INSTRUMENTATION FOR DATA REDUCTION AND ANALYSIS
REPORT ON THE ACTIVITIES OF ISPRS COMMISSION II, 1980 - 1984

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ORGANIZATION AND OBJECTIVES

The major part of the activities of Commission II is conducted through five Working Groups. All of these were reorganized or established by the beginning of 1981, according to the recommendations and resolutions of the Hamburg Congress. At the same time the terms of reference of each Working Group and the corresponding topics of studies were defined.

The areas of activities of the Working Groups are reflected in their names. Working Group II/1 on "Analytical and Hybrid Instruments" and Working Group II/2 on "Automatic Equipment and Systems" are concerned with photogrammetric instrumentation. The remaining three Working Groups are concerned with the instrumentation for processing and analysis of remotely sensed data. They are: Working Group II/3 on "Instruments for Analysis of Remotely Sensed Data"; Working Group II/4 on "Instruments for Preprocessing, Storage and Dissemination of Remotely Sensed Data"; and Working Group II/5 on "Equipment for Processing Synthetic Aperture Radar Data".

In addition to the five working groups an Instrument Manufacturer's Group was established in 1981. The membership of this group is composed of representatives of instrument manufacturing companies to Commission II. These members communicate directly with the Commission president and secretary.

The general objectives of Commission II are: the conduct of theoretical and feasibility studies in support of innovations and advancements in the design of instruments and systems for processing and analysis of data; the conduct of studies related to the analysis, testing and evaluation of existing instruments and systems; and the dissemination of information on studies and research activities performed by the members of Working Groups and other colaborators of Commission II.

In the area of theoretical formulations and feasibility studies the emphasis is on the new concepts and the new technologies for their implementation. Despite the fact that the processing and analysis of photogrammetric and remotely sensed data cannot be neatly separated into hardware, algorithms, software and other sub-entities, all the Working Groups have endeavored not to concentrate on specific algorithms except in cases where they affect directly the system design or require generic instrument development.

In the area of studies related to the analysis and testing of existing instrumentation the main concern was the development of standard procedures for testing of instruments and systems, and the establishment of criteria, guidelines and procedures for evaluation of prototypes and commercially available instruments. To this area of activities belong also the attempts to develop procedures for the determination of optimal configuration of hardware components and optimal organization of software for large data processing and analysis systems.

In the area of the Commission's activities concerned with the dissemination of information on the results of studies and research work it has been felt that the presentation of papers and reports at the inter-congress Symposia and at

the Congresses should not be the only form of information dissemination. Consequently some of the Commission II Working Groups have organized, already during the period 1976-1980, informal colloquia in conjunction with their business meetings. In the period 1980-1984 the organization of these colloquia and workshops has become a general practice with all Commission II Working Groups.

THE WORKING GROUPS

The Working Groups of Commission II are composed of members representing research and academic organizations, instrument manufacturers and production oriented agencies. The mode of operation of the Working Groups is influenced by the fact that an international group of this kind does not in principle represent a research team. Studies and research on particular topics are conducted normally by individual members or by small groups of two to three members. The activities of members usually reflect the activities of the organizations or agencies represented by them. In some cases for specific themes, sub-groups are formed by Working Group members representing several organizations cooperating on a specific project (e.g. the "ISPRS Correlation Test" of Working Group II/2).

The activities conducted by a Working Group are coordinated and the results of the research work reviewed during the Working Group meetings. The main purpose of these meetings is the exchange of information and the discussion of unsolved problems. Some of the Commission II Working Groups (e.g. W.G. II/1 and II/2) have established the practice of maintaining communication with their members during the periods between the Working Group meetings by Working Group newsletters.

Following is the general information on the Commission II Working Groups including a summary of their terms of reference and the major topics addressed by them in the period 1980 - 1984.

Working Group II/1 on "Analytical and Hybrid Instruments"

Chairman: L.W. Fritz, NOAA/National Ocean Survey, U.S.A.
Co-Chairman: G. Ducher, Institut Géographique National, France.
Secretary: M.L. McKenzie, U.S. Geological Survey (retired), U.S.A.

Working Group II/1 is concerned with the studies related to all computer-assisted, human controlled photogrammetric instruments such as analytical plotters, hybrid instruments, and ortho-photo printers.

This Working Group has also assumed the responsibility for the tasks of working groups on "A System for Evaluation of Analytical Plotters" and on "Global Accuracy Tests for Analytical Plotters" that were active during the period 1976 - 1980.

The tasks of Working Group II/1 are grouped into six areas of activities.

1. Analytical Instrument Developments. This group of tasks is related mainly to the studies of new system concepts and design principles and to the studies of the structural and functional characteristics of analytical instruments under construction.

2. Software Development for Analytical Instruments. The main tasks are concerned with the studies of basic real-time and application software and related algorithms, with the analysis of on-line analytical systems using

software simulation, and with the standardization of software and output formats.

3. Testing Procedures for Analytical Plotters. The major task related to this area of activity is the development of standardized test procedures.

4. Analytical Plotter Evaluation Guide. The tasks are related to the review of the effectiveness of the "Analytical Plotter Evaluation Guide" published by W.G. II/1 in 1980 and to its revision in respect to new developments in the design of analytical plotters and new testing procedures.

5. Hybrid Instrument Developments. The main tasks are related to the analysis of systems composed of computer-assisted analog instruments such as conventional analog plotters interfaced with digital computing devices.

6. Orthophoto and Stereo-Orthophoto Instrument Studies. The related tasks are concerned with the non-automated instruments for generation and exploitation of orthophotos and stereo-orthophotos.

Working group II/2 on "Automatic Equipment and Systems".

Chairman: B. Makarovic, International Institute for Aerial Survey and Earth Sciences (ITC), The Netherlands

Secretary: M. Tariel, International Institute for Aerial Survey and Earth Sciences (ITC), The Netherlands

After the Hamburg Congress this Working Group continued the activities of the working group on "Automated Instruments and Systems" that was active during the period 1976-1980 (Makarovic, 1982).

The tasks of Working Group II/2 are grouped into four major areas of activities.

1. Theoretical Studies. These comprise the studies related to the definition of concepts concerning automation, signal processing techniques (e.g. image matching, change detection, image understanding, digital image extraction, pattern recognition), control considerations such as control strategies, self-adaptive controls, feasibility studies of the new conceptual developments and the evaluation of automation.

2. Design. The tasks under this heading are related to the design principles and characteristics of the existing automatic systems, design and development of new systems, design of digital components (e.g. digital sampling devices and preprocessors, special processors for real-time operation), and the design of large integrated systems with automatic components.

3. Performance and Reliability. These tasks concern the performance criteria (e.g. for preprocessing input data and for automatic image matching) "correlation tests", the performance and reliability of automated equipment and systems in production, and cost analysis.

4. Impact of Automation. These studies are concerned mainly with the changes in organizational and human environments caused by automation of processes (e.g. planning and management techniques, professional background and skills), with compatibility of hardware, software and data, with maintenance facilities, and with the analysis of changing technology.

In connection and in support of studies on performance and reliability a subgroup of Working Group II/2 is conducting the "ISPRS Correlation Test". This international test was initiated in 1978. The first phase of the test whose goal was the evaluation of the methodology and the establishment of basic evaluation criteria was completed in 1982. Four organizations with five operating systems participated in the first phase. In 1982 the second phase of the test was initiated to consider the various parameters that affect the process of correlation of conjugate images and to expand the number of participating organizations. Reports on the "ISPRS Correlation Test" have been presented at the Hamburg Congress and the Ottawa Symposium (Lindig, 1980; Allam and Schliebener, 1982). A report on the present status of the test will be submitted at the Rio Congress.

Working Group II/3 on "Instruments for Analysis of Remotely Sensed Data".

Chairman: F.C. Billingsley, Jet Propulsion Laboratory, California Institute of Technology, U.S.A.

This is one of the two Working Groups (II/4 is the other) formed in 1981 to cover the activities of the working group on "Processing and Analysis of Remote Sensor Data" that was active in the period 1976 - 1980. Concurrently, with the splitting of the old group, the areas of interest were also divided. The emphasis of Working Group II/3 is on instruments for analysis of remotely sensed data (including systems, components, devices, configuration of hardware and software). Primary consideration of this group was on digital analysis because of the growing importance of this analysis method. However optical processing was also addressed (Billingsley, 1982).

Topics related to the activities of Working Group II/3 are organized under five main themes.

1. Systems. This topic encompases the studies of large systems characterized by large computers with multiple peripherals and networking capabilities; the studies of medium size systems characterized by minicomputers that are incorporated in a large number of the stand-alone systems provided by industry; the studies of micro systems characterized by lesser cost microprocessors of lower capabilities which due to their low cost make the special multiprocessor configuration practical; and the studies of optical and hybrid opto-electronic systems.

2. Media Conversion Devices. Analysis of remotely sensed data requires various other data types in conjunction with the imagery. This necessitates the conversion of data between various media. The tasks under this topic are concerned with the studies of input devices such as image scanners and devices for map conversion (e.g. raster scanners), and of output devices such as film recorders, dot and line printers.

3. Computer Graphics Applied to Image Processing. Since image analysis and display places considerable requirements on the graphics systems, computer graphics are deemed sufficiently important to be treated separately. This topic encompasses studies of display techniques and interactive techniques as well as the analysis of human factors influencing the efficiency of interfaces between the human and the machine.

4. Special Devices. The developments in the area of microcomputers and the area of very large scale integrated circuits (VSLI) may make the use of special devices more commonplace in image processing. The tasks under this topic are related to the studies of potentials for special purpose peripherals

including the conversion of analytical techniques to hardware form, and to the studies of networking and distributed systems for image processing which, with the advances in modern technology and reliability of high speed links, may become practical.

5. Interfaces. This group of tasks is concerned with the transfer of data and algorithms which may be facilitated by standardization. The subjects of specific interests are: data interchange (e.g. assessment of suitability of data formats) , standardization of user-system interfaces (e.g. interactive terminal protocols and user procedures, and terminal-to-system connections and software protocols), and the system-algorithm interface.

In the studies related to all five areas of activities of Working Group II/3 special attention is given to the present status of the developments and to the identification of significant trends for future developments.

Working Group II/4 on "Instruments for Preprocessing, Storage and Dissemination of Remotely Sensed Data".

Chairman: L. Marelli, ESA-ESRIN Earthnet Programme Office, Italy.
Co-Chairman: J.J. Quann, NASA-Goddard Space Flight Center, U.S.A.

As already mentioned this Working Group was formed in 1981 to cover the topics related to preprocessing, archiving and distribution of data that were a part of the activities of Working Group on "Instruments for Processing and Analysis of Remote Sensor Data" in the period 1976-1980.

The three main areas of activities defined by the terms of reference of Working Group II/4 are: the identification of requirements associated with the tasks of preprocessing, storage and dissemination of data; the assesment of available instrumentation and technological trends; and the identification of priority areas where the need for special research activities is expected. In general the activities are focussed on ground equipment but include as well on-board instrumentation for data handling.

The studies and research activities are organized under seven major topics.

1. Acquisition Recording Techniques and Instrumentation. The subjects of studies under this topic are concerned with the data formatting and annotation, on-board preprocessing of data, data storage, and data compression and decompression.

2. Preprocessing instrumentation. This topic encompasses the hardware related subjects of studies such as computer architecture, array processors, peripherals and film recorders; and the software related subjects of studies such as languages, standards and software maintenance.

3. Archiving and Retrieval. This topic includes a group of tasks concerned with the remote sensing archives design, available technology and storage media (e.g. magnetic disks and high density digital tapes).

4. Future technology. Subjects of studies comprised under this topic are: video disks, optical disks, and holographic systems.

5. Catalogs. The subjects of interest are: computer-based catalogs, catalogs on film and on microfiche.

6. Data Distribution. The main subjects of research under this topic are the near-real-time data distribution systems using high speed lines (landlines) and the near-real-time data distribution systems using high speed channels with Telecom satellites.

7. Standard Support for Remote Sensing Products to be Distributed to Users. Computer compatible tapes (1600 - 6250 bpi), high density digital tapes, floppy disks, cassettes, optical disks and video disks are considered and analyzed as potential media for dissemination of data.

Working Group II/5 on "Equipment for Processing Synthetic Aperture Radar Data".

Chairman: J.P. Guignard, European Space Agency- ESTEC, The Netherlands

Co-Chairman: R.K. Raney, Canada Centre for Remote Sensing - RADARSAT Project Office, Canada

The purpose of this Working Group is to asses the on-going developments and identify the required development of the instrumentation related to end-to-end SAR systems. The term end-to-end SAR systems implies the concern for all the aspects related to the sensor technology, that is, for data acquisition, data processing, data interpretation and data dissemination. However, the scope of the Working Group studies and research activities is limited to the impact of these on the requirements for instrumentation with the emphasis on SAR processing. In general the activities of this Working Group are focused on those topics which are SAR unique and therefore not covered by any other working group.

The subjects of interest are grouped in six main areas of activities.

1. On-board SAR Processing. in this area of activities the research work is related to analog preprocessing techniques (e.g. CCD and SAW techniques) to digital preprocessing techniques (e.g. on-board utilization of VLSI and possibly Ga As devices), and to signal conditioning.

2. Ground SAR Preprocessing. The major areas of concern under this topic are: the digital processing techniques and instruments (i.e. ground hardware for generation of SAR data in image form) including the associated software aspects (i.e. software architecture and software for numerical analysis running on parallel machines), and the optical processing techniques and equipment.

3. Algorithms of SAR Preprocessing (Impact on Instrumentation). To this area of activity belong the subjects related to matters of significant influence on the design of instrumentation. They are: algorithms and simulations, auxiliary data requirements and processing, image specification and image quality assessment.

4. Acquisition, Validation and Calibration. Under this topic the main subjects of interest are: the airborne and spaceborne systems, the data validation and calibration systems, and the compatibility of SAR sensor products with non SAR products.

5. Optimal Extraction of Information. The main subjects are: adaptive application oriented processing, SAR image simulation, properties of image spectra, and pattern recognition methods.

6. Baseline Information. This area of research is concerned with the gathering and analysis of information on current systems, on on-going and planned developments, and on user requirements.

WORKING GROUP MEETINGS

As indicated earlier in the report, most of the Commission II Working Group meetings in the period 1980 - 1984 have been organized as colloquia or workshops combined with business meetings.

Joint Working Group II/1 and II/2 Meeting and Colloquium was held at NOAA - National Ocean Survey in Rockville, Maryland, U.S.A., from 3rd to 5th of November 1981. The meeting was organized by L.W. Fritz, Chairman of W.G. II/1 and M.L. McKenzie, Secretary of W.G. II/1. The sponsor of the meeting was NOAA - National Ocean Survey.

Working Group II/3 Meeting was held at the EROS Data Center in Sioux Falls, South Dakota, U.S.A., on 16th of October 1981. This business meeting was organized by F.C. Billingsley, Chairman of W.G. II/3. The sponsor of the meeting was EROS Data Center.

Joint Working Group II/4 and II/5 Meeting and Workshop was held at European Space Agency, ESRIN, Earthnet Programme Office in Frascati, Italy, from 3rd to 5th of December, 1981. This meeting was organized by L. Marelli, Chairman of W.G. II/4 and J.P. Guignard, Chairman of W.G. II/5. The sponsor of the meeting was the ESA-ESRIN Earthnet Program Office.

Business Meetings of all five Working Groups were held during the Commission II Symposium in Ottawa, Canada (August 30 - September 3, 1982).

Joint Working Group II/1 and II/2 Meeting and Colloquium was held at the International Institute for Aerial Survey and Earth Sciences (ITC) in Enschede, The Netherlands, from 26th to 28th of October, 1983. The meeting was organized by B. Makarovic, Chairman of W.G. II/2 and M. Tariel, Secretary of W.G. II/2. The sponsor of the meeting was the International Institute for Aerial Survey and Earth Sciences (ITC).

Joint Working Group II/3, II/4 and II/5 Meeting and Workshop was held at the Nihon University in Tokyo, Japan, on 9th and 10th of November, 1983. The meeting was organized by L. Marelli, Chairman of W.G. II/4 and J.P. Guignard, Chairman of W.G. II/5. The Program Committee was chaired by K. Tsuchiya of Chiba University. The sponsor of the meeting was the Remote Sensing Society of Japan. In connection with this meeting the Remote Sensing Society of Japan organized the "2nd International Symposium on Remote Sensing" on 11th of November, 1983.

Detailed reports on these meetings will be presented by the chairmen of the respective Working Groups at the Rio Congress.

COMMISSION II SYMPOSIUM

The symposium of Commission II on "Advances in Instrumentation for Processing and Analysis of Photogrammetric and Remotely Sensed Data" was held in Ottawa, Canada, from August 30th to September 3rd, 1982. The Symposium was sponsored by: The Canadian Institute of Surveying, The National Research Council of Canada, The Department of Energy, Mines and Resources (Canada Centre for Remote Sensing, and Surveys and Mapping Branch) and the Canadian Remote Sensing Society.

The sponsors gave generous support to the Commission II in human resources and kind. A grant covering the full expenses for publication of proceedings and a grant for support of traveling funds for speakers were received from the National Research Council of Canada.

The Symposium was attended by 136 registered participants from 18 countries.

The technical program of the Symposium was organized in nineteen technical sessions. Two technical sessions were assigned to each of the five Working Groups. The W.G. II/4 had one and the W.G. II/5 had three additional concurrent technical sessions. Two technical sessions were devoted to panel discussions, one concerned with photogrammetry and the other with remote sensing. In addition to the technical sessions related to the activities of the Working Groups, three special technical sessions ("Manufacturers' Forum") were devoted to the presentation of papers by the representatives of the industry on the latest advances in commercial equipment and services.

The proceedings of the Symposium have been prepublished. They contain 58 papers (about 83% of the papers presented at the Symposium).

An exhibition related to the theme of the Symposium was held during the Symposium. There were 15 exhibitors.

CONCLUDING REMARKS

The activities of Commission II in the period 1980-1984 have been proceeding equally well in the scientific and research work, in the organization of a number of successful international meetings, and in the consolidation of the structure of the Commission. The organizational structure of the Working Groups and their terms of reference represent a sound foundation for a successful continuation of the Commission's activities.

However, to be able to meet the challenges of the next four years two significant modifications in the organization of the Commission would seem appropriate.

One of them concerns the clearly perceived need for closer cooperation between the photogrammetrists and the remote sensing specialists in Commission II. To create the proper facility for this cooperation a new "Interdisciplinary Working Group" (W.G. II/6) should be established. This Working Group would concentrate on matters of mutual interest to photogrammetry and remote sensing and play the role of a catalyst for exchange of information and ideas between the two disciplines.

The second required change is dictated by the need to cover the emerging area of possible vigorous developments in the near future related to the new instrumentation for photogrammetric digital image metrology and processing. To accommodate this need two alternative solutions are possible i.e. to form another new Working Group or to expand the terms of reference of the Working Group II/2 on "Automated Equipment and Systems". A possible new name for the reorganized W.G. II/2 could be: "Automated and Digital Photogrammetric Image Processing Instrumentation".

In view of the areas of activities of Commission II reflected in the terms of reference of its Working Groups and in view of the modern concepts in the design of the instrumentation, a modification of the Commission II name seems appropriate. The new name should be: "Instrumentation for Processing and Analysis of Data".

ACKNOWLEDGEMENTS

In conclusion of this report I would like to express my appreciation of the support given by the Secretary of Commission II, Dr. W.M. Strome of Canada Centre for Remote Sensing, in the organization of the Working Groups, in the planning and conduct of the Commission's activities, and in the preparation of the Commission II Symposium.

My sincere thanks go to the chairmen, co-chairmen, secretaries, and members of the Working Groups without whose invaluable initiative, cooperation and support the many and varied activities of Commission II in the period 1980-1984 would not have been possible.

In the name of the Commission, I would like to thank all those individuals and organizations that have generously contributed to the endeavors of Commission II. An expression of special gratitude goes to the hosts and sponsors of Working Group meetings, colloquia and workshops and to the sponsors of the Ottawa Symposium of Commission II.

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