapping Based on Optical and Radar Data (B. Koch/ T. Kremmers, Institute of Forestry, University of Freiburg. Presented by F. Horlacher)

Analysis of Wavelet-Compressed ERS-PRI Imagery of Tropical Guyana (B. Triebfuerst, C. Schneider, IPG, Freiburg/ R. Verhoeven, Wageningen Radar Surveys)

Synergy of Remotely Sensed Data - Network Contributions by the Department of Physical Geography of the University of Freiburg' (H. Gossmann, C. Schneider, H. Saurer)

Knowledge-Based Interpretation of Remotely Sensed Data' (K. Pazad, H.-J. Birkner, University of Hannover)

Compression of NOAA-AVHRR Data with a Wavelet Transform' (C. Schneider, B. Triebfuerst, IPG, University of Freiburg/ A. R. S. Marcal, R. A. Vaughan, University of Dundee)

Forestry Information from Microwave and Optical Remote Sensing'; 'The JRC Geophysical Processor (GPROC)' (T. Tares, JRC)

Synergy in Remote Sensing - What's in a Pixel?' (A. P. Cracknell, University of Dundee. Presented by C. Cassells, ITC)

Image Fusion Activities at the Western European Union' (D. Munro, WEU Satellite Centre)

Under the Chairmanship of Prof. J.L. van Genderen, ITC the following topics were highlighted:

Geometric Aspects of Multisensor Image Fusion for Topographic Map Updating in the Humid Tropics (C. Pohl, Western European Union Satellite Centre)

Laboratory Modelling of Underground Coal Fires (C. Cassells, ITC)

Quality Assessment of Interferometric Data (R. Gens, ITC)

Investigations on Synergy and Complimentarity of Multispectral and Anisotropy Information from MOMS-02/D2

Mode 3 Data for Land Use Classification in the Sinaloa District of Mexico (T. Schneider, Dept. of Land Use Planning, University of Munich)

Geometrics Aspects of Multisensor Image Fusion for Topographic Map Updating in the Humid Tropics (C. Pohl, Western European Union Satellite Centre)

Laboratory Modelling of underground Coal Fires (C. Casselles, ITC)

Besides, the network members spent considerable time in reviewing the past three years collaboration, proposing improvement for "Synergy II" and planning further bilateral and multilateral research cooperation between network members now that "Synergy I" research network has completed its tasks. This final workshop was co-hosted by the



International Society of Photogrammetry and Remote Sensing (ISPRS), Commission VII, Working Group VII on Non Renewable Resources and Geotechnical applications.

Working Group VII/7 has arranged *two sessions at the ECO BP'98 Symposium* in Budapest. The first session was devoted to the topics related to data integration and geotechnical application of remote sensing, the second one focused more on geological application of remote sensing. The presentations covered assessments in valley areas, underground water exploration, landslide monitoring, investigation of neotectonic and earthquakes activities, mineral exploitation etc.

Recommendations passed during the Workshops and meetings held by the ISPRS WG VII/2 and VII/7 clearly demand the importance of this topic "Environmental impact analysis of mining areas" to be considered in the ISPRS 2000 Congress. Both the developed and developing countries are affected by mining induced environmental problems. 130 million people by coal fire in China, 40 million by similar problem in India. The impact of mining in the environment affects countries in Russia, Germany, Spain, Hungary, Czech Republic, Slovakia, Philippines, USA, Canada and others.

A *special conference of the NATO Advanced Studies* was held in Hungary, 6-19 September, 1998 has managed to bring around 100 experts from 39 countries to discuss this topic under chairmanship of dr. Péter Kardeván. The participants unanimously agreed that the impact of mining on the environment is too big to be disregarded lightly and recommended all participants to work on this problem. Major research and collaboration programs were proposed on topics such as impact of mining, environmental impact modeling and site assessment, RS, GIS, data fusion and integration, modeling, hazard zonation (seismic hazards, landslide hazards, mountain hazards), risk assessments, sensitivity analysis – topics which can be used as keywords. Ecological assessment of reclamation activities, monitoring of long term development of these areas. Change in the socio-economical structure in an area, especially in open cast mining region. Additional subjects to be covered: toxic waste and their impact to health, groundwater pollution, soil degradation, environmental geoindicators and geoindices, air, water and soil pollution as a result of mining, mining induced urbanisation, illegal mining, assessment of lowering the groundwater – influences to the ecosystems in the surrounding, mineralogical classification of the tailings and spoiled sediments, assessments of the acid mine drainage, influences to the surface waters, hydrochemical analysis of the lakes etc.

The main topics in the preparation of the WG VII/7 for the ISPRS Congress will be related to Remotely sensed data and GIS applications in non-renewable resources management; Field data capture techniques, data fusion and modelling; Risk assessment; Geological hazard zoning and mapping (volcanic, seismic); Mountain hazards; RS and GIS in environmental geological applications; Synergy of remotely sensed data; Predictive modelling in geomorphology for environmental impact analysis; Geoenvironmental modelling; Integration of airborne and spaceborne RS data including hyperspectral data; Geophysical and geochemical assessment in mineral exploration; Development of software dedicated to resources management; The role of the satellite industry, software developers etc. versus the end user in the year 2000. Invited co-operating ISPRS WGs: VII/2, VII/3 and VII/6. Co-operating organisations/institutions planned: ITC – Geological Survey Division, MAFI and others.

Additionally, special emphasis will be given to the theme mining and its impact on the environment i.e. the applicability of remote sensing and GIS for sustainable development in environmentally sensitive mining areas. This theme includes: Modelling of mining impacts and site assessment, Field data capture and fusion techniques in environmental impact assessment, Mining induced environmental problems (seismic, Landslide, flood hazards, toxic wastes, tailings and spoiled sediments, soil degradation etc.), Risk assessments, sensitivity analysis, Toxic waste and their impact to health (Medical Geology), Ecological assessment of reclamation activities and monitoring of long term development in a mining areas. Groundwater, soil and air pollution

Mining induced urbanisation. Legal/Illegal mining and its influences to the ecosystem, Acid mine drainage and its influences to the surface waters.

Major activity of the WG VII/7 is planned for the *ISPRS 2000 Congress in Amsterdam* where WG VII/7 is involved in TC VII-8, TU11 and WS5. In view of these, little was done in organising Symposium/Workshop/seminars in Europe. Instead, the Chairman of the WG VII/7 (also in his capacity also as *Secretary General of the African Association of Remote Sensing of the Environment - AARSE*) fully participated in various meetings and organisations in line with the activities of the Working Group.

- March 1999 - a three days meeting of the organising and scientific Committee in Cape Town, South Africa. The purpose was to prepare ground for *the Cape Town 2000 Symposium of the 28<sup>th</sup> International Symposium on Remote Sensing of Environment and the 3<sup>rd</sup> African Association of Remote Sensing of the Environment (AARSE) on "Information for Sustainable Development"*. The Symposium covers several themes and is planned for March 27-31, 2000. So far more than 400 abstracts have been received. (For more information refer to: <http://www.isrse.co.za/>).
- Accra, 21-25 June 1999. *4<sup>th</sup> Africa GIS Conference and exhibition on "Emergent Africa-GEO-Information and Globalisation"* organised by the EIS Program, OACT, and AARSE in collaboration with the Ministry of Environment, Science & Technology and Ministry of Lands & Forestry. More than 140 participants attended the Conference.

- Enschede, 11-13 July, 1999. *Second EARSeL Workshop on Imaging Spectroscopy*, The Netherlands (<http://www.itc.nl/is2/>). Attended only.
- Vechta, Germany (October 28-29, 1999). *Two days Workshop on "Integrated Modeling by favourability functions"* held under the European Union GETS Project in Vechta, Germany. Woldai, attended the GETS meeting of Team Leaders. Woldai's involvement in this meeting as Chairman of CVII/WG7 has resulted in both financial and participatory support for the TU11 Workshop will be held in Amsterdam. The EU-GETS Project will totally finance (all speakers, students, and computers for the workshop, Workshop rooms at the Free University of Amsterdam, including the publication of the papers presented in a book form).
- Cotonou 06 - 09 December 1999. *Conference on "Promoting Space Technology Transfer and Geomatics Education in Africa"*, Cotonou, Benin. The Conference dealt with several themes and more than 120 participants coming from 20 African and other countries attended the conference. The Conference was organised by the ISPRS Commission VI, AARSE and CENATEL (Benin). (<http://xerxes.sph.umich.edu:2000/confs/benin/>). The Proceedings of the Conference is given in ISPRS, Volume XXXII, part 6W7, edited by Luigi Mussio.

In 1998 (11-15 May), a scientific *Symposium on Operational Remote Sensing for Sustainable Development* was held at the International Institute for Aerospace Survey & Earth Sciences (ITC), Enschede, in The Netherlands. It was organised by the European Association of Remote Sensing Laboratories (EARSeL), the Netherlands Society for Earth Observation and Geo-informatics (NSEOG) and co-sponsored by Rijkwaterstaat, Surveying Department, ESA/ESTEC and European Union. In this Symposium, the ISPRS Commission VII/7 together with the Geological Survey Division of the ITC organised a half day workshop on May 14, 1998 related to remote sensing and GIS for non-renewable resources and geotechnical applications. An outcome of the papers delivered during this Symposium is now published in the *International Journal of Applied Earth Observation and Geoinformation, Vol. 1, issue, pp.2-78, ITC, The Netherlands* (Special Editors: van der Meer, F., Molenaar, M., Niewenhuis, G., Woldai, T.).

#### **Working Group Program for 2000**

Active participation of the 28<sup>th</sup> International Symposium on Remote Sensing of Environment and the 3<sup>rd</sup> African Association of Remote Sensing of the Environment (AARSE) on "*Information for Sustainable Development*". Cape Town, March 27-31, 2000. (For more information refer to: <http://www.isrse.co.za/>).

WG VII/7 is involved in TC VII-8, TU11 and WS5 of the ISPRS Congress in Amsterdam.



Two of the Commission Staff members  
with ISPRS President Larry Fritz  
(Photo taken in the Bartók Room of the Hungarian Academy of Sciences in 1998)

*Thank you for all of the contributors for the excellent 4-year teamwork!*