

REPORT ON THE ACTIVITIES OF COMMISSION III 1980 - 1984

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Commission III

Area of the Commission III

The areas of the seven Commissions of the International Society for Photogrammetry and Remote Sensing were newly confirmed at the Hamburg Congress 1980. The area of the Commission III "Mathematical Analysis of Data" consists of the following subareas:

1. Mathematical modelling of photographic and other remote sensing systems.
2. Computation of object data from photographic and other remote sensor records.
3. Theory of adjustments of observations, and measures of precision and accuracy of results.
4. Theory of digital processing of sensor data for geometric, radiometric, and visual enhancement.

Resolutions for 1980 - 1984

In accordance with the above definition and the urgent need for research in the area, five resolutions were accepted at the Hamburg Congress for the activity of Commission III for the period 1980 - 1984:

Identification and Elimination of Gross and Systematic Errors

The Congress, noting that during the last four-year period a Working-Group on Analytical Correction of Image Errors has emphasized the compensation of systematic errors of image and model coordinates, further noting that many studies on reliability of photogrammetric triangulation have already been carried out,

realizing that quality of photogrammetric triangulation is decisively dependent on detection and elimination of gross and systematic errors,

recommends that a unified approach for the identification and elimination of gross and systematic errors be developed, possibly contacting the OEEPE to institute cooperation in this area.

Combined Adjustment

The Congress, noting that acquisition of non-photogrammetric data for aerotriangulation has become more versatile,

realizing that their use has a favourable effect on efficiency and accuracy in aerotriangulation,

recommends that adjustments combining photogrammetric and non-photogrammetric data should be further studied both theoretically and empirically.

On-Line Photogrammetric Triangulation

The Congress, realizing the recent expansion of on-line photogrammetric systems, which resulted in a variety of new analytical applications supported and controlled by minicomputers,

recognizing that the on-line capability to measure and immediately process data increases the speed and reliability of photogrammetric triangulation and may significantly improve the organization of routinely performed work, recommends that studies of on-line photogrammetric triangulation be continued.

Mathematical Aspects of Digital Terrain Information

The Congress, noting that Digital Terrain Models have been studied for a long time and a resolution for continuing those studies was made at the 13th Congress,

recognizing the importance of the results of such studies to practice, recommends that further studies, including comparative tests, be performed in such relevant areas as resampling and accuracy aspects.

Image Processing and Pattern Recognition

The Congress, noting that the widespread development and application of image processing and pattern recognition technology and the involvement of many scientific and engineering fields in this technology,

realizing its great potential for present and future photogrammetry and remote sensing,

recommends that mathematical and numerical aspects of the entire spectrum of image processing and pattern recognition as related to photogrammetry and remote sensing be studied, and that communication with organizations and societies with similar interests be pursued.

Organization of Commission III

The Commission III was assigned by the General Assembly of the Society at the Hamburg Congress to the Finnish Society of Photogrammetry for the period 1980 - 1984. The president and the secretary of the Commission and the chairmen of the Working Groups which were established on the basis of the above resolutions have comprised the Board of the Commission.

President: Dr. E. Kilpelä, Helsinki University of Technology, Otaniemi, FINLAND

Secretary: Mrs. Aino Savolainen, as above

Working Groups

WG 1: Identification and Elimination of Gross and Systematic Errors

Chairman: Dr. F. Ackermann
University of Stuttgart
Stuttgart, FRG

WG 2: On-Line Photogrammetric Triangulation

Chairman: Dr. V. Kratky
National Research Council
Ottawa, CANADA

WG 3: Mathematical Aspects of Digital Terrain Information

Chairman: Dr. K. Torlegård
Royal Institute of Technology
Stockholm, SWEDEN

WG 4: Mathematical Aspects of Image Registration, Rectification and Enhancement

Chairmen: Dr. P. Anuta and Dr. E. M. Mikhail
Purdue University
West Lafayette, Ind., USA

WG 5: Mathematical Pattern Recognition and Image Analysis

Chairman: Dr. Franz Leberl
Graz Research Center
Graz, Austria

Terms of reference of WGs

The terms of reference of each WG are more closely described in Table 1. WG 2 and 5 have had the character of study groups, and they have not performed any uniform closely controlled experiments. They are generally concerned with the advancement of the technologies concerned. WGs 1, 3 and 4 have in addition carried out empirical studies using real or simulated data.

Symposia, meetings and publications

The Symposium of the Commission III was held in Otaniemi, Finland, June 7 - 11, 1982. The theme was "Mathematical Models, Accuracy Aspects and Quality Control". There were 121 participants from 23 countries. Altogether 63 papers were submitted for the Symposium, and they are printed in the International Archives of Photogrammetry, Vol. 24 - III, parts 1 and 2. Part 1 was published before and part 2 after the Symposium. Part 2 contains e.g. all late papers and the records of the Technical Sessions.

The programme of the Symposium consisted of 10 technical sessions with 46 lectures, technical tours to three photogrammetric organizations, and a social programme.

Wg 1, together with the OEEPE Commission A, organized a seminar on "Mathematical Models for Assessing Gross and Systematic Errors at Geodetic-Photogrammetric Point Determination" in Stuttgart, FRG, November 26 - 27, 1981. More than 50 participants attended. The proceedings are to be published.

A Workshop and Business Meeting of WG 2 on "On-Line Photogrammetric Triangulation" was arranged in Ottawa, Canada, May 17 - 19, 1983. Nearly 20 WG members and other participants took part.

An International Colloquium of WG 3 on "Mathematical Aspects of Digital Elevation Models" was held in Stockholm, Sweden, April 18 - 20, 1983. It had over 30 participants. The papers presented are published in a publication of the Department of Photogrammetry of the Royal Institute of Technology, Stockholm, 1983.

WG 5 held a Specialist Work-Shop on "Pattern Recognition in Photogrammetry" in Graz, Austria, September 27 - 29, 1983. There were approximately 80 participants. The lectures presented were distributed to the participants in the Work-Shop.

The Commission Board has had three meetings, two during the Helsinki Symposium and one during the Graz Specialist Work-Shop. It will have a meeting in Rio de Janeiro just before the Congress and e.g. the resolution Group of the Commission will be elected there. Each WG has had several meetings mainly during the Helsinki Symposium, their own seminars and other photogrammetric events.

In the Rio Congress Commission III has planned to have in addition to a Business Meeting, altogether 12 technical sessions, one joint session with C I and C V and a number of poster sessions. The activities of the WGs are reported by their chairmen, and by the authors of the invited and presented papers. Besides the WG reports each WG has asked for two invited papers. In addition to these there will be an Invited Paper based on the resolution on the combined adjustment.

Table 1. Terms of Reference of the Working Groups

WG 1: Identification and Elimination of Gross and Systematic Errors

- Detection and localization (identification) of gross errors
- Compensation of systematic errors
- Reliability of photogrammetric point determination (aerotriangulation)

WG 2: On-Line Photogrammetric Triangulation

- Further development of recursive methods for dynamic least squares adjustment of data
- Studies of those operational aspects which can reduce the volume of preparatory work and increase the cost-effectiveness of triangulation
- Quality control in the environment of on-line photogrammetric triangulations

WG 3: Mathematical Aspects of Digital Terrain Information

- A comparative test to study sampling-interpolation-accuracy of photogrammetrically measured DEMs
- Mathematical methods to classify types of terrain as to its elevation

WG 4: Mathematical Aspects of Image Registration, Rectification and Enhancement

- Generation, distribution and analysis of standard test data
- Image control point determination
- Image registration
- Image resampling
- Reconstruction of irregularly sampled scenes
- Mathematical models for geometric restitution
- Utilization of multiple coverage
- Integration of multiple data types
- Radiometric correction
- Image enhancement
- Data processing methods

WG 5: Mathematical Pattern Recognition and Image Analysis

- Image enhancement
- Image data compression and coding
- Classification and clustering
- Spatial feature recognition
- Change quantization
- Analysis of binary images
- Use of image analysis techniques with non-image data
- Digital processing of synthetic aperture radar signal histories
- Image based digital information systems
- Computer science aspects of image processing mathematics
- Generation of synthetic images