- Recommend best practices for integrating attitude and position information with data processing algorithms

WG I/4 Advanced Sensor Systems
Chair: Masanobu Shimada (Japan)
Co-Chair: Janio Kono (Brazil)

WG I/4 Terms of Reference
- Small satellites for Earth observation—complexity, reliability, and comparative costs
- Platform guidance, navigation and positioning, integration of GPS, and orientation systems
- Performance of high resolution and hyperspectral imaging systems for Earth system science
- Monitor and report developments of new sensors such as smart sensors, polarisation sensors, pollution monitors, laser altimeters, and precipitation radar

WG I/5 Platform and Sensor Integration
Chair: Karsten Jacobsen (Germany)
Co-Chair: Ismael Colomina (Spain)

WG I/5 Terms of Reference
- Define best practices for recording and presenting sensor data together with auxiliary platform data—GPS, INS, orbital definition
- Liaise with Commission III
- Capability of high resolution earth observation systems
- Relation and long-time stability of attitude and position information to sensor orientation

WG I/6 Airborne Optical Sensor Systems
Chair: Brian Huberty (USA)
Co-Chair: Brian Gorin (USA)

WG I/6 Terms of Reference
- Assess data quality for advanced aerial digital camera and video systems
- Integrate airborne digital camera and video systems into user applications
- Install, test, and calibrate airborne digital camera and video systems on aerial platforms
- Develop guidelines for designing aerial missions for small format and video data acquisitions

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ISPRS TECHNICAL COMMISSION II
SYSTEMS FOR SPATIAL DATA PROCESSING, ANALYSIS AND REPRESENTATION

Outgoing President
Ian Dowman (UK)

Incoming President
Chen Jun (China)

Outgoing Secretary
Ray Harris (UK)

Incoming Secretary
Jie Jiang (China)

Report of Outgoing President
Commission II is mainly concerned with systems. These are relevant to a large number of areas as the work of the working groups demonstrates.

In the area of real time mapping technologies (WG II/1) SAR, LIDAR and hyper-spectral sensors are becoming more widely used in applications, complementing GPS, INS and CCD cameras, where not only real-time but also all-weather and high accuracy is essential. Research in multisensor and multi platform based sensor integration and data processing will be an important topic in the next few years. Its applications can be found in emergency management, environmental monitoring, and others. Great efforts have been made in high-accurate real-time navigation data using radio-link based local DGPS correction techniques for a broad range of applications. It will greatly improve the real-time positional accuracy of sensor orientation. Intelligent processing of mobile mapping data remains a research topic. Multiple image based matching has found its application in mobile mapping processing. Bayesian networks have been actively researched and promise great potential for feature extraction. The application of invariance theory for sensor orientation and georeferencing in cases of weak navigation data has attracted attention. Object recognition and feature extraction will benefit from the availability of high quality orientation parameters and image sequential information.

Software and modelling aspects for integrated GIS (WG II/2) has concentrated on three dimensional data in GIS, particularly data acquisition, on one side, and the management and modelling of 3-D data on the other. New concepts for integrating the data components to create detailed large scale realistic 3-D models have been developed. Methods combine the generation of 2D building information with a data structure and with topological models to manage them in context with a digital surface model. Generally performance still seems to be a problem but further technical developments in the field of digital acquisition techniques will have 3-D GIS applications combined with acquisition techniques as one of the main future topics in the field. There is an interest in using fuzzy techniques, algorithms and applications and there is work on integration of fuzzy rules and neural networks in GIS modelling for land use classification with different layers and parameters. Visualisation standards and also spatial analysis through the Internet advance at high speed. These are topics that will be of considerable interest in the future.

Rapid development in web based services using the Internet

is continuing in WG II/3 (Spatial data handling technologies) and distributed search and retrieval for distribution is a major issue. Many new tools, mostly based on Java are being developed. New fully commercial end to end providers are entering the Earth observation market, providing very high resolution data at high processing levels via the Internet. They will meet the increasing demands of faster satellite data distribution. The lack of globally accepted standards and non-existing co-ordination in elated fields leads to different metadata standards, protocols and incompatible services being developed and this continues to be a problem.

The key trend in systems for processing SAR data (WG II/4) is in the use of data sets with increasing dimensionality. This trend began with the use of multi-temporal interferometric data sets from satellites ERS and RADARSAT. A further increase in dimensionality now exists through increasing research interests involving the use of multitemporal multi-polarimetric data, derived from experimental platforms such as the E-SAR airborne system operated by DLR. This trend will enable data from future satellites such as ALOS and RADARSAT 2 to be fully exploited.

Techniques supporting this high dimensionality are multitemporal speckle reduction processes, coherence measurement and polarimetric signature techniques. An important example of speckle reduction is an annealing technique that produces an image segmentation with common region boundaries, as far as is possible. Coherence is a feature that measures the similarity of two complex SAR images. It is now fundamental to many applications although these are constrained by the satellite repeat cycles available. Recently coherence techniques have been extended for use with fully polarimetric radar data, spectacular results have been achieved that isolate returns from particular scattering mechanisms. It is likely that these multi-polarimetric techniques will produce an explosion of new applications in the next few years, in the same way that interferometric data has over the past decade.

In the area of Integration of image understanding into cartographic systems (WG II/6) work continues on the design and implementation of automated and semi-automated cartographic feature extraction (CFE) systems. These systems have reached a level of competence where rigorous performance evaluation is required to truly understand their characteristics. A main thrust of this Working Group has been the definition and dissemination of meaningful evaluation standards for CFE systems. Equipment manufacturers and data producers are looking seriously at automated systems, in terms of in-house development and for licensing technology. While current applications of CFE automation are fairly limited, the demand for such technology is high. We expect to see more examples of automated applications in production systems within the next four years.

WG II/7 has been concerned solely with practical and implementation issues in digital standard data transfer formats, especially image data transfer formats. From 1999 through 2000 the WG has collaborated with the OpenGIS Consortium (OGC), and the International Standardisation Organisation (ISO) mainly through Prof. Wolfgang Kresse. These activities can be summarised as follows:

- The proposal by ISPRS WG II/7 will form the two important components for the ISO/TC211 standard that has been under development since the first meeting of the Project Team (project 19124) in March 1999. The ISO/TC211 standard will be completed by the end of 2001. It is worth mentioning that this is thanks to the tireless activity of Prof. Wolfgang Kresse, who is an active member of ISO/TC211.

- The WG has established links with the proponents of the standard Co-ordinate Transformation Interface to the OGC.

WG II/7 has worked successfully to gain credibility and recognition in ISO and OGC and has succeeded in having ISPRS viewpoints accepted by both organisations. By participating in the development of these standards, we can be confident that the ISPRS ideas will be included and that the industry will adopt them as soon as they become public.

A large number of Digital Photogrammetric Systems (DPS) (Digital systems for image analysis WG II/8) including input and output devices with different degrees of functionality, user friendliness, and automation potential are now commercially available. Vendors of DPS include traditional photogrammetric, but increasingly also remote sensing and GIS companies. The traditional photogrammetric companies are concentrating their resources and merging meaning fewer systems will be available in future years. However a major trend can be observed towards using Windows NT as operating system.

Modules for automatic interior and relative orientation and for automatic aerial triangulation (AAT) are operational and are in daily use in practice. For AAT interactive editing is necessary, at least as a safeguard against distorted blocks. Automatic DTM generation has been accepted by the practice some time ago, but interactive verification and editing is here to stay, especially in difficult terrain, and at large scales. Digital orthoimages are being produced and are being integrated into geographic information systems (GIS). There is a need especially for large scale applications to use true orthoimages, i.e. to correct for effects from 3-D topographic objects.

Semi-automatic extraction of GIS and CAD (computer aided design) data is still mostly restricted to research and development. Implemented algorithms combine computer vision approaches with rigorous photogrammetric modelling. Some results indicate that future systems will be equipped with more powerful tools. The human-computer interface is increasingly being seen as an important factor.

Photogrammetric and remote sensing imagery play a significant role in spatial data base revision. As compared to map revision, there is much more attribute data to be acquired. The research arena is starting to develop integrated updating concepts including various data sources and automation. Relatively little attention is being paid to data compression and its effects for photogrammetric and remote sensing processing. It is estimated that this topic will receive more attention once digital cameras will become available.

Outlook by Incoming President

Under the presidency of Prof. Ian Dowman during the period of 1996-2000, Commission II continued to concentrate on systems based on the principles of digital photogrammetry and integration of data with GIS, with an emphasis on the integration of different types of data and handling of large volumes of data from satellite sensors and aircraft. The technological achievements, status, problems and consensus are reflected by the Commission II symposium in Cambridge), the Congress in Amsterdam and other workshops of Commission II. A working group structure is proposed for the period of 2000-2004 that is based on the terms of reference of Commission II and the resolution of Commission II at Amsterdam Congress.

It was recognised that systems for spatial data production from digital imageries are becoming more operational and easier to use. Modules of automatic interior and relative orientation as well as automatic aerial triangulation in Digital photogrammetric workstations (DPWs) are in daily use in practice. More image processing systems provide facilities for handling SAR. More advanced algorithms are being developed, particularly for DEM generation using interferometric and stereoscopic techniques. Mobile mapping concepts have been expanded from land-based platforms to airborne and even satellite platforms. Progresses have been made in GPS/INS integration, real time sensor orientation and intelligent processing of real-time mobile mapping data. In order to promote the development and exchanges in these fields, three working groups on spatial data production have been set up: one is a on real-time mapping technologies, the second one is on systems for SAR and Lidar processing, and the third one is on systems for automated geospatial data production and updating from imagery.

There has been increasing demands of the development of systems for spatial data custodian and delivery. Efforts have been devoted to the development of systems and tools for the integrated management of large-volume heterogeneous spatial data and for enabling users to access various EO and other spatial data at regional, national and global scales. The Working group on Information Systems and Services (WGISS) of the Committee on Earth Observation Satellites (CEOS) is one of such spatial data custodian organisations. Commercial systems have been developed by manufacturers for facilitating the spatial image-based product generation and archiving. Data integration and archiving, interoperability and distributed

search, on-line spatial data dissemination as well as pricing policy are among the key issues related to the development of such systems. It is the consensus that a uniform standard for image format or even data format in general should be developed by the join effort of users, manufacturers, data suppliers and researchers. Two working groups on spatial data custodian are established, one is the WG on integrated systems for information services and the other on image transfer standards.

While many organisations and companies are still concentrating on spatial database development and hardcopy maps, more and more attention is now paid to value-added products. The Amsterdam Congress recognised 'the need for efficient processing and presentation of such data in a value added form', and recommended 'the development and validation of end-to-end processing systems for specific applications, making use of a range of imaging systems, a range of components from the spatial information sciences and paying particular attention to techniques for the delivery and presentation of information'. Designing a spatial image-based decision support system for solving user's specific problems is one of tendencies now. The other direction is to develop spatial analysis systems for interpreting and mining the raw and historical data. Moreover, new visualisation platforms, interface devices and metaphors present more opportunities for scientists to explore and share complex remotely sensed datasets. Three working groups are proposed for enhancing the academic exchange and promoting the development in the field of value-added spatial data application, three working groups are proposed, one is the WG on the design and operation of spatial decision support systems, the second is on spatial analysis and visualisation systems.

Working groups of Technical Commission II for 2000-2004

WG II/1 Real-time Mapping Technologies
Chair: Rongxing (Ron) Li (USA)
Co-Chair: Norbert Haala (Germany)

WG II/1 Terms of Reference
- Design and development of integrated real time mobile data collection systems and autonomous vehicle navigation systems
- Real and near-real time processing of mobile mapping data
- Systems aspects related to sensor calibration, data reduction and optimisation and sensor information processing
- Automation of information extraction from mobile mapping sensor data
- Integration of navigation and mapping sensors

WG II/2 Systems for SAR and LIDAR Processing
Chair: Bryan Mercer (Canada)
Co-Chair: Charles Toth (USA)

WG II/2 Terms of Reference

- Evaluation and assessment of systems for processing SAR and LIDAR data
- Systems for generation and editing of DEMs from InSAR and LIDAR
- Multi-frequency SAR, multi polarised SAR, reflectance data from LIDAR, multi-pulse and array sensor systems for applications
- Systems for integration of SAR, LIDAR and optical systems
- Data quality, calibration and standards of SAR and LIDAR
- Liaison with other groups such as CEOS and OEEPE

WG II/3 Integrated Systems for Information Services

Chair: Poul Frederiksen (Denmark)
Co-Chair: Chongjun Yang (China)

WG II/3 Terms of Reference

- Systems for integrating existing geo-spatial data and new acquired spatial information as well as administrative data for spatial data custodians
- Assessment and development of database archiving and maintenance strategies
- Integrated services involving economic, technical and political aspects
- Development of geo-spatial information distribution and accessibility systems using internet (including cost and pay models)
- Development and validation of end-to-end spatial data access systems
- Liaison with CEOS WGISS and other relevant organisations

WG II/4 Image Data Standards

Chair: Wolfgang Kresse (Germany)
Co-Chair: Liping Di (USA)

WG II/4 Terms of Reference

- Analysis of the requirements for standardised image data exchange formats
- Characterisation and evaluation of universal sensor models
- Development of a metadata standards which includes all necessary sensor parameters within their technical and their application environment
- Collaborate with WGI/1, OGC and ISO/TC211 on imagery and related standards

WG II/5 Design and Operation of Spatial Decision Support Systems

Chair: Wolfgang Kainz (Netherlands)
Co-Chair: Qiming Zhou (Hong Kong)

WG II/5 Terms of Reference

- Development of concepts, implementation techniques and tools of image-based spatial decision support systems (SDSS)s
- Integration of different types of data (field and object) and systems in SDSS
- Integration of knowledge-based system and artificial intelligence with SDSS for problem solving and decision-making support
- Co-operation between users, producers and system designers for integrated SDSS

WG II/6 Spatial Analysis and Visualisation Systems

Chair: Zhilin LI (Hong Kong)
Co-Chair

WG II/6 Terms of Reference

- Web-based systems for mapping and value-added data analysis
- Mobile-based systems for visualisation and value-added analysis
- Systems for on-demand visualisation and value-added data analysis
- Image-based systems for visualisation and spatial analysis
- Integration of 3-D, temporal and dynamic aspects into spatial analysis and visualisation systems

WG IC II/IV Systems for Automated Geo-spatial Data Production and Updating from Imagery

Chair: Christian Heipke (Germany)
Co-Chair: Ammatzia Peled (Israel)

WG IC II/IV Terms of Reference

- Advancement of digital photogrammetric workstations
- Development of new functionality for digital airborne cameras and GPS/INS integration
- Evaluation and implementation of semi-automated systems for object capture and update
- Facilitate the integration and interfacing of photogrammetric, CAD, and GIS systems
- Transition of experimental systems for data acquisition and revision into operational and commercial solutions (co-operation between academia/ research and industry)
- GIS-driven change detection, spatial data capture and revision.
- Consistency estimation and quality control of spatial data.

Plans of Commission II

Commission II will be co-sponsoring the 3rd International Workshop on Dynamic and Multi-dimensional GIS, to be held in Bangkok in May 2001.

WG II/2 is planning a workshop in Banff from July 11th-13th, 2001 on 'Three Dimensional Mapping from LIDAR and InSAR'.