
ISPRS TECHNICAL COMMISSION IV SPATIAL INFORMATION SYSTEMS AND DIGITAL MAPPING

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Dieter Fritsch (Germany)

Incoming President

Costas Armenakis (Canada)

Outgoing Secretaries

Monika Sester (Germany)

Incoming SecretaryYuk-Cheung Lee, Scientific
(Canada)

Markus English

Francine Cusson, Administrative
(Canada)**Report of Outgoing President**

In the year 2000 we can review the position of the Commission in the light of the changes introduced after the Congress in Vienna. It was decided during the Vienna Congress that in future this commission should be a "homebase" for Geographical Information Systems, in particular dealing with fundamental theoretical developments, operational aspects and GIS applications. The review today clearly confirms that this move was very. Co-operation has started with the International Cartographers Association (ICA) and with the Spatial Data Handling Expert's Group of IGU - the incoming meeting of SDH in 2001 will be a Joint Meeting together with ISPRS Commission IV. It should be an objective of the future President to integrate SDH and TC IV.

It was also realised that the integration of image analysis and GIS is an important issue for data collection processes, in particular for GIS data revision. Up to now most of the image analysis strategies are data driven in a bottom up mode. Using existing GIS data this will strengthen the knowledge-driven approach, in top-down mode. It seems to be clear, that especially for GIS data revision processes the combination of top-down and bottom-up is the result for the future.

Technical Commission IV started to integrate indoor mapping capabilities offered by CAD and Facility Management Systems with 3D GIS. Therefore there is a need to interface Computer Aided Facility Management Systems with 3D city models to make our real world also virtually accessible. ISPRS can play an active part here. Preparations have been made to use high resolution satellite imagery producing these products, but unfortunately through the lack of data not that much experience could be gained. This hopefully will change in near future.

TC IV started also with models for spatial-temporal data management and analysis to consider time as an additional co-ordinate. It became clear that the work should be continued to study the behaviour of spatial objects according to its geometry, topology and semantics. TC IV brought out a book for the documentation of existing global databases, this book is a valuable source for all

those scientists and practitioners who are concerned with environmental monitoring.

Outlook by Incoming President

The ISPRS Commission IV on Spatial Information Systems and Digital Mapping covers a wide spectrum of scientific, technical and application fields. During 1996-2000, under the successful presidency of Prof. Dr. Dieter Fritsch of Germany, Commission IV has evolved to emphasise the need for investigating the spatial information systems and databases theory, modelling, development and applications. We intend to continue and expand these efforts by stimulating further activities towards the integration of remotely sensed imagery in spatial information systems.

The theme of the Commission will be 'New Solutions for Spatial Understanding'.

The temporal and dynamic aspects of geo-data, spatial databases, modelling and analysis will continue as active research areas. Interest in the fourth dimension facilitates the understanding of the evolution of spatial elements. Research will be oriented towards the determination and representation of interaction among space, time, attributes and procedures. The use of multi-source data in a synergetic approach will require reliable measures on the consistency and quality of data and will stimulate further work on the modelling and propagation of uncertainty in data.

The need for connectivity, data sharing, open models, and transparency to the user for effective geo-processing and accessing non-homogeneous databases, will require the scientific community to address problems of designing, modelling, organising and accessing distributed and heterogeneous databases over networks, including the Internet. Internet and web-based developments will go beyond just data accessing to address queries, analysis, processing and visualisation, including mobile and wireless environments. With respect to the acquisition of geo-data, the idea that "one collects and many use" will continue to spread with the establishment of local, national and regional data frameworks. Therefore, the design and implementation of geospatial data infrastructures in the form of large databases, distributed databases, and clearinghouses along with data catalogues, metadata and metadata tools will also be studied. The related issues of vertical and horizontal data integration for data aggregation, multi-scale representation and knowledge extraction and discovery will be dealt with in the work on data generalisation and data mining.

The populating of spatial databases from new airborne and spaceborne sensors will continue with the investigation of their potential in providing geometric and thematic data. The evolving role of digital imagery in modern geospatial databases, due to its high information content and high degree of understanding will be investigated. At the same time, we

anticipate a shift towards the maintenance of these databases through the use of enhanced updating approaches involving multi-resolution, multi-spectral and multi-temporal imagery. The work on automated change detection, feature extraction and feature classification from imagery for mapping purposes will continue. The existing spatial databases will play the role of 'prior' knowledge to provide cues and guidance in the (semi-) automated processes. Existing algorithmic and image segmentation techniques will be tested and transferred to operational environments.

To generate enhanced data sets and expand the use of image analysis and processing techniques, data fusion techniques employing multi-source actual sensors and complementary virtual sensor-like data will be investigated. The use of InSAR and LIDAR technologies for DEM generation will expand including their integration with optical video and frame sensors. To serve decision-making and societal needs, digital mapping operations will integrate both topographic and thematic aspects, with expansion to 3-D and even near real-time and 4D applications. The enhancement of extraterrestrial mapping will continue along with the space exploration activities. Landscape modelling and advanced visualisation and multimedia methods will further support the data exploration and understanding process. Reconstruction of reality in virtual reality environments from abstract and symbolic data representations, in conjunction with the cognitive pattern recognition process, will emulate certain functions of the human brain's synthetic process and will significantly improve the interpretation capabilities.

As environment and sustainable development will continue to be high in the international forums, contributions will be made also towards the advancement and dissemination of knowledge on global environmental databases and mapping. Together with this will be the advancement of techniques, such as monitoring of landscape changes, for sustainable development.

We plan to put emphasis on the synergy and collaborative operation of the working groups and the activities of Commission IV to integrate theories, concepts, technologies, data, products, and systems for the better understanding and management of the space and our environment. To complete our holistic approach we will seek inter-commission co-operation through joint working groups and initiatives, while at the same time we will actively pursue co-operation and contacts with other related organisations, such as SDH, ICA, FIG, OGC and ISO/TC211.

The proposed theme for the Commission is "New Solutions for Spatial Understanding". This is to underline the pursue of innovative approaches by the Commission at the threshold of the 21st century as we move from data, through information, to knowledge for the better understanding of and interaction with our space and environment.

The upcoming quadrennial period 2000-2004 is going to

be scientifically and technically challenging for Commission IV. The working groups of Commission IV will address the presented topics, trends, and developments as well as their impact on geo-information systems and digital mapping in accordance with the Terms of Reference and the resolutions approved at the ISPRS Amsterdam Congress.

Working Groups of Technical Commission IV for 2000-2004

WG IV/1 Spatial and Temporal Data Modelling and Analysis

Chair: Yvan Bédard (Canada)

Co-Chair: Wenzhong (John) Shi (Hong Kong)

WG IV/1 Terms of Reference

- Fundamentals of spatio-temporal spaces
- Spatio-temporal database design and development
- Spatio-temporal query and analysis
- Three-dimensional GIS modelling
- Multi-dimension and multi-scale models in GIS
- Spatial data quality and spatial model quality in the context of spatio-temporal GIS

WG IV/2 Federated Databases and Interoperability

Chair: Jianya Gong (China)

Co-Chair: Rolf A. de By (The Netherlands)

WG IV/2 Terms of Reference

- Conceptual aspects of inter-operable database environments
- Distributed spatial data models
- Connectivity, data sharing, open models and transparent geo-processing
- Link and integration of imagery, DEM, attribute and vector data from federated databases
- Generic access, search and retrieval methods for heterogeneous databases
- Concurrence control and data security for federated databases
- Spatial data standardisation (OGC, ISO/TC211)
- Inter-operation specifications for spatial data
- Internet GIS, based on heterogeneous databases
- Collaboration with Commission II (WG II/3, II/4)

WG IV/3 Data Generalisation and Data Mining

Chair: Monika Sester (China)

Co-Chair: Dianne Richardson (Canada)

WG IV/3 Terms of Reference

- Methods for the generalisation, aggregation and abstraction of image and vector data
- Data structures for the representation, processing and integration of multi-source and multi-scale data

- Concepts and techniques for hierarchical data analysis related to image and map object classification
- Methods and algorithms for the cartographic presentation of spatial objects with special focus on real-time, integrated approaches
- Enhancement of spatial data mining through inference using hierarchical classification and aggregation techniques, and synergy between image and map objects
- Co-operation with the ICA Commission on Map Generalisation

WG IV/4 Spatial Data Infrastructures

Chair: Parth Sarathi Roy (India)

Co-Chair: David Holland (UK)

WG IV/4 Terms of Reference

- Design and access of large spatial databases
- Development of comprehensive metadata, quality evaluation procedures and their standardisation
- Development of techniques for data integration in spatial information systems
- Logical and mathematical data modelling for mapping of spatial data infrastructures
- Development of basic framework concepts for the selection, aggregation and integration of fundamental data

WG IV/5 Image-based Geospatial Databases

Chair: Peggy Agouris (USA)

Co-Chair: Dimitris Papadias (Hong Kong)

WG IV/5 Terms of Reference

- Design aspects and characteristics of image-based geospatial databases
- Image queries and content-based geospatial information retrieval methods
- Geospatial knowledge management, synthesis, propagation, and communication in image databases
- Integration of digital images and GIS for spatial reasoning
- Imagery in digital libraries and web-based GIS environments
- Multimedia in integrated spatial information systems
- Co-operation with WG II/5

WG IV/6 Landscape Modeling and Visualisation

Chair: Marguerite Madden (USA)

Co-Chair: Jochen Schiewe (Germany)

WG IV/6 Terms of Reference

- Assessment of traditional and new remote sensing data for generating and visualising landscape models (e.g., orthoimages, DSMs, DEMs and 3-D city models)
- Integration of multi-source and multi-scale data in local and regional landscape modelling and visualisation applications
- Application and examination of dynamic and kinematic

- models for integrating multi-temporal landscape data sets and revising spatial databases
- Application and assessment of advanced visualisation, virtual reality and multimedia methods for 2-D, 3-D and 4-D mapping tasks in stand-alone or web-based environments
- Collaboration WG III/7

WG IV/7 Data Integration and Digital Mapping

Chair: Michael Hahn (Germany)

Co-Chair: Ryosuke Shibasaki (Japan)

WG IV/7 Terms of Reference

- Determination of the characteristics and issues related to data fusion at image, feature and information level in collaboration with WG III/6
- Integration of multi-type air- and space borne imagery as well as GIS and map data for the enhancement of spatial databases
- Techniques for high quality topographic, thematic and 3-D urban mapping requirements and applications using multi-source data
- Mapping from high resolution satellite imagery
- Quality estimation and evaluation of the fused spatial data
- Monitoring of object changes from multi-source and multi-temporal data
- Integration of 3-D spatial databases with simulation models for event representation

WG IV/8 Global Environmental Databases

Chair: Ryutaro Tateishi (Japan)

Co-Chair: David Hastings (USA)

WG IV/8 Terms of Reference

- Collection and dissemination of state-of-the-art information and knowledge on development of global environmental databases
- Evaluation, characterisation and assessment of global environmental databases
- Promotion of integrated global environmental databases
- Co-operation with related initiatives -Kyoto Protocol, Global Mapping, UN Cartographic Initiative addressing environmental global databases management
- Publication of the second volume of the book "Global Environmental Databases"
- Co-operation with WG VI/4 and VII/6

WG IV/9 Extraterrestrial Mapping

Chair: Randy L. Kirk (USA)

Co-Chair: Jan-Peter Muller (UK)

WG IV/9 Terms of Reference

- Status and technical definition of coordinate systems and geodetic control networks for mapping of planets and satellites
- Documentation of basic spacecraft data-sets for extrater-

- restrial mapping, current and planned extraterrestrial mapping activities, and planetary cartographic products
- Development and documentation of new techniques for data acquisition and extraterrestrial mapping
 - Development of GIS applications to support extraterrestrial exploration and science
 - Web-based delivery of extraterrestrial map products and GIS data

- Co-operation with related working groups from ICA, IAU, NASA and ESA

Plans of Commission IV

Working Group IV/6, Landscape Modelling and Visualisation is planning a workshop at The University of Georgia from October 29 – 31, 2001.

ISPRS TECHNICAL COMMISSION V CLOSE-RANGE TECHNIQUES AND MACHINE VISION

Outgoing President
Hirofumi Chikatsu (Japan)

Incoming President
Petros Patias (Greece)

Outgoing Secretaries
Eihan Shimizu (Japan)

Incoming Secretary
Alexandra Koussoulakou
(Greece)

Report of Outgoing President

The last four years (1996-2000) have witnessed rapid progress in close-range digital photogrammetry. Real-time imaging applications have developed and close range photogrammetry has become a more widely adopted measurement tool in fields such as industrial metrology, machine and robot vision, medical and sports science, archaeology, architecture and construction management. Over this period, Commission V has pursued the goal of becoming a focal point, within both the ISPRS and associated organisations, for the communication of ideas and research progress in interdisciplinary areas where close-range imaging is used for 3-D scene reconstruction and visualisation. These developments have culminated in the Congress where they have been presented and discussed.

Innovations in digital imaging and recording technology over the past four-years have spanned a wide scientific spectrum, which has offered a significant opportunity for Commission V to broaden its focus and become more interdisciplinary in its activities. In particular, recently developed laser scanning technology will contribute greatly to issues such as real-time 3-D data acquisition, modelling and scene reconstruction. However, there are still many research goals related to existing theories and technologies that need to be realised and work on these areas can be expected to continue. Such current topics include real-time image sequence analysis, automated sensor orientation and calibration, automated feature extraction and image matching, modelling, and integration of ground-based vision techniques with aerial/space imagery.

There were many interesting new developments and applications in on-line and off-line multi-image and multi-

sensor system configurations, laser scanning, three line scanner, virtual reality and computer animation. To further the aim of ensuring that Commission V remains closely associated with such new progress in close-range imaging,

Outlook by Incoming President

Traditionally Commission V was the focal point for close-range photogrammetric applications. Unlike other Commissions, Commission V followed a vertical approach developing theories, pursuing research and implementing it all to a wide scientific spectrum of close-range Photogrammetry applications and real-world problems, with close co-operation to the other ISPRS Commissions.

This approach attracted the interest of many researchers, coming from disciplines other than Photogrammetry, thus offering Commission V a significant opportunity to broaden its focus and become more interdisciplinary in its activities. Commission V can serve as a focal point within both ISPRS and associated organisations, for the communication of ideas and research progress in interdisciplinary areas where close-range imaging is used for 3-D scene reconstruction and visualisation.

Further pursuing this goal, we plan to enhance the interdisciplinary nature of Commission V, as close-range imaging applications, has become a more widely adopted measurement tool in fields such as industrial metrology, machine and robot vision, medical and sports science, archaeology, architecture and construction management.

Automation in Vision Metrology Systems and Industrial Applications remain a main issue and involves the further realisation of many research goals related to existing theories and technologies. These include the development of off-line and on-line systems and solutions for metrology and robot visions, and the evaluation of systems' performance in theoretical and practical aspects. Further, the use of new sensors call for new developments in data fusion, automated sensor orientation and calibration, and new algorithmic advances.
