

## Deliberations of the Technical Commissions — Délibérations des Commissions techniques — Verhandlungen der Technischen Kommissionen

The ISP Council and the Presidents and Secretaries of the ISP Commissions discussed the drafting of the minutes of commission sessions, to be published in the *Archives*, at their meeting held in Helsinki on July 11, 1976. Here they decided that the minutes should be recorded by the Commission Secretaries, after which the Commission Presidents should approve them and hand them over to the Secretary of the Congress by the end of the Congress.

As to the contents of the minutes, it was decided not to give a verbatim report, but to include only summaries of discussions. In principle, only the titles and authors of the papers presented at the Congress were to be mentioned.

Later on, however, the editors of the *Archives* considered it appropriate to complete and make uniform the minutes of the different Commissions, partly by following the procedure of the meetings on magnetic tape and partly by quoting the forms with written comments handed in by speakers having participated in the discussions. Even so, only minor alternations have been made.

Amendments improving the readability of the text include the chronological numbering of the sessions of each Commission, covering business meetings and technical sessions alike. Furthermore, the Reports, Invited Papers and Presented Papers are followed by code numbers referring to either *Archives*, Vol. XXI, Parts 2—5 or *Presented Papers*, Parts 1—7. No code number is given for papers not delivered to the Secretariate of the Congress and consequently not included in the publications mentioned above.

### COMMISSION I

#### PRIMARY DATA ACQUISITION RECUEIL DE L'INFORMATION PRIMAIRE GEWINNUNG DER AUSGANGSINFORMATION

President: *Dr. E. P. Welander* (Sweden)  
Secretary: *Mr. B. Adolfsson* (Sweden)

Monday, July 12, 1976, from 14.15 to 15.00  
Session 1 of Commission I

Topic: Business Meeting  
Chairman: *Dr. E. P. Welander* (Sweden)

#### 1. *Opening of Business Meeting*

*Dr. Welander*, President of Commission I, opened the meeting and gave a brief summary of Commission I activities during the past four years.

#### 2. *Working Group Reports*

The chairmen of the Working Groups summarized their Reports and gave the following statements:

##### 2.1. *WG I/1 Image Geometry*

*Dr. D. C. Merchant* (U.S.A.), co-chairman, stated that the Working Group was chaired by *Dr. H. Ziemann* (Canada). Two reseau cameras, Zeiss RMK-AR 15/23 and modified Wild RC-8 15UAg R10,

had been calibrated by seven different camera calibration facilities which were representative on a world-wide basis. These results would be compared to assess consistency among the various procedures. No attempt would be made to assess accuracy. The Working Group had also been concerned with studies using test field photography. It was anticipated that work would be continued on these studies.

##### 2.2. *WG I/3 Remote Sensing*

*Dr. W. A. Fischer* (U.S.A.) said that the remote sensing session would stress applications of Landsat information, the observation of luminescence, and the observation of thermal structures of the earth.

##### 2.3. *WG I/2 OTF/MTF*

*Mrs. C. Norton* (U.S.A.) gave a brief summary of the Working Group Report and outlined the coming session on this subject. The Working Group has made a summary of the definitions of MTF in various countries and ascertained the position of MTF as a quality criterion in optical tests.

#### 3. *Technical Sessions of Commission I*

President *Welander* reviewed the Commission I sessions during the Congress.

#### 4. Commission I Resolutions Committee

*Dr. P. D. Carman* (Canada) was appointed chairman of an ad-hoc Resolutions Committee. The chairmen of the Working Groups were asked to supply further candidates to the Resolutions Committee.

#### 5. Role and Position of Remote Sensing

A short discussion was held on the role of remote sensing and its position with the Technical Commissions. *Mr. S. G. Möller* (Sweden) stated that natural resources vanish, that pollution is increasing, and that the world population would double up to 2010. He said that photogrammetry and remote sensing are the only means to observe the world-wide situation of the landscape and the changes in it and to supervise land use and misuse. I.S.P. should therefore be organized in commissions for landscape information, data reduction with mathematical and electronic analysis of data, interpretation of data, and for presentation of data, updating and filing.

*Dr. L. Sayn-Wittgenstein* (Canada), President of Commission VII, replied that the question of the role of remote sensing in I.S.P. would have to be dealt with at the Congress and definite action was mandatory. The Commission VII Resolutions Committee would cooperate closely with its counterpart in Commission I on the matter.

After some comments on the technical procedure of the sessions by *Mr. B. Adolfsson* (Sweden), Secretary, the meeting was adjourned.

Wednesday, July 14, 1976, from 14.00 to 15.30  
Session 2 of Commission I

Topic: Commission I Progress Report —  
Image Geometry

Chairman: *Dr. E. P. Welander* (Sweden)

#### Commission Report

Author: *Dr. E. P. Welander* (Sweden)  
Title: Primary Data Acquisition CR 1/0.

Leading off the Image Geometry session, President *Welander* summarized the Commission I report for the 1972—1976 period noting that the classical concept of "image acquisition" has been replaced by "data acquisition" because of the development of both aircraft and satellite electro-optical sensor systems with digital recording capabilities. Despite these new systems, however, classical photogrammetric photography will remain the predominant medium for topographic mapping tasks, although a marked increase in the utilization of improved camera systems mounted in high-altitude jet aircraft is evident.

In 1972—1973 the three Working Groups already mentioned in connection with the Business Meeting had been established:

#### WG I/1 Image Geometry

Chairman: *Dr. H. Ziemann* (Canada)  
Co-chairman: *Dr. D. C. Merchant* (U.S.A.)

#### WG I/3 Remote Sensing

Chairman: *Dr. W. A. Fischer* (U.S.A.)

#### WG I/2 OTF/MTF

Chairman: *Mrs. C. Norton* (U.S.A.)

*Dr. Welander* concluded the introduction by outlining the technical program of Commission I during the Congress.

#### Working Group Report

Author: *Dr. H. Ziemann* (Canada)  
Title: Preliminary Report of the Working Group on Image Geometry WGR 1/02

*Dr. Ziemann* summarized the work carried out so far by the Working Group on Image Geometry. An attempt was being made to determine differences between various camera calibration procedures. Two reseau cameras Zeiss RMK AR 15/23 and Wild RC-8 15UAg R10 had been calibrated by means of visual calibration with horizontal and vertical goniometers, by means of photographic calibration with a bank collimator or two-dimensional multicollimator, with the ITEK Artificial Stellar Calibrator, by two stellar calibration methods and using test fields photography of five test fields. Although considerable data are still to be reduced, marked differences have been noted in the distortion and image quality characteristics at comparable field angles and image parts.

The determination of the MTFs of camera lenses by different laboratory methods and using aerial photography of three bar test field were also found necessary. Analyses of the relationships between radial distortion, image quality and pointing errors are being conducted.

The following institutes and persons have participated in the work:

Canada:  
National Research Council (NRC) *Mr. H. Brown*  
*Dr. P. D. Carman*  
*Dr. H. Ziemann*

Finland:  
Helsinki University of Technology (HUT) *Mr. J. Hakkarainen*  
F.R.G.: *Mr. H. Salmenperä*  
Carl Zeiss, Oberkochen *Dr. W. Lorch*  
*Dr. H.-K. Meier*  
Physikalisch-Technische Bundesanstalt (PTB) *Dr. K.-J. Rosenbruch*  
University of Bonn (UB) *Mr. K. H. Ellenbeck*  
*Dr. G. Kupfer*

Switzerland  
Wild Heerbrugg *Mr. G. Bormann*

U.S.A.  
Air Force Avionics Laboratory *Mr. E. L. Gliatti*  
*Mr. W. C. Martin*  
DBA Association *Mr. J. S. Strahle*  
ITEK Corporation *Mr. R. H. Howell*  
*Mr. J. A. Vogenthaler*  
National Ocean Survey *Mr. L. W. Fritz*  
*Mr. C. C. Slama*  
U.S. Geological Survey *Mr. W. P. Tayman*

A preliminary Working Group Report was available. Due to a series of unexpected delays no final results could be presented. The work would be continued.

## Panel Presentation

Topic: Lens Distortion Determination  
Moderator: *Dr. H. Ziemann* (Canada)  
Panelists: *Mr. J. Hakkarainen* (Finland)  
*Mr. G. Bormann* (Switzerland)  
*Dr. H.-K. Meier* (F.R.G.)  
*Dr. P.D. Carman* (Canada)  
*Mr. H. B. Loving* (U.S.A.)  
*Mr. R. Ondrejka* (U.S.A.)  
*Mr. C. C. Slama* (U.S.A.)  
*Mr. J. S. Strahle* (U.S.A.)  
*Dr. G. Kupfer* (F.R.G.)  
*Dr. H. Ziemann* (Canada)  
*Dr. D. C. Merchant* (U.S.A.)

*Dr. Ziemann* successively introduced his panelists who gave short presentations as follows:

**Mr. Hakkarainen:** Helsinki University of Technology Goniometer for Calibration of Wide-Angle Cameras

He presented the main features of and some measurements with the HUT goniometer, which is suitable for calibration of several different aerial cameras. The instrument can be used for the determination of the radial distortion, the main component of tangential distortion, the lateral color error, the optical resolving power and the MTF of cameras. One of the two reseau cameras was found very symmetrical, but the radial distortion of the other was very asymmetrical and the tangential distortion great (*PPI/19*).

**Mr. Bormann:** Wild Heerbrugg Horizontal Goniometer

He explained first the measuring possibilities and the structure of Wild goniometer, then gave a short description of the measurement of the radial distortion and finally presented the calibration program performed for the reseau camera of Wild.

**Dr. Meier:** Carl Zeiss Oberkochen vertical Goniometer

The structure of the instrument was shortly described. The visual calibration method is preferred because of its simplicity and accuracy. *Dr. Meier* presented some results of an accuracy comparison; RMS of the radial distortion measurements of four different laboratories was 1-1,5  $\mu\text{m}$ . He went on dealing with the problem of the reference point in calibration; only the principal point of autocollimation (PPA) can be realised in the measurement. The point of best symmetry (PBS) is, however, the best reference point.

*Dr. Meier* considered the so called tangential distortion as impossible to measure with a visual goniometer.

**Dr. Carman:** National Research Council Camera Calibrator

He described the structure of the NRC instrument, which has 43 parabolic mirror collimators in the same fan. The measurement also with infra-red radiation is possible. The collimators have no chromatic error. The photographic plates

used in the calibration are flattened with a pneumatic flattener with 25 suction caps and with interferometric control, which ensures that the largest image position errors due to lack of emulsion flatness are less than 1  $\mu\text{m}$ .

**Mr. Loving:** U.S. Geological Survey Multi-collimator

U.S.G.S. is the Government Agency for calibration of aerial cameras. The instrument has four fans of collimators. Both photographic glass plates and film diapositives made from film exposed in the magazine of the camera in the operational position on the calibrator are used. The distortion figures used in the analytical works of the U.S.G.S. are based on the measurements of the diapositives made with the last mentioned method (*William P. Tayman: Analytical Multicollimator Camera Calibration/U.S.G.S.*).

**Mr. Ondrejka:** ITEK Portable Artificial Stellar Calibration

ITEKs equipment represents fully new techniques in the camera calibration. The method is based on the use of diffraction patterns produced with coherent light generated by a red laser. *Mr. Ondrejka* gave a short presentation of the structure of the equipment. For the calibration of the whole wide-angle field several photographs are needed because of the limited size of the coherent light path.

**Mr. Slama:** Multi-Plate Multi-Exposure Stellar Calibration at the National Ocean Survey

The calibration techniques include combined data from several two-and-one-half hour chopped and precisely timed exposures. Each exposure is made with the camera rigidly mounted and oriented to a different direction about zenith. The double measurement of up to 2400 catalogued star images evenly spaced throughout the format of each plate provides sufficient redundancy to determine accurately the systematic deviations of all rays in the format from a central perspective. Special provisions have been included in the data reduction processes to minimize the influence of measurement errors, atmospheric refraction anomalies, thermal variations and random variations in plate flatness.

**Mr. Strahle:** DBA Stellar Calibration

The parameters of the inner orientation will be determined by using simultaneous adjustment of multiple stellar photographic plates. The photography is carried out with 3 different exposure times. For computing the SMAC-program of DBA has been used. The calibrated focal length, the principal point of autocollimation, the radial and decentering distortion are determined. Finally, *Mr. Strahle* showed some results of Wild and Zeiss reseau cameras.

**Dr. Kupfer:** Rheidt Test Field

The size of this test field is 2x2 sqkm and situated near Bonn. The point net is homogenous with 41 groups of 3 points. The signals are white

plastic plates with a grass contrast. The field was photographed with both reseau cameras using two different aeroplanes at the scales 1:11 000 and 1:5 500. Several different methods were used, for the elimination of systematic errors. The measurement and utilizing the reseau crosses had only small influence on the final results (PP 1121).

**Mr. Hakkarainen:** Jämijärvi Test Field

The test field is 200 km northwest of Helsinki. There are two point nets lying one inside the other. The smaller field is 800 × 800 sqm consisting of 187 points and the larger field correspondingly 2 × 2 sqkm consisting of 140 points. All points are levelled. The accuracies are in  $x, y \pm 2$  mm and  $\pm 5$  mm correspondingly. The field was photographed with both reseau cameras at scales 1:5000 and 1:10000. *Mr. H. Salmenperä* has computed the radial and tangential distortion of the cameras. These preliminary results show the same type of results as the determinations with HUT goniometer.

**Dr. Ziemann:** Sudbury Test Field

*Dr. Ziemann* first explained shortly the structure of this Canadian test field. All points are levelled to  $\pm 2$  mm. The  $x, y$  accuracy is  $\pm 1$  cm. The targets are mostly 30 × 30 sqcm white plates, fitted on the rock with bolts. The rock is also used as contrast. The field has been photographed at scales 1:8000 and 1:15 000 with the reseau cameras.

**Dr. Merchant:** Casa Grande and Mt. Graham Test Fields

Ohio State University has a mountaineous 3-dimensional test field at Mt. Graham. The maximum difference in height is 1100 m. With the reseau cameras also the flat test field of Casa Grande was photographed. This field has been planned for small scale flights. The targets are black triangle groups on white sand.

**Presented Papers**

The session concluded with brief reviews of Presented Papers by their authors:

Author: *Mr. K. Ellenbeck* (F.R.G.)  
Title: Untersuchung zum stochastischen Verhalten von Reseauaufnahmen (PP 1111)

The main result was, that the geometrical noise of reseau photographs studied was  $\pm 3 \mu\text{m}$ .

Author: *Dr. L. N. Wassiljew* (U.S.S.R.)  
Title: Kalibrierung der Messkammern unter Verwendung der Luftbilder eines Prüffeldes

*Dr. Wassiljew* considered the test field calibration be more reliable than the laboratory calibration because of environmental factors affecting the stability of the aerial camera. The session was adjourned.

Thursday, July 15, 1976, from 9.00 to 10.30  
Session 3 of Commission I

Topic: Space Imagery  
Chairman: *Dr. E. P. Welander* (Sweden)

**Invited Paper**

Author: *Dr. F. J. Doyle* (U.S.A.)  
Title: Space Photography (IP 1106)

**Presented Paper**

Author: *Dr. A. Colvocoresses* (U.S.A.)  
Title: Status Report on Landsat as a Source of Cartographic Data PP 1105

**Panel Discussion**

Topic: Space Imagery  
Moderator: *Dr. F. Doyle* (U.S.A.)  
Panelists: *Dr. L. Kashin* (U.S.S.R.)  
*Mr. R. Ondrejka* (U.S.A.)  
*Mr. J. Denègre* (France)  
*Mr. P. Mott* (U.K.)  
*Mr. G. Petric* (U.K.)

The Panel Discussion was led off by *Dr. Kashin* who spoke on the use of space imagery in the U.S.S.R. He mentioned Solyut and Soyuz, noted that cartographic and photogrammetric imagery at scales of 1:2 500 000 and 1:1 000 000 had been obtained in several spectral bands, and that the imagery was used for agriculture, geology, and forestry. *Mr. Ondrejka* continued with a rather provocative proposal for GEOSAT, a system which would have stereo capability and a 10-meter ground resolution and would include multi-spectral, thermal IR, and SLAR and color photography capability. He noted that such a system would have industry support. *Mr. Denègre* spoke further on Spacelab, noting that a convergent system might be employed to obtain stereo coverage, and that the system should be capable of supporting map compilation at 1:100 000 scale or even 1:50 000 scale. *Mr. Mott* talked about his experiences with Skylab imagery for mapping a portion of Nepal. He was able to contour at a 200-meter interval. He noted the desirability of stereo coverage and suggested that a laser altimeter be employed. He suggested that space imagery might be used to generate ground control, and he stated that he had used Landsat imagery for flight planning. Finally, *Mr. Petric* indicated that contouring was the main problem with space imagery. He was in favor of Spacelab, and he encouraged I.S.P. to give it support in order to overcome political problems.

Thursday, July 15, 1976, from 10.45 to 12.15  
Session 4 of Commission I

Topic: Remote Sensing  
Chairman: *Mr. W. A. Fischer* (U.S.A.)

**Working Group Report**

Authors: *Mr. W. A. Fischer* (U.S.A.)  
*Mr. W. R. Hemphill* (U.S.A.)  
*Mr. A. Kover* (U.S.A.)  
Title: Progress in Remote Sensing 1972 — 1976 WGR 1104

*Mr. Fischer* summarized the accomplishments, developments, and trends of the Landsat program and reviewed global applications of sensors operating in the visible, infrared, and microwave portions of the electromagnetic spectrum. The great number of applications he reported included among other things, cartographic applications, discovering of major curvilinear geological structures, and environmental monitoring.

*Mr. Fischer* pointed out the low unit cost for data acquisition by remote sensing. This was illustrated by figures showing the growing use of Landsat data. In 1973 the income from various data products at EROS Data Center was \$ 374000 (Landsat data \$ 229000) and the estimated income 1976 would be \$ 2780000 (Landsat data \$ 1720000).

#### Panel Discussion

Topic: Remote Sensing  
Moderator: *Mr. W. A. Fischer* (U.S.A.)  
Panelists: *Dr. A. P. Colvocoresses* (U.S.A.)  
*Mr. M. Fuchimoto* (Japan)  
*Dr. S. G. Gamble* (Canada)  
*Mr. F. Garcia-Castaneda* (Mexico)  
*Dr. P. Fagundes* (Brazil)  
*Dr. O. A. Gerasimova* (U.S.S.R.)

*Dr. Colvocoresses* reviewed the utilization of Landsat data for the production of small-scale prototype image maps, map and chart revision, thematic maps, hydrographic maps, aeronautical charting. He emphasized that Landsat-1 and -2 has been an experimental program. Landsat-C should be designated operational.

*Mr. Fuchimoto* told about the geological works using Landsat data in Japan.

*Dr. Gamble* reviewed the remote sensing activities in Canada and discussed its position in I.S.P. and consequently the name of the society.

*Mr. Garcia-Castaneda* told that they started to use space imageries in Mexico 10 years ago. Up to now they have used visual methods to produce geological and land-use maps, but also studied computer-based methods especially for agriculture and land-use inventory.

*Dr. Fagundes* said that many remote sensing projects have been carried out in Brazil. Data from various sensors have been utilized in coastal studies, geology, forestry to inventore coffee crops, soils and land-use.

*Dr. Gerasimova* compared optical and electronic methods to process remote sensing data and told about the optical methods used in the U.S.S.R.

Friday, July 16, from 14.00 to 15.30  
Session 5 of Commission I

Topic: Image Quality  
Chairman: *Dr. E. P. Welander* (Sweden)

*Dr. Welander* first explained the principle of the OTF Conception.

#### Working Group Report

Authors: *Mrs. C. Norton* (U.S.A.)  
*Dr. G. Brock* (U.S.A.)  
*Dr. R. Welch* (U.S.A.)

Title: Optical and Modulation Transfer Functions WGR I/03

*Mrs. Norton*, chairman of the WG I/2 on OTF/MTF, pointed out that the Working Group had been concerned with updating Section 6 of the "Procedures for Calibrating Photogrammetric Cameras and Related Optical Tests". Furthermore, the status of OTF/MTF standards in various countries was included in the Report.

The Application of MTF techniques in the analysis of aerial and space photographs had proven to be a reliable evaluation of the quality of operational systems when control targets were lacking.

*Mrs. Norton* then read the updated Section 6. The revision included:

1. updating of paragraphs on lenses,
2. changing of the numbering system
3. adding paragraphs on MTF camera testing, and
4. adding references.

After a short discussion between *Mr. R. Lorenz* of the I.T.C. (Netherlands), *Dr. Welch*, *Dr. Welander* and *Mrs. Norton*, the recommended Section 6 (see Working Group Report: Optical and Modulation Tansfer Functions WGR I/03) was approved. *Mrs. Norton* then dealt with the pupil function and the importance of the phase shift on the image quality after which she read a proposal for a resolution on OTF/MTF.

#### Invited Papers

Author: *Dr. R. Welch* (U.S.A.)  
Title: Progress in the Specification and Analysis of Image Quality IP I/09

*Dr. Welch* pointed out that the reliability of predicted and measured photographic system MTF's is influenced by variations in component MTF's, non-linearity of the photographic process, target fidelity and microdensitometer parameters. However, predicted MTF's have been found to correspond to within 10 to 15 per cent of measured values.

Specifications of performance for Landsat C sensors indicate that the 30m IFOV planned for the Thematic Mapper of the Landsat Program will produce images of comparable quality to those recorded by the Skylab S-190A MTF.

Formation of a Working Group on Image Quality for further studies was recommended by *Dr. Welch*.

Author: *Dr. K. J. Rosenbruch* (F.R.G.)  
Title: Considerations of Image Geometry and Image Quality of Lenses in Aerial Mapping Cameras IP I/08

*Dr. Rosenbruch* pointed out the difficulty of testing of optical systems and errors of centration in lens production. However, high-class aerial cameras are rarely affected by this. Further, a combination of aberration measurement and OTF measurement has proven to be an efficient and economic method of testing. The number of the OTF measurements needed can be remarkably reduced by combining with these the data of field curvature.

To sum up, the Invited Paper by *Dr. Welch* and the one following it, by *Dr. Rosenbruch*, considered the applications of MTF's for assessing

the performance of optical and electro-optical imaging systems and the relationships between image quality and image geometry. In general, OTF/MTF measurement techniques are now utilized by most major optical laboratories for lens testing and their validity for the prediction and measurement of the camera system (lens — film — image motion) performance has been established.

#### Presented Paper

Author: *Dr. O. A. Gerasimova* (U.S.S.R.)  
Title: The Determination of Modulation Transfer Functions of Airsystems at ZNIIGAIK PP 11/13

*Dr. Gerasimova* told that at ZNIIGAIK there are two precise optical bench systems EOS-1 and EOS-2 for determining of MTF's. The accuracy of EOS-2 is  $\pm 2\%$  and the spatial frequency range is 7.5—120 cycles/mm. She also proposed an approximation formula for MTF's based on 400 MTF determinations. The EGA method will be replaced by some method using Fourier-spectra. Film threshold contrast curves are based on Fevinsky-target measurements.

#### Panel Discussion

Topic: Testing of Lenses and Photographic Systems  
Moderator: *Mrs. C. Norton* (U.S.A.)  
Panelists: *Dr. M. Gerencsér* (Hungary)  
*Dr. K. J. Rosenbruch* (F.R.G.)  
*Dr. E. P. Welander* (Sweden)  
*Dr. R. Welch* (U.S.A.)

*Dr. Welander* stated that OTF/MTF procedures are now well established and that the Section 6 should be updated with tolerance, a task for a Working Group for the next period. Special attention should be given to wide angle cameras including the frame.

*Dr. Rosenbruch* showed results of MTF measurements carried out of two complete reseau cameras with four measuring methods (*Mr. J. Hakkarainen* of Finland, *Mr. W. G. Martin* of U.S.A. and two different methods at PTB, F.R.G.). The first mentioned was photographic and the other three were photo-electric methods. The results of the one camera showed very good agreement, but the results with the other camera by the first method differed from the results by the other methods, because in the first method the camera frame plane was used as reference plane. In the latter methods this was the best focal plane. *Dr. Rosenbruch* pointed out that the reference plane can have a great influence on OTF measurements. Also the phase shift can have great importance when using some lenses, which should be taken into account especially in accurate distortion measurements, where the target used has influence on results.

Finally *Dr. Gerencsér* made a few comments on the use of the EGA method for testing photogrammetric systems.

Friday July 16, 1976, from 15.45 to 17.15  
Session 6 of Commission I

Topic: Underwater Photography  
Chairman: *Mr. G. McNeil* (U.S.A.)

#### Invited Paper

Author: *Mr. G. McNeil* (U.S.A.)  
Title: Determination of Limiting Resolution of Underwater Lens Owing to Change in Back Focal Distance Caused by Change in Water Refractive Index IP 11/07

Having presented parts of his Invited Paper, *Mr. McNeil* proposed an Underwater Photography Working Group under Commission I with close cooperation with Commission V.

#### Panel Discussion

Topic: Underwater Photography  
Moderator: *Mr. G. McNeil* (U.S.A.)  
Panelists: *Mr. V. Seifert* (U.S.A.)  
*Dr. K. Torlegård* (Sweden)  
*Mr. D. Rebikoff* (U.S.A.)

*Mr. Seifert* referred to his "State-of-the-Art" Report to the Commission I Symposium in Stockholm 1974. Developments have been made of camera systems and calibration techniques as well as of the knowledge and understanding of the significance of underwater photography. *Dr. Torlegård* discussed results obtained by himself and *Mr. T. Lundälv* (Sweden) concerning marine biology. A simple calculator-assisted mini-comparator has been developed to be used by the biologist for evaluation of stereo pictures over selected shallow sea areas.

*Mr. Rebikoff* gave his Presented Paper, "1976 Report on Underwater Photogrammetric Survey of Man Made Structures Located Underwater, Such as Oil and Gas Pipelines" (PP 11/25). He also demonstrated two underwater camera systems with 250 and 1500 frame cartridges for format 24 x 36 mm. Due to the low "altitude" possible major efforts have to be made to develop complete computer-supported automated evaluation systems considering the large amount of pictures that are produced. He also believed that many data program systems developed for aerial photography evaluation could be used with limited alterations.

In the discussion *Mr. Seifert* urged people from other nations to join the I.S.P. work on underwater photography. Upon a question from *Mrs. C. Norton* (U.S.A.) on the scope of underwater photography, *Mr. McNeil* answered that the most important subject now was to get underwater photography established in the photogrammetric world. *Dr. Torlegård*, being a member of the Commission V Resolutions Committee, asked for resolution proposals in this matter.

Monday, July 19, 1976, from 14.00 to 15.30  
Session 7 of Commission I

Topic: Navigation and Flight Systems —  
Aerial Photography Instrumentation  
Chairman: *Mr. F. Corten* (Netherlands)

### Invited Paper

Authors: *Mr. F. Corten* (Netherlands)  
*Mr. F. Heimes* (Netherlands)  
Title: Integrated Flight and Navigation Systems *IP 1105*

*Mr. Corten* gave a condensed review of  
a. the survey navigation methods and instruments available,  
b. the accuracy of these systems reached in survey flights,  
c. their possible applications in aerial photography and survey, and  
d. the cost/benefit of these systems.

The following survey navigation methods were discussed by *Mr. Corten*:

1. Visual contact navigation
2. Deduced reckoning
3. Ground controlled radio navigation
4. Purely airborne navigation
5. Integrated navigation.

Special attention was given to the PHOTNAV system based on doppler, and to the Fokker F-27 integrated inertial system. A comparison was given of the merits of doppler and inertial navigation systems, with the conclusion that doppler-based systems were well-suited to use in propeller driven aircraft, but that despite high cost, inertial systems may be preferred for jet aircraft.

*Mr. Corten* stated that doppler systems have a tendency to be more accurate for low speed aircraft, long flight lines, a low number of flight lines and turns, and for flights of long duration. Inertial systems can be regarded more accurate for high speed aircraft, short flight lines, a large number of flight lines and turns, and for flights of short duration.

Additional remarks were given by *Mr. Heimes* who reported about the first experiences from test and training flights with Fokker F-27 at the Institut National de Cartographie of Algeria. INS-systems had proved to have a very high relative positioning accuracy.

### Presented Papers

Author: *Dr. D. Hobbie* (F.R.G.)  
Title: Orthophoto Flight Planning  
Author: *Dr. H. Schöler* (G.D.R.)  
Title: Some Aspects of Photographic Flight Planning for the Orthophotography *PP 1128*

Authors: *Mr. F. Corten* (Netherlands)  
*Mr. F. Heimes* (Netherlands)  
Title: ITC PHOTNAV System *PP 1110*

*Mr. R. Ondrejka* (U.S.A.) gave his comments upon the development in the United States within this field.

The latter part of the session was devoted to Aerial Photography Instrumentation, subdivided into

- a. Aerial Camera Systems.
- b. Aircraft and Flight Systems, and
- c. Photographic Processing Equipment.

#### Aerial Camera Systems

A short presentation of Exhibitors' news was given by *Dr. K. Lorch* of Carl Zeiss, Oberkochen,

(F.R.G.) and by *Dr. O. Weibrecht* of Carl Zeiss, Jena, (G.D.R.).

#### Aircraft and Flight Systems

*Mr. Corten* summarized his Presented paper, "A Decision Model for Optimizing the Survey Flight System — Including Choice of Aircraft" (*PP 1108*).

Then a ten-minute film was shown on flight systems using the aircraft AM-30 in the U.S.S.R. The show was preceded by an introduction by *Dr. O. A. Gerasimova* (U.S.S.R.).

The meeting was adjourned and continued in another lecture hall after a short break.

Short presentations of Exhibitors' news concerning aircraft and flight systems were given by *Mr. C. H. Collinsworth* of Beech Aircraft (U.S.A.), *Mr. R. F. Bradbury* of Gates Learjet (U.S.A.), and *Mr. T. Leacock* of Mann Aviation (U.K.).

#### Photographic Processing Equipment

Recent developments in photographic processing equipment were presented by *Mr. H. Morgan* of Eastman Kodak (U.S.A.), *Mr. R. MacDonald* of Gestalt International (Canada), *Mr. H. Hiersemann* of Himex Instruments (Sweden), and by *Mr. C. Keating* of Log. E. (U.S.A.).

After a lively general discussion mainly on the characteristics of camera frame glass, Doppler and INS navigation systems, and automatic exposure control, *Mr. Corten* closed the three-hour-long session.

Thursday, July 22, 1976, from 14.00 to 14.45  
Session 8 of Commission I

Topic: Business Meeting  
Chairman: *Dr. E. P. Welander* (Sweden)

#### 1. Opening of Business Meeting

*Dr. Welander* opened the session and announced the purpose of the meeting.

#### 2. Decisions of the General Assembly

Information on decisions made by the General Assembly as to the coming Council, Congress Site 1980 (Hamburg, F.R.G.), and Commission Boards was given by the Secretary, *Mr. B. Adolfs-son* (Sweden).

#### 3. Efficiency of I.S.P. Congresses

The next item had been brought forward by the Council. It concerned the question of how to increase the efficiency of Congress work. No comments were made by the audience.

#### 4. Resolutions

The main purpose of the meeting was to finalize the Resolutions to be passed over to the Council and the incoming Commission I.

*Dr. P. D. Carman* (Canada), chairman of the ad-hoc Resolutions Committee, read the Draft Resolutions. The members of the Resolutions Committee had been *Mr. F. Corten* (Netherlands), *Dr. H. Ziemann* (Canada), *Dr. R. Welch* (U.S.A.), *Mr. J. Sievers* (F.R.G.), and *Mr. R. W. Lorenz* (Netherlands).

Some amendments of the Draft Resolutions were made after remarks from *Mr. Sievers*, *Dr. G. Hildebrandt* (F.R.G.), *Dr. W. Fischer* (U.S.A.), *Dr. G. Kupfer* (F.R.G.), and *Mr. Corten*. *Dr. Fischer* proposed that the concept image quality should also include the dynamic range of the receptor. He also suggested that the number of exterior orientation elements should be seven, including time.

After having closed the business meeting, *Dr. Welander* had time to introduce *Mr. H.-J. Böhnel* (F.R.G.), who summarized the Presented Paper on the "Radiometric Determination of Spectral Signatures for Natural Surfaces" (PP 1104) by *Mr. Böhnel*, *Dr. Fischer* and *Mr. G. Knoll* (Austria)

Friday, July 23, 1976, from 9.00 to 10.30  
Session 9 of Commission I

Topic: Progress in Remote Sensing 1972  
—1976

Chairman: *Dr. E. P. Welander* (Sweden)

#### Presented Paper

Author: *Dr. H. G. Jerie* (Netherlands)  
Title: Proposal for a Modification of Line Scanners and Panoramic Cameras for the Acquisition of Stereo Imagery  
PP 1120.

#### Panel Discussion

Topic: Remote Sensing  
Moderator: *Dr. W. Fischer* (U.S.A.)  
Panelists: *Dr. F. Doyle* (U.S.A.)  
*Dr. S. G. Gamble* (Canada)  
*Dr. G. Hildebrandt* (F.R.G.)  
*Dr. H. G. Jerie* (Netherlands)  
*Dr. L. Sayn-Wittgenstein* (Canada)  
*Dr. H. Schmid* (Switzerland)  
*Dr. E. P. Welander* (Sweden)

*Dr. Doyle* raised the question of what would be more appropriate to have in a remote sensing system — a film return system or digital MSS data. Digital data have so far too low a resolution for photogrammetric and cartographic applications.

*Dr. Gamble* pointed out that Landsat data had been used for map revision at small map scales. But the major efforts in map revision will be at larger scales, such as 1:20 000 — 1:50 000, for which purpose a system with higher resolution will be needed.

*Dr. Hildebrandt* pointed out that a number of thematic maps such as land-use, forestry, and agricultural maps must be considered, in addition to topographic maps.

*Dr. Jerie* said that a distinction has to be made between one-time-surveying missions and

monitoring systems. Aerial systems should be used for the first type of missions and space imagery for monitoring systems. He also asked if fields of co-operation could be defined between remote sensing specialists and photogrammetrists.

*Mr. S.-G. Möller* (Sweden) proposed that a special Commission within the I.S.P. should be organized to deal with what landscape information we need and how to classify it.

*Dr. A. Fontanel* (France) thought that film return systems would bring about tedious digitizing for having the information processed by a computer.

*Dr. Doyle* felt that it was not necessary to digitize film information; analogue procedures could be used preferably, but the digital way is one of the best ways to handle data which are in digital form.

*Dr. Gamble* noticed that the best computer in many tasks is the human brain.

Upon a question from *Mr. Möller*, *Dr. Hildebrandt* and *Dr. Doyle* stated that users' requirements on remote sensing are considered to a reasonable extent.

Upon a question from *Dr. Jerie*, *Mr. R. Ondrejka* said that remotely sensed thematic data have acquisition requirements common with photogrammetric requirements and told an example of oil and mineral exploration. If the proposed geological missions had a five per cent impact on U.S. petroleum and gas exploration it would be valued over \$ 5 billion over the next 15 years.

*Mr. Difas* (G.D.R.) asked *Dr. Hildebrandt* in what area of the spectre the spectral resolution should be improved. *Dr. Hildebrandt* answered that he had meant the Landsat and referred to his presented paper in Commission VII.

*Dr. R. Heller* (U.S.A.) told about experiments using aircraft scanners and suggested that future satellite MSS-systems have narrower wavebands. *Dr. H. Rib* (U.S.A.) said that his experience indicated that Satellite data are suitable for detailed investigation only in a few applications. *Dr. Doyle* pointed out experiences from Skylab 13-channel scanner and spectral resolution. In future the channel number should be limited to reasonable and feasible amount.

*Dr. Schmid* remarked that a wide use of remote sensing data could create metric requirements (xyzt). He was also of the opinion that remote sensing naturally belongs to the scope of the I.S.P.

Upon a question from *Mr. Möller*, *Dr. Doyle* said that the use of the color IR-film used in Skylab should be possible also in high-altitude aircrafts, but is not yet available.

*Dr. Sayn-Wittgenstein* pointed out that the utility of remote sensing data depends now more on interpretation methods (soft-ware) than on hardware.

*Dr. Fischer* concluded the panel discussion. A film by the U.S.G.S., "EROS-Response to a Changing World", was shown.



## COMMISSION II

### INSTRUMENTATION FOR DATA REDUCTION APPAREILLAGES D'EXPLOITATION DES DONNEES AUSWERTEINSTRUMENTE

President: *Dr. G. Inghilleri* (Italy)  
Secretary: *Dr. B. Astori* (Italy)

Monday, July 12, 1976, from 15.15 to 16.00  
Session 1 of Commission II

Topic: Business Meeting  
Chairman: *Dr. G. Inghilleri* (Italy)

#### 1. Activities of the Commission in the Past Period

The President summarized the activities covered in the printed report and thanked all who had contributed to the work of the Commission.

The Working groups of Commission II during 1972—1976:

WG III/2 Standard Tests  
Chairman: *Dr. M. Döhler* (F.R.G.)  
WG III/3 Automated and Digital Instruments  
Chairman: *Mr. K. Korimoto* (Japan)  
WG III/4 Orthophoto Equipments  
Chairman: *Dr. T. Blachut* (Canada)

#### 2. Activities of the Commission During the Congress

It was pointed out by the President that one of the most important tasks is the drafting of the Resolutions concerning the future activities of the Commission. The following persons were appointed to draft the Resolutions: *Dr. B. Makarović* (Netherlands) as chairman, *Dr. H. Schöler* (G.D.R.), *Dr. T. J. Blachut* (Canada), *Dr. Inghilleri*, *Dr. J. Case* (U.S.A.), *Mr. M. Bausart* (France), and *Dr. L. Wassiljew* (U.S.S.R.).

#### 3. Future Activities of the Commission

The President suggested the continuation of Working Group II/4, "Orthophoto Equipments", for performing further experimental work on comparing apparatuses and for allowing improvements of the techniques.

The proposal to split Working Group II/3 into two was accepted. The new Working Groups would be called "Automated Equipments" and "Analytical Instruments". One of the tasks of the latter one would be to define what exactly is meant by "Analytical Instruments".

The President suggested that the eventual formation of any other Working Group should be discussed at the 2nd Business Meeting, where the new President of Commission II would be able to participate. On this occasion it would also be convenient to assign new names to the existing Working Groups.

Tuesday, July 13, 1976, from 14.00 to 15.30  
Session 2 of Commission II

Topic: Orthophoto Equipments  
Chairman: *Dr. G. Inghilleri* (Italy)

The first Technical Session of Commission II

was opened by *Dr. Inghilleri*, President of the Commission, who reviewed the activities of the Commission during the past four years. He noted that a successful Symposium was held by Commission II in Turin Italy, in October 1974. The theme of the session, Orthophoto Equipments, was then highlighted by *Dr. T. J. Blachut* of Canada who gave the Working Group Report on the International Orthophoto Experiment.

#### Working Group Paper

Authors: *Dr. M. C. van Wijk* (Canada)  
*Dr. T. K. Blachut* (Canada)  
Title: Results of the International Orthophoto Experiment 1972—1976  
WGR III/03

The accuracy and resolution of orthophotos produced by several different equipments were compared. Every effort was made to perform comparable tests with the different instruments. The tests appeared to be quite definitive. One interesting test was to generate orthophotos from both the right and left photograph of a stereo pair of photos: the resulting orthophotos, when viewed in stereo, should form a perfectly flat model if produced without error.

At the end of the presentation a discussion was solicited by the chairman, asking for comments and remarks by the audience.

*Mr. G. Ducher* (France) asked if the experiments on orthophoto would be continued. *Dr. Blachut* informed the audience that at the first Business Meeting the Commission Board had decided on the continuation of the Working Group on orthophoto, and that the new President of Commission II would probably be a Frenchman, a photogrammetrist whom *Mr. Ducher* could easily contact.

*Dr. B. Makarović* (Netherlands) pointed out that, in the results of the experiments made, it is necessary to take into account that some instruments are automatic and others manual and suggested such a division for further investigation. *Dr. Blachut* answered, that so far the investigation is made with available commercial instruments for practical purposes, and it can be increased in future if the need arises.

*Dr. J. Case* (U.S.A.) asked for information about the problems which are typical of productive work. He pointed out, that in future it will be suitable to separate profiling and orthophoto-printing. *Dr. Blachut* said that in a scientific experiment these types of problems cannot be dealt with.

*Ms. Fleming* (Canada) asked about the quality of images particularly about the contrast.

*Dr. Blachut* answered, observing that the problem of the quality of images is a very important and difficult one, and that it has to be studied by means of special experiments.

Finally *Dr. G. Birardi* (Italy) brought forth the problem of the orthophoto as a tool for the revision of maps. A less sophisticated instrument could be useful for this purpose. *Dr. Blachut* answered, that orthophoto technique has been used especially in France where also many less expensive instruments are in use.

#### Presented Papers

The chairman then communicated to the audience the other contributions to the investigation of the problem of orthophoto and his regrets that these Presented Papers could not be examined within the time limits of the session. The fifteen Papers concerned had been presented by: *Dr. G. Parenti* (Italy), *Dr. H. Schöler* (G.D.R.) PP III/46, *Mr. R. Schumann* (G.D.R.) PP III/47, *Mr. D. Clegg* (south Africa) PP III/06, *Mr. J. Hensch* (F.R.G.), *Mr. W. Marckwardt* (G.D.R.) PP III/34, *Dr. O. Weibrecht* (G.D.R.) PP III/65, *Mr. P. Spata* (G.D.R.) PP III/52, *Dr. K. Szangolies* (G.D.R.) PP III/56, *Mr. P. Stewardson* (Switzerland) PP III/55, and *S. Collins* (Canada).

Wednesday, July 14, 1976, from 9.00 to 10.30  
Session 3 of Commission II

Topic: Analytical Instrumentations  
Chairman: *Dr. L. Solaini* (Italy)

#### Invited Papers

Author: *Mr. Z. Jaksic* (Canada)  
Title: The Significance of Analytical Instruments for the Development of Methods and Techniques in Photogrammetric Data Processing IP III/04

*Mr. Jaksic* provided a complete functional description of analytical plotters and noted the advantage of offering an interactive editing capability with a cathode ray tube (CRT), i.e., eliminating the plotting table. He also discussed orthophoto printing.

*Dr. Case* (U.S.A.) asked if it was possible to put orientation data e.g. from earlier aerotriangulation directly to the program of an analytical plotter. *Mr. Jaksic* answered that such possibility is already used.

Author: *Dr. G. Konecny* (F.R.G.)  
Title: Software Aspects of Analytical Plotters IP III/06

*Dr. Konecny* said that his presentation was a revised version of the one presented at the Torino Symposium and published in a German periodical.

In his comprehensive presentation *Dr. Konecny* listed all analytical plotters with their features, particularly with regard to software. He classified the equipment as fully analytical plotters, digital stereo cartographs, and stereocords, the latter having no feedback for continuous plotting. He made a comparison of costs in 1972 and 1976, noting that the overall cost of analytical plotters was going down as a consequence of less costly computers. He then suggested that software

costs might go down if the software were user (not equipment) oriented and were usable in various plotters.

At the end, *Dr. Konecny* called upon *Mr. E. Keune* (F.R.G.) and asked him to give the brief general presentation on software that he had prepared for A.P.C. *Mr. Keune* mentioned some advantages of the program for searching error or destinating turning-point of the terrain.

#### Presented Paper

Author: *Mr. H. Rüdener* (F.R.G.)  
Title: Digitale Datenerfassung mit dem analytischen Plotter AP/C-3 PP III/42

Next, there was a Presented Paper on semi-automatic point transfer using analytical plotters. No marking is necessary and the plotter automatically drives to previously measured points (on one photo) and the operator need only remove parallax on the second plate.

*Dr. E. Dorrer* (F.R.G.) put forward a question to *Dr. Konecny* about classification of analytical plotters and to *Mr. Keune* about transferring points from one strip to the next one. *Mr. Keune* answered, that it is possible, if there is a program for such transformation. *Dr. Höhle* (Switzerland) also asked about the classification of analytical plotters.

#### Panel Discussion

Topic: Presentation of New Analytical Instruments

Moderator: *Dr. G. Inghilleri*

After opening the panel the chairman informed the audience that a new instrument belonging to the category of digital stereocartographs called PC 1 had been built by Officine Galileo. However, its presentation had been delayed due to the military nature of the instrument:

The following panelists gave a description of their instruments:

*Mr. Ch. Vigneron* (France): Traster of Matra  
*Mr. A. M. Colla* (Italy): New version of APC 4 by OMI

*Mr. S. Menchinelli* (Italy): The off-line orthophotoequipment OP 2 of OMI

*Miss A. M. Michellis* (Italy): D.S. analytical plotter of Officine Galileo with renewed computer and software

*Dr. H.-K. Meier* (F.R.G.): The line of computer connected instruments of Carl Zeiss, Oberkochen with the Planicomp C 100 as the analytical instrument.

*Mr. R. Hamaguchi* (Canada): The Instronics Ltd analytical Plotter built in cooperation with NRC of Canada.

*Mr. U. V. Helava* (U.S.A.): The U. S. 1 built by Bendix.

The chairman informed the audience that 11 presented papers gave further contribution to the topic of the session, but that they could not be presented for lack of time.

Thursday, July 15, 1976, from 15.45 to 17.15  
Session 4 of Commission II

Topic: Analogical Instrumentations  
Chairman: *Dr. A. J. van der Weele* (Netherlands)

#### Invited Papers

Author: *Mr. H. C. Zorn* (Netherlands)  
Title: The Development of Analogue Instruments *IP III/08*

*Mr. Zorn* stressed that his report was supposed to be a comprehensive review of all the new analogue instruments. But the completeness of the information to be contained in the report depended greatly on the collaboration of the manufacturing companies, which unfortunately had not always been readily available. Consequently, the report was lacking in many places.

Author: *Dr. B. Makarović* (Netherlands)  
Title: Trends in the Development of Computer Supported Analogue Instruments *IP III/07*

*Mr. E. Greer* (South Africa) mentioned a system with feedback from computer to an analogue instrument for profile measuring.

#### Presented Papers

Author: *Dr. E. Dorrer* (F.R.G.)  
Title: Software Aspects in Computer-Assisted Stereoplotting *PP III/07*

After considering three different combinations of calculators for assisting stereoplotters, i.e., desk, mini and terminal, *Dr. Dorrer* spoke more about the application of the first one. *Dr. J. Trinder* (Australia) asked about the speed of registration when using a desk calculator. *Dr. Dorrer* answered that it is possible to record 3 to 5 points per second.

Author: *Mr. G. E. Bormann* (Switzerland)  
Title: Features and Design Parameters of the Wild Aviomap System *PP III/02*

Author: *Mr. H. Schöler* (G.D.R.)  
Title: Some Comments on the Comparison of Instrument Parameters of Stereoplotters *PP III/45*

*Mr. Schöler* presented three instruments by Zeiss Jena, namely, the Topoflex, Topocart and Stereometrograph, and gave for each of them their field of application.

Author: *Dr. R. Schwebel* (F.R.G.)  
Title: The New Photogrammetric Data Acquisition and Transfer System ECOMAT 12 *PP III/50*

In his presentation *Dr. Schwebel* observed that the three instruments of Carl Zeiss, Planimat, Planicart and Planitop, cover all the requirements of photogrammetric work.

Author: *Mr. J. Klaver* (Switzerland)  
Title: The Kern PG 2-AT Semi-Automatic Stereoplotter System *PP III/24*

The chairman regretted that there was no more time for the presentation of the following two Presented Papers that had been announced: "The Galileo Stereosimplex G6" by *Dr. W. G. Ferri* (Italy) *PP III/08* and "The Stereo Facet Plotter" by *Mr. H. Yzerman* (Switzerland).

Friday, July 16, 1976, from 9.00 to 10.30 and from 10.45 to 12.15  
Session 5 of Commission II

Topic: Automation in Photogrammetry  
Chairmen: *Mr. G. Ducher* (France)  
*Dr. G. Inghilleri* (Italy)

These two consecutive sessions on automation in photogrammetry were held jointly with Commission IV and are reported under that Commission.

Monday, July 19, 1976, from 14.00 to 15.30 and from 15.45 to 17.15  
Session 6 of Commission II

#### Panel Discussion between Builders and Users of Photogrammetric Instruments

- Topics:
1. Is the current equipment adequate for training in photogrammetry at the various levels?
  2. Should there not be a greater effort towards standardizing photogrammetric equipment?
  3. Should more emphasis be given to developing equipment for non-conventional applications?
  4. Should more of the equipment be capable of correcting for model deformation?
  5. Should emphasis be given to equipment that directly generates information?
  6. Is the current photogrammetric equipment adequate for map revision?

Chairman, Lecturer and Moderator: *Dr. S. G. Gamble* (Canada)  
Co-Chairman: *Mr. K. Rainesalo* (Finland)

Panelists representing users:  
*Dr. H. G. Jerie* (Netherlands)  
*Dr. G. Inghilleri* (Italy)  
*Dr. H. M. Karara* (U.S.A.)  
*Mr. P. Mott* (U.K.)  
*Dr. S. K. Ghosh* (U.S.A.)  
*Mr. G. Ducher* (France)

Panelists representing manufacturers:  
*Mr. G. E. Bormann* (Switzerland)  
*Dr. H.-K. Meier* (F.R.G.)  
*Mr. J. O. Danko* (U.S.A.)  
*Mr. H. Busch* (France)  
*Mr. J. Klaver* (Switzerland)

The chairman announced that the procedure to be followed would be to deal with each of the six questions listed above with one panelist representing users and one representing builders. The co-chairman dealt with the question concerning the establishment of a special category within the I.S.P. for sustaining members. Panelists *Dr. Jerie* (users) and *Dr. Bormann* (builders) discussed the first question, concerning

the adequateness of current equipment for training in photogrammetry at various levels.

*Dr. Jerie* spoke on experiences gained in training at the operator level at the International Institute for Aerial Survey and Earth Sciences (ITC), Enschede, Netherlands, presenting instruments and educational routines.

*Mr. Bormann* presented Wild apparatuses adequate for training purposes, Wild being particularly interested in this field. Wild prepares also special materials used in training given in Switzerland by private companies and by the Swiss School for Photogrammetric Operators in St. Gallen.

The discussion was continued by *Messrs. P. Roos* (Netherlands), *R. C. Barrett* (U.K.), *R. Scholl* (Switzerland), *H. Zorn* (Netherlands), *Dr. D. Gordon* (New Zealand), *Dr. B. Macarovic* (Netherlands) and by *Mr. Danko*, *Mr. Klaver* and *Dr. Inghilleri* who spoke about the role of double optical systems in training, about the problem of training large numbers of people, about the costs of the instruments involved, and about training at upper levels.

The chairman concluded that if we have specialists training photogrammetrists at the various levels maybe there is a need for training equipment. There are several levels of training and quite obviously different types and classes of equipment are needed.

The second question, concerning the eventual standardization of photogrammetric equipment, was shared by *Dr. Inghilleri* (users) and *Dr. Meier* (builders).

The representative of the users, *Dr. Inghilleri*, spoke about the differences between the construction of a plant for which mutually compatible parts are needed and the construction of a machine in which the greater number of parts are built by a single company, which buys only a few common parts of the machine outside. He stressed that photogrammetric apparatuses fall into the latter group, and that photogrammetric companies are not interested in promoting the standardization of parts of instruments. Nevertheless, the coordinatograph, the coordinate recorder and, perhaps, the orthophoto instruments can be considered as peripherals suitable to be standardized.

The representative of the builders, *Dr. Meier*, first defined the word standardization to be "finding of an economic and optimal solution of the repeating problems". He also observed that standardization is not an academic problem, but an economic one. Furthermore, standardization generates clarity both in terminology and in operations. Standardization is possible at different levels, and for each level it is necessary to establish its own convenience. He also pointed out that standardization must be done very fast, or it will be a very expensive procedure.

The audience joined in the discussion. *Dr. Jerie* observed that the areas of standardization should be clearly defined. *Mr. Zorn* stated that also small but important things, such as voltages, pins, etc., should be standardized. *Mr. Grabmaier* (Netherlands) pointed out the importance of standardization of the coordinate systems including the positive sense of the rotational elements. This seems important with respect to numerical orientation procedures and inde-

pendent model triangulation. *Mr. Danko* observed that standardization is a fine thing as far as it does not hinder progress in the development and innovation of new instrumentation.

Panelists *Dr. Karara* (users) and *Mr. Danko* (builders) opened the discussion on the third question, on the emphasis to be given to developing equipment for non-conventional applications.

*Dr. Karara* said that, instead of non-conventional photogrammetry, one should speak of short-range photogrammetry. He discussed the use of metric and non-metric cameras, and pointed out that comparators and analytical plotters at low cost and of small format should be available for the use of non-metric cameras. *Mr. Danko* agreed with *Dr. Karara*, and stressed that non-conventional photogrammetry opens a new market, since simple instruments at low cost are required for some of the uses that he had listed.

Photogrammetrists sitting in the audience intervened in the discussion: *Dr. D. Hobbie* (F.R.G.) spoke about the stereocord, *Mr. Mott* stated that close-range instruments are becoming more and more complex, whereas most of the close-range work is still limited to relatively small projects, whereafter *Mr. Busch* asked about the accuracy required. In answer to this, *Dr. Karara* said 10—15 microns. *Dr. Inghilleri* pointed out other fields of non-conventional photogrammetry, x-rays, panoramic cameras, etc. *Dr. R. E. Herron* (U.S.A.) stressed that the cost of the apparatuses was not to be the sole criteria. *Dr. L. Stoch* (Israel) observed that the problems arising concern cameras, not plotting instruments. *Dr. Meier* stated that the requirements in the field of non-conventional photogrammetry are different and cannot, therefore, be satisfied at low cost. Finally *Mr. Bormann* made a remark to the effect that it is nonsensical to use a "half-a-million" analytical plotter for the exploitation of photographs taken with a "ten-dollar" camera. *Dr. Karara* closed with: "Better a ten-dollar camera than nothing."

After a short break the session was continued with a discussion of the remaining three of the foreseen six questions.

Panelists *Mr. Mott* (users) and *Mr. Busch* (builders) started this latter session with a discussion on equipment capable of correcting for model deformation.

*Mr. Mott* observed that, after the earth curvature and refraction corrections, no more corrections are needed for plotting, because the cameras of today are very good. *Mr. Busch* did not agree with him, because, according to his opinion, also the effects of lens distortion, film shrinkage and other errors must be corrected. These corrections are easy to make with analytical instruments, but difficult with analogue ones. In addition to the panelists photogrammetrists in the audience participated in the discussion: *Dr. Inghilleri* said that many errors arise in the process of taking photographs even with a very good camera. He pointed out also that model deformations can be corrected in computer-assisted plotters. *Mr. Zorn* stressed that a large model deformation has causes that must be analyzed, and that the practice of correcting

model deformation may be dangerous. *Mr. Mott* intervened by saying that, if the film shrinkage is negligible, the model should not be deformed. *Mr. J. Thorpe* (South Africa) did not agree with *Mr. Mott* and said that lens distortion correction is essential.

*Messieurs Roos* and *Klaver* spoke on model deformation and on various possibilities of correcting it. *Dr. E. P. Welander* (Sweden) pointed out that the radial distortion of  $\sim 2 \mu\text{m}$  for modern cameras can be ignored today, but the refraction and earth curvature have to be corrected. What is still needed from the camera manufacturers is a sensitometric control by means of a step tablet built into the aereal camera. In that way the processing and the exposure can be matched. *Dr. Ghosh* stressed that there are many systematic errors that must be corrected. *Dr. Welander* spoke on the possibilities of ameliorating photographs.

Panelists *Dr. Ghosh* represented the users and *Mr. Klaver* the builders in the discussion on equipment that directly generates information, i.e., on question number five.

*Dr. Ghosh* pointed out that there are users who need direct information concerning things such as velocity of object point, angles between crystal surfaces etc., and observed that this is a new field in which much can be accomplished with the help of photogrammetry. *Dr. Gamble* intervened to say that a non-photogrammetric method, involving electrical and mechanical engineers, already existed for the direct generation of the types of information mentioned by *Dr. Ghosh*.

In the course of the ensuing general discussion *Dr. Meier* said that the question is how the photogrammetric information is processed; there are a lot of interfaces for the processing on-line or off-line: for the decision a careful system analysis must be done. *Mr. Z. Jaksic* requested that the question be better formulated. *Dr. Makarovič*, in turn, supported the formulation of the question, pointing out that the generation of direct information involves the presentation of information in the way desired by the user.

Panelist *Mr. Ducher* (users) opened the discussion on the adequateness of photogrammetric equipment for map revision. He spoke about the instruments used in map revision, such as the E.T.S. of Bausch & Lomb and the Stereo Facet of OMI. He listed the requirements set for instruments suitable for map revision. He also gave a list of the specifications that have to be taken into account, such as stereoscopic vision simultaneous with the vision of the map, a good range of enlargements, easy superimposition of the facet on the map, good illumination, low cost, and so on.

*Dr. M. Tienstra* (Netherlands) of the audience was of the opinion that simple instruments require difficult methodology, and that it is better to use more sophisticated instruments with which it is possible to use simple and well-known procedures. He also spoke of the use of orthophoto in map revision. *Mr. Ducher* was not convinced about the use of orthophoto.

Further on, *Mr. J. I. Davidson* (U.S.A.) observed that map revision is rather a cartographic problem than a photogrammetric one. *Dr.*

*Macarovič* pointed out that an updating system should be flexible. An efficient way is to apply digital mono-plotting which comprises of digitizing on original photographs, and transformation of the data (including DTM) into the map. For this an affine transformation with linear prediction is feasible.

The chairman thanked all who had participated in the panel, both panelists and audience, and closed the session.

Thursday, July 22, 1976, from 15.00 to 15.45  
Session 7 of Commission II

Topic: Business Meeting  
Chairman: *Dr. G. Inghilleri* (Italy)

The chairman opened the session by saying that the only point remaining on the agenda was the final drafting of the proposed Resolutions. He explained that eight Resolutions had been set forth by the Committee established at the first Business Meeting of the Commission. *Dr. Inghilleri* thanked the Committee for its work and asked *Dr. B. Makarovič* (Netherlands) to read the drafted Resolutions. *Dr. Makarovič* presented the Resolutions to the meeting, which then gave its unanimous approval. *Dr. Inghilleri* remarked that all of the proposals would be submitted to the Resolutions Committee, which has the responsibility of presenting the drafted Resolutions to the Plenary Session for its approval (see Part I page 76).

*Dr. Inghilleri* extended his sincere thanks to all those who had contributed to the successful work of the Commission during the past four years and at the Congress. He urged the members of the Commission to give the same kind of support to the newly elected President of Commission II.

The meeting then adjourned.

Friday, July 23, 1976, from 9.00 to 10.30  
Session 8 of Commission II

Topic: Standard Tests  
Chairman: *Dr. K. Szangolies* (G.D.R.)

The chairman opened the session, recalling the ten years of activity of Working Group II/2, which had been chaired first by *Dr. R. Burkhardt* (F.R.G.) and after him by *Dr. M. Döhler* (F.R.G.). He also mentioned the report presented at the Ottawa Congress. During the past four-year period the Working Group was to probe the Standard Tests in practical applications and was to make an effort to improve and simplify them.

#### Working Group Paper

Author: *Dr. M. Döhler* (F.R.G.)  
Title: Standardtests für photogrammetrische Auswertegeräte WGR III/02

*Mr. H. D. Janssen* (F.R.G.) read the Report prepared by *Dr. Döhler* who could not attend the Congress.

*Mr. K. Grabmeier* of I.T.C. (Netherlands) and *Dr. H.-K. Meier* of Carl Zeiss (F.R.G.) commented on the Report, making some remarks concerning the software and the complexity of Standard Tests.

## Presented Papers

Authors: *Mrs. Aino Savolainen* (Finland)  
*Mr. R. Ruotsalainen* (Finland)  
Title: Experiences of the ISP Standard Tests PP III/43

In delivering her Paper, *Mrs. Savolainen* pointed out that one problem is that of the accuracy of grid plates. Here *Dr. Meier* informed the audience that grid plates with maximum errors of less than one micrometer are now available.

Author: *Mr. H.-D. Janssen* (F.R.G.)  
Title: Bemerkungen zum Standardtest für Komparatoren PP III/22

Upon *Mr. Janssen's* presentation, *Mr. Grabmeier* pointed out that only the affinity error had been considered. *Mr. Janssen* answered that a more sophisticated mathematical model would be necessary.

Author: *Dr. K. Szangolies* (G.D.R.)  
Title: On the Definition of the Accuracy of Stereoplotters PP II/58

Upon *Dr. Szangolies's* presentation *Dr. Meier* pointed out, that for the user it is more important to test his own instrument for a prospective problem, than make tests between several instruments.

*Dr. Macarovič* (Netherlands) mentioned, that from the very beginning it was clear, for the WG II/2, that it is necessary for the user to test his instrument for several input materials.

The chairman closed the session after recommending the use of I.S.P. Standard Tests and after announcing that Working Group II/2 had finished its activity.

## COMMISSION III

### MATHEMATICAL ANALYSIS OF DATA

### ASPECTS MATHÉMATIQUES DU TRAITEMENT DE L'INFORMATION

### MATHEMATISCHE GESICHTSPUNKTE DER INFORMATIONSVERRARBEITUNG

President: *Dr. F. Ackermann* (F.R.G.)  
Secretary: *Dr. H. Bauer* (F.R.G.)

Tuesday, July 13, 1976, from 14.00 to 15.30  
Session 1 of Commission III

Topic: Aerial Triangulation (1): State of Development, Auxiliary Data, Point Transfer

Chairmen: *Dr. F. Ackermann* (F.R.G.)  
*Dr. H. Bauer* (F.R.G.)

#### Invited Paper

Author: *Dr. F. Ackermann* (F.R.G.)  
Title: On the Development in the Field of ISP Commission III during 1972—1976 CR III/01

*Dr. Ackermann* reviewed past and current developments, reaching the conclusion that, after a long and intensive period of development, the final goals sought in this area had nearly been achieved and that future efforts should be concentrated on: use of minicomputers for aerial triangulation; refinement of self-calibration procedures; comparison of mono- and stereocomparators; determination and accuracy of perspective centers in analogue instruments; investigation of point transfer problems; and detection and elimination of gross data errors.

Then *Dr. Ackermann* proceeded to give a brief summary of the following Presented Papers, for the full presentation of which there would not have been enough time.

Author: *Dr. I. Antipov* (U.S.S.R.)  
Title: Automated System of Processing Photogrammetric Measurements PP III/08

This article dealt with strip and block triangulation.

Author: *Mr. M. Allam* (Canada)  
Title: Photogrammetric Deformation of Lake Surfaces Caused by Air Temperature Differential over Water Bodies PP III/04

Here the author discussed the effects of special errors in APR measurements of lake shore points, due to the refraction effect on the rays at the interface between cold and warm air layers which develop during the exposure of aerial photography.

Authors: *Dr. H. Ebner* (F.R.G.)  
*Mr. R. Mayer* (F.R.G.)  
Title: Numerical Accuracy of Block Adjustments PP III/20

In this work it is shown that a word length of 60 bits is sufficient in computers for the computational purposes of block adjustment.

Author: *Dr. W. Faig* (Canada)  
Title: Independent Model Triangulation with Auxiliary Vertical Control PP III/21

Here the author observed that recent developments indicated the possibility of substantial reductions in vertical control requirements when using auxiliary data in simultaneous photogrammetric block adjustments.

Tests had indicated that the bridging distance can be increased to the extent that there is virtually no need for control points within the block for small and medium scale mapping purposes.

Authors: *Mr. H. Leppänen* (Finland)  
*Mr. I. Kukkonen* (Finland)  
Title: The "MAPS" Data System for Mapping Projects PP III/36

Here the authors presented a software package for block adjustment and geodetic calculations which makes possible a comprehensive data flow in topographical mapping.

Author: *Mr. A. Salmán Gonzáles* (Mexico)  
Title: Development of Aerial Triangulation in CETENAL Mexico

The author gave a report on the development of aerial triangulation in Mexico where extensive use is made of the polynomial adjustment of blocks developed by *Mr. G. Schut* at N.R.C., Canada.

The first paper of the session was given by *Mr. Z. Paršić* from Switzerland.

#### Presented Papers

Author: *Mr. Z. Paršić* (Switzerland)  
Title: Ergebnisse einer Aerotriangulation nach unabhängigen Modellen am Autographen Wild A10: OEEPE Oberschwaben-Block-Zürich PP III/44

*Mr. Paršić* presented results from independent model triangulation using the Wild Autograph A 10. Location of projection centers on an analogue plotter and various control point configurations were evaluated in tests performed with a portion of the Oberschwaben test area.

A comparison was made between the results of aerotriangulation using targeted points and transferred points. The two methods proved to be equally accurate.

*Dr. F. Ackermann* (F.R.G.) intervened by observing that in planimetric adjustment more accurate results were obtained with transferred points than with targeted points. *Mr. Paršić* answered that this was probably due to the difference between the sizes of the measuring marks and of the points to be measured. The ratio was 1:1.2 for the transfer points and 1:0.8 for the targeted points.

Authors: *Dr. J. Albertz* (F.R.G.)  
*Mr. W. Kreiling* (F.R.G.)  
*Mr. J. Wiesel* (F.R.G.)  
Title: Weitere Untersuchungen zur Blocktriangulation ohne Punktübertragung PP III/02

*Dr. Albertz* with *Mr. Kreiling* and *Mr. Wiesel* had experimented with block triangulation without point transfer. Accuracies of 6  $\mu$ m to 7  $\mu$ m at image scale and elevations to within 1/1000 of flight elevation were achieved.

The economy of this method is satisfactory, provided that use is made of blocks with unusual overlap, forward overlap = 20% and side lap = 60%. Equally accurate results are obtained with this method as with conventional aerotriangulation.

*Colonel M. Datta* (India) asked what the share of point transfer was estimated to be. *Dr. Albertz* replied that he was unable to give any detailed estimate of the role played by point transfer, having based his statement on rather crude data. *Dr. H. Schmid* (Switzerland) pointed out that the method here discussed differs from the use of conventional blocks only in what concerns overlap. As regards the principle of analytical geometry, it is the same as the one applied in conventional bundle adjustment.

*Dr. R. Helmering* (U.S.A.) asked how the results obtained were to be used in the subsequent mapping process. *Dr. Albertz* replied that they were used for the orientation of models. For this purpose suitable points have been chosen and measured simultaneously with the points to be used in triangulation. Intersection is used for the calculation of their coordinates.

*Dr. H. Ebner* (F.R.G.) asked whether aerial photography was not difficult with a forward overlap of 20% and a side lap of 60%. He also inquired whether manual exposure was required in the photography. *Dr. Albertz* answered that the slight deficiencies in matching that occur when photographing without manual exposure cause no problem.

Authors: *Mr. M. Allam* (Canada)  
*Mr. C. Wong* (Canada)  
*Mr. C. Chaly* (Canada)  
Title: Geometrical Distribution of Vertical Control and the Simultaneous Adjustment of Auxiliary Data in Independent Model Triangulation PP III/06

A report was given of results of the use of auxiliary data with independent model triangulations. The use of an Airborne Profile Recorder (APR) along and across flights and the use of lakes for auxiliary vertical control had yielded increased vertical accuracies and permitted increased bridging distances.

*Mr. J. Gauthier* (Canada), who read the paper, gave also some further information about the SPACEM program.

In the course of the subsequent general discussion, *Dr. W. Faig* (Canada) completed the statements made by *Mr. Gauthier* by observing that he had come to similar conclusions in his own work.

*Mr. J. Kure* (Netherlands) said it was astonishing to hear that accuracy was improved with a reduction of APR-points. He himself had experienced the contrary. *Dr. J. Zarzycki* (Canada) answered to this by saying that the poor points were removed, thus improving the quality of the final results.

Author: *Dr. A. Lobanov* (U.S.S.R.)  
Title: Analytical Aerotriangulation and Its Application in the U.S.S.R. PP III/38

In the absence of *Dr. Lobanov*, *Dr. I. Antipov* (U.S.S.R.) reviewed analytical aerotriangulation in the U.S.S.R. Efforts had been concentrated on



analytical aerotriangulation, systems analysis, and combinations of programs for photogrammetric and geodetic work. At the time, approximately 70 per cent of aerotriangulation in the U.S.S.R. was done by analytical methods.

Tuesday, July 13, 1976, from 15.45 to 17.15  
Session 2 of Commission III

Topic: Aerial Triangulation (2): Systematic Image Errors, Self-Calibrating Block Adjustment

Chairman: *Dr. J. Anderson* (U.S.A.)

After opening the session, *Dr. Anderson* listed the following papers related to the topic at hand, but for the presentation of which there would not have been enough time.

Author: *Dr. P. Boniface* (Australia)  
Title: The Effect of Manual Plate-Centering on the Accuracy of Independent Model Triangulation *PP III/15*

Here *Dr. Boniface* discussed the effect of plate-centering errors on models of independent model triangulation which require reobservation. It is shown that unless a diapositive is centered on a plate-holder in a position identical to that of the original observation, undetected "phi cracks" can occur which will give rise to large errors in height even after a strip adjustment. A method of correcting these errors at the observation stage is proposed and the error propagation is studied by means of a large scale test area. *Dr. Boniface* concludes that models are not in fact independent and must be observed in strict sequence in order to maintain optimum triangulation accuracy.

Author: *Dr. A. Grün* (F.R.G.)  
Title: Die simultane Kompensation systematischer Fehler mit dem Münchener Bündelprogramm MBOP *PP III/24*

*Dr. Grün* presents here a new and operational computer program (i.e. computation of starting values, automatical detection and elimination of gross errors together with the adjustment in one program) based on a very general and variable bundle formula: rigorous solution with additional parameters as weighted observations, analysis of the stochastic properties of these parameters, control points as weighted observations.

Author: *Mr. G. Haug* (F.R.G.)  
Title: Analysis and Reduction of the Systematic Image and Model Deformations of the Aerial Triangulation Test Oberschwaben *PP III/25*

The paper deals with a method for the correction of the influence of systematic image and model deformations in aerial triangulation which had been suggested by *Mr. G. de Masson d'Autume* (France). The method is applied to the test material of Oberschwaben. The results of block adjustments by the bundle method and by the method of independent models, with and without correction for systematic errors, are compared with each other and checked for the harmony with theoretical accuracy expectations. Here the

bundle method proves to be superior to the method of independent models.

Author: *Ms. J. Hvidegaard* (Denmark)  
Title: Densification of Trigonometric Nets. Practical Experiences with Bundle Adjustment *PP III/27*

Here the accuracy of 11 blocks, covering an area of 631 km<sup>2</sup>, has been tested in the field by measuring distances between points with determined coordinates. The standard error of the distances calculated from the coordinates of 850 photogrammetrically determined points was 5 cm. The photo scale was 1:8000—1:10000.

Author: *Mr. M. Schilcher* (F.R.G.)  
Title: Some Practical Examples of Systematic Errors of Stereo-Models *PP III/52*

A study of various controlled blocks has produced interesting and valuable information regarding important characteristics of systematic model errors. The most essential result of empirical analysis is proof that the magnitude of the systematic horizontal and vertical errors of the model is considerable, with only slight variance. As a rule, correction therefore results in considerably increased accuracy.

Author: *Mr. L. Turdeanu* (Romania)  
Title: Un procédé de compensation en bloc des photographes à recouvrement simple pour le cas des terrains plans *PP III/61*

The author suggests an adjustment method for blocks of aerial photographs having 20 per cent forward overlap and sidelap in flat ground, where stereoplotting is not necessary. This method implies a reduced number of control points — on the two sides of the block — which are to be determined in the ground, thus, using two tie points for photograph connection.

Author: *Mr. L. Mauelshagen* (F.R.G.)  
Title: Teilkalibrierung eines photogrammetrischen Systems unter Verwendung von Testfeldern *PP III/40*

A report on test field calibration is given. Neglecting the determination of the focal length and the coordinates of the principle point, a calibration was done over the nearly levelled Rheidt/Bonn test area using different control point configurations. Results of wide angle and super wide angle flights, which have been carried out in context with the OEEPE-mission of Oberschwaben 1969, are presented for single, double and quadruple strips applying a partial third order polynomial (additional parameters).

Author: *Dr. J. Thomas* (F.R.G.)  
Title: Kompensation systematischer Bildfehler durch die Bildflughanordnung? *PP III/59*

The question is considered, whether a compensation of systematic errors is to be reached by manifold flying and subsequent simultaneous bundle adjustment. Based on extensive empirical investigations fundamental connections between types of systematic image errors and optimal compensating flying dispositions are found; the respectively resulting compensation can be re-



duced to the arithmetic mean (of all photo-overlaps) of the systematic errors in the image plane. For that average of two-dimensional errors in a two-dimensional distribution a graphical and an algebraic method is developed, the meaning of which exceeds the application in photogrammetric block adjustment. With the aid of both methods, partly novel flying dispositions for compensation of systematic image errors are conceived; under economic aspects, too, manifold flying represents a real alternative to photo-flying practised till now.

The first paper of the session was given by *Dr. H. Ebner* from the Federal Republic of Germany.

#### Invited Paper

Author: *Dr. H. Ebner* (F.R.G.)  
Title: Self-Calibrating Block Adjustment  
IP III/04

*Dr. Ebner* discussed a method for simultaneous self-calibration for bundle or independent models block adjustment and results obtained with the Oberschwaben test site. Results agree with theoretical developments based on random errors only and confirm the effectiveness of compensation of the systematic errors by self-calibration. Also in agreement with theory, the bundle adjustment with self-calibration had proved superior to independent models with self-calibration.

In the course of the general discussion that followed, *Mr. G. Schut* (Canada) said it would be interesting to make a comparison between the correction parameters suggested by the author, *Mr. de Masson d'Autume* and himself. He also warned against the use of too many parameters, as according to his experience 12 parameters double the computing time required. Using additional parameters in only one adjustment saves computing time.

*Dr. Ebner* answered that the use of several parameters and groups of parameters is justified if high accuracy is required. If error detection is taken into consideration, the computing time needed is increased by only 20 to 30 per cent.

#### Presented Papers

Authors: *Dr. P. Wiser* (Belgium)  
*Dr. F. Ackermann* (F.R.G.)  
Title: The OEEPE Test "Oberschwaben"  
PP III/62

*Dr. Ackermann* presented results using the bundle adjustment with added parameters in a triangulation of the Oberschwaben test site. With self-calibration, the bundle adjustment furnished the more accurate results when compared with an independent model adjustment. He observed that, in this test, the accuracy obtained was three times the one expected, and that in fact the theoretically expected accuracy has been reached for the first time here.

Author: *Dr. G. Kupfer* (F.R.G.)  
Title: On Accuracy Achieved by Different Triangulation Procedures PP III/33

By order of the State Survey Office of Northrhine-Westphalia the Rheinbach area near Bonn of approximately 8x10 square kilometers had been flown twice in perpendicular directions, using a

Zeiss RMK A 15/23. Before and after that the Rheidt test field area had been flown with four test strips each for the purpose of partial field calibration of the system.

*Dr. Kupfer* discussed accuracies achieved by different triangulation methods. He found the bundle and anblock methods using image data refined by field calibration provided results superior to those obtained with unrefined data. The largest corrections of the image coordinates were 10  $\mu\text{m}$ .

Author: *Dr. W. Tegeler* (F.R.G.)  
Title: Densification of Trigonometric Networks by Bundle Adjustment PP III/58

*Dr. Tegeler* had used a bundle adjustment with added parameters in tests made for photogrammetric network densification using the Hordorf test area. Substantial reductions in the errors had been achieved by utilizing the added parameters.

In 1974 the Landesvermessung of Lower Saxony had carried out a photogrammetric network densification on a photo scale of 1:6000 in the test area (6 kmx12 km) of Hordorf. The planimetric accuracy of the control and check points had amounted to 1 cm. The RMS errors of coordinates of the multiple blocks with 10 horizontal control points at the perimeter had been as follows:

Double-blocks:  $m_{EN} = \pm 3,3 \text{ cm}$  (5,4  $\mu\text{m}$ )  
Fourfold-block:  $m_{EN} = \pm 2,5 \text{ cm}$  (4,2  $\mu\text{m}$ )

Author: *Mr. K. Jacobsen* (F.R.G.)  
Title: Test Königshügel, Control by Bundle Adjustment PP III/28

*Mr. Jacobsen* had used a bundle adjustment with added parameters in Test Königshügel. The results had been computed with an independent model adjustment corrected by prediction with filtering. The test area control had had distortions. By manipulating the weights of control points, the bundle adjustment had produced improved results which had been comparable to results obtained by prediction and filtering.

The result of the measurement with the Wild A 7 had shown a 47% to 79% higher error than the results of the measurements with the comparator.

Wednesday, July 14, 1976, from 9.00 to 10.30  
Session 3 of Commission III

Topic: Aerial Triangulation (3): Methods, Computer Programs, Application  
Chairman: *Dr. F. Ackermann* (F.R.G.)

*Dr. Ackermann* opened the meeting and then briefly discussed a number of Presented Papers that he considered of interest, but for the full presentation of which there would not have been enough time.

Author: *Colonel G. Agarwal* (India)  
Title: A Study of Errors in Slotted Templet Combination PP III/01

The planimetric accuracy expected of a slotted templet combination is usually calculated by an empirical formula known as Trorey's formula. The applicability of this formula has been analyzed with the help of a large statistical sample of combinations carried out under controlled

conditions for different control distributions. Under the condition that certain rules of control point configuration are adhered to, a new formula for the prediction of errors is presented here.

Author: *Mr. M. Ali* (Canada)  
Title: Aerial Triangulation with SKYLAB Photography PP III/03

A research program had been carried out to utilize the SKYLAB photography for aerial triangulation purposes. An efficient algorithm had been developed and had been tested to adjust simultaneously the photogrammetric measurements and the coordinates of the ground control points. As an example, using one SKYLAB model, covering an area of 165x100 sqkm, and seven ground control points whose coordinates were known to the nearest 500 m, it had been possible to obtain RMS errors of 67 m in planimetry and 136 m in height respectively.

Authors: *Dr. I. Katzarsky* (Bulgaria)  
*Dr. D. Antonov* (Bulgaria)  
Title: A Program for Semi-Analytical Aerial Triangulation PP III/29

A program for semi-analytical strip aerial triangulation by independent models is developed. It incorporates: perspective center determination, strip formation, absolute orientation and adjustment. Strip adjustment is done by second-degree polynomial interpolation separately for each coordinate axis. Except ground coordinates of new determined points, the output information also contains data for the accuracy and for rejection of gross errors, as well as other intermediate information.

Author: *Mr. J. Blais* (Canada)  
Title: SPACE-M — Spatial Photogrammetric Adjustment for Control Extensions Using Independent Models PP III/14

The computer program SPACE-M has been designed to adjust large blocks of independent stereoscopic models with very few restrictions about the position and density of ground control points, and with the flexibility of using auxiliary control information such as lake surfaces as levelling constraints.

Author: *Colonel P. Datta* (India)  
Title: A Generalised Mathematical Model for Photogrammetric Adjustment and Interpolation PP III/16

Problems of digital and computational photogrammetry are here looked upon as problems of mathematical interpolation involving two steps. First, the parameters of a transformation of one vectorspace into another are worked out with corresponding samples from the two vectorspaces. Secondly, using these calculated parameters, the same transformation model is used to find the coordinate vector in one vectorspace corresponding to known coordinate vectors in the other.

Author: *Dr. W. Förstner* (F.R.G.)  
Title: Statistical Test Methods for Blunder Detection in Planimetric Block Triangulation PP III/22

In this paper the detection of gross errors with

the help of Baarda's Data Snooping Test are discussed. A presentation of the versatility of error detection is given.

Authors: *Mr. C. van den Hout* (Netherlands)  
*Dr. P. Stefanović* (Netherlands)  
Title: Efficient Analytical Relative Orientation PP III/26

This paper describes a new analytical relative orientation procedure. Compared with known methods, it requires less mathematical work in the initial computations and converges about three times more quickly.

Author: *Mr. R. Larsson* (Sweden)  
Title: System of Independent Conditions for Bundle Adjustments PP III/34

Here equations are developed that make it possible to prepare bundle adjustment programs for smaller computers.

Author: *Dr. M. Leupin* (Canada)  
Title: Optimisation of Photogrammetric Point Determination PP III/37

The optimisation of photogrammetric point determination is possible, if the costs and time consumption of point transfer and of the geodetical determination of additional control points are known.

Author: *Mr. M. Molenaar* (Netherlands)  
Title: Error Detection in Planimetric Block Adjustment PP III/41

As did the paper by *Dr. Förstner*, this paper deals with the detection of gross errors with the help of Baarda's Data Snooping Test.

Author: *Dr. A. Pérez Salas* (Argentina)  
Title: Analytical Aerial Triangulation: Its Obtention through a Simple Algorithm PP III/45

Here the mathematical principles of aerial triangulation are derived anew from a pedagogical point of view.

Authors: *Mr. H. Salmenperä* (Finland)  
*Mr. H. Vehkaperä* (Finland)  
Title: The Use of a Minicomputer in Photogrammetric Data Logging and Data Processing PP III/51

Here observations have been made with a PSK comparator supervised by an on-line computer HP 2100. The computer is used here both for the detection of gross errors and for block adjustment.

Next, *Mr. D. Brown* from the United States started the presentation of papers.

#### *Invited Paper*

Author: *Mr. D. Brown* (U.S.A.)  
Title: Bundle Adjustment — Progress and Prospects IP III/03

*Mr. Brown* considered the state of development of numerical photogrammetry citing results from numerous practical applications as foundations for his conclusions. *Mr. Brown*, an advocate of the use of added parameters in analytical block adjustment, was convinced that systematic errors contributed by the camera platen cause many of the discrepancies not before understood in ana-

lytical photogrammetry. Improved error models developments are (1) improved error models to compensate for systematic errors; (2) universal use of radial and tangential weight functions; (3) auto-regression processing of statorscope observations; (4) doppler control of large projects; (5) incorporation of inertial surveying methods; and (6) global positioning systems.

In the course of the general discussion the following comments were made.

*Dr. G. Kupfer* (F.R.G.) observed that in the S.W.A. photography of the Rheidt test field the vertical accuracy obtained was as expected when field calibration was used. To this *Mr. Brown* replied that in field calibration it is essential that the platen is calibrated as part of the radial distortion.

*Dr. F. Ackermann* (F.R.G.) said that in Oberschwaben no improvement was achieved by using self-calibration. He added that the reason for this was to be sought in the fact that in the Test Oberschwaben the image quality of S.W.A. photographs was much poorer than that of W.A. ones.

*Dr. D. Merchant* (U.S.A.) observed that vacuum causes a deformation of the platen, and that the deformation should thus change with the flying height. He asked whether it was not necessary to perform a calibration separately for every flight altitude. *Mr. Brown* answered yes and no, saying that the quality of new platen is so good that deformation caused by vacuum is not significant.

*Dr. H. Ebner* (F.R.G.) wondered whether an effort should not be made to standardize the correction terms used in self-calibration. *Mr. Brown* gave a positive answer, but added that further practical experience is necessary so that the best parameters can be found. In particular, the connection between the physical sources and systematic errors should be further studied. Very little has been heard about the systematic errors of the Wild cameras, especially RC 10.

*Mr. W. Pryor* (U.S.A.) said tests using the Zeiss aerial camera indicate that the vacuum platen system was the cause of large image position deformations. Newly designed platen had greatly reduced such deformations. He asked whether this meant that all aerial cameras should be tested for the deformations caused by the vacuum platen in use. He also asked whether it would be possible to develop camera calibration parameters for each type of aerial camera and, if so, should all aerial cameras be tested, using *Mr. Brown's* methods, before use for aerial analytical triangulation. *Mr. Brown* answered that he considered it appropriate to calibrate cameras before use. He said the quality of new platen was good, but that they are deformed with the times, so much so that they are rejected after the lapse of 4 to 6 years at the U.S.G.S.

#### Presented Papers

Authors: *Mr. E. Sigmark* (Sweden)  
*Mr. A. Andersson* (Sweden)  
Title: Block Triangulation by Independent  
Three-Dimensional Method PP III/55

A description of the Swedish block triangulation system "STEREO" was given. Here use was made of the method of independent models for

adjustment in planimetry and height according to the method of least squares. Practical results were demonstrated and discussed.

*Dr. P. Stefanović* (Netherlands) asked *Mr. Sigmark* whether this program could be used for the detection of gross errors. The answer given was to the effect that this obviously was not possible in an automatic way.

Authors: *Dr. B. Shmutter* (Israel)  
*Dr. A. Perlmutter* (Israel)  
Title: Block Triangulation PP III/54

*Drs. Shmutter* and *Perlmutter* discussed a simplified version of a bundle adjustment compatible with a small computer.

This triangulation procedure is applicable to photographs measured on a comparator as well as to stereomodels evaluated in an analogue instrument. The idea of the method is to replace the simultaneous solution of all unknowns by consecutive solutions of groups of unknowns, which is achieved by performing series of spatial resections and intersections of points taken one at a time.

The paper illustrates the method with two computed examples, a block consisting of single photographs and a block consisting of models evaluated in an Autograph A 8.

Author: *Mr. G. de Masson d'Autume* (France)  
Title: L'interpolation par une règle flexible (spline) et ses applications en photogrammétrie numérique PP III/39

*Mr. de Masson d'Autume*, in his paper given by a colleague, presented a method for "Interpolation by a Flexible Rod (Spline): Applications to Digital Photogrammetry".

Interpolation by flexible rod (spline) on N points can be carried out using an interpolation function which gives the value of a particular point as a linear function of the values of the N basic points. A very simple algorithm, using precalculated interpolation matrices, enables one to calculate the coefficients. The interpolation algorithm can be applied to various problems of digital photogrammetry, the most important applications being the parametrization of the systematic deformations of a bundle of rays, interpolation in a random distribution of points, filtering of grossly inaccurate data and finally an extremely simple method for the adjustment of aerial triangulation blocks.

Tests of the latter method yield results comparable to those obtained using independent models or the bundle adjustment.

Wednesday, July 14, 1976, from 14.00 to 15.30  
Session 4 of Commission III

Topic: Digital Terrain Models, Digital Mapping  
Chairman: *Dr. K. Kraus* (Austria)

The following Presented Papers related to the main topic of the session had been handed in, but could not be presented due to the lack of time.

Authors: *Dr. M. Allam* (Canada)  
*Dr. C. Wong* (Canada)  
Title: Gridding Topographical Surfaces  
PP III/05

Here a computer program has been written to obtain a Digital Terrain Model which is a regularly spaced grid of height points discrete from irregularly spaced points such as digitized contours.

Authors: *Dr. K. Kubik* (Netherlands)  
*Dr. A. Botman* (Netherlands)  
Title: Interpolation Accuracy for Topographic and Geological Surfaces *PP III/32*

This paper considers the theoretical accuracy of point interpolation for topographic and geological surfaces. The accuracy results prove that interpolation accuracy depends primarily on the properties of the surface, on the spacing of the control points, and, to a much lesser extent, on the interpolation methods used.

Author: *Dr. W. Marckwardt* (G.D.R.)  
Title: The Mathematical Treatment of Digitized Curved Lines *PP III/30*

A qualitative characteristic is correlated to each digitized point, permitting an analysis of the curve with a view to generalization and decimation of the data set to be stored.

Author: *Dr. U. Rauhala* (U.S.A.)  
Title: A Review of Array Algebra *PP III/48*

Array algebra is a concept generalizing conventional vector, matrix and tensor algebra. It deals with systems of multilinear equations that are at the base of the "fast" solution algorithms like the FFT. Estimation using array algebra is based on the theory of loop inverses, which is an extension of the generalized matrix inverses. A multilinear function theory, the array prediction using covariance functions, is the main application of the array estimation. It is based on banded R-matrices. With a regular grid of data considerable savings are achieved in computation and core space requirements compared with the conventional case.

The first paper of the session was presented by *Mr. G. Schut* from Canada.

#### *Invited Paper*

Author: *Mr. G. Schut* (Canada)  
Title: Interpolation Methods for Digital Terrain Models *IP III/07*

This paper reviewed the methods of height interpolation for digital terrain models which had been published in photogrammetric and related journals.

In the course of the following general discussion, *Dr. U. Rauhala* (U.S.A.) said that his array algebra provides a general solution for all interpolation methods. He said an advantage of his method is that the computer time required increases only linearly with the number of parameters used.

#### *Presented Papers*

Author: *Mr. O. Ayeni* (U.S.A.)  
Title: Objective Terrain Description and Classification for Digital Terrain Models *PP III/11*

Here various quantitative methods for describing

a terrain had been investigated. Based on the different terrain characteristics four major classes of terrains which span the whole spectrum of terrain types had been identified, using techniques of objective classification theory derived from multivariate statistical cluster analysis. Suggestions were made as to how the reactions of various interpolation techniques could be properly evaluated in relation to the four major classes of terrains with a view to achieving automation.

Author: *Dr. W. Stanger* (F.R.G.)  
Title: The Stuttgart Contour Program SCOP — Further Development and Review of Its Application *PP III/56*

The Stuttgart Contour Program SCOP described here has been conceived as an independent part of a data flow ranging from (semi) automatic data acquisition up to the automatic plotting of isolines. A grid-form digital terrain model is obtained as an intermediate result. This D.T.M. also provides a wealth of information and has many independent uses. The possibility of using the SCOP program for the production of special-purpose thematic maps also deserves mention.

Author: *Mr. E. Assmus* (Austria)  
Title: Extension of Stuttgart Contour Program to Treating Terrain Break-Lines — Theory and Results *PP III/10*

For the computation of maps with complex geomorphological structures an expanded program version SCOP-B has been developed. For this purpose linear prediction has been modified in such a way as not to permit the points separated by terrain break-lines to correlate with one another. In this way the edges of the terrain are clearly indicated. This paper deals with the theoretical foundations of program extension and its technical realisation. With the aid of a number of maps, computed by means of SCOP-B, the absolute accuracy of the contour lines is examined and their cartographic quality demonstrated.

Author: *Dr. O. Hofmann* (F.R.G.)  
Title: KARTOSCAN — A New MBB-Data-Acquisition System for Cartography Use *PP III/19*

KARTOSCAN is a fully automatic system for the digitization of maps, especially contour lines. Compared with conventional digitization methods, the time-consumption is 1/500. A computer is used for the formation of lines from the tonal values of all screen points stored on magnetic tape.

Authors: *Mr. A. Beier* (G.D.R.)  
*Mr. P. Hanke* (G.D.R.)  
Title: The DIGICART Data Processing System and Its Applicability to Surveying and Mapping *PP III/13*

The introduction of electronic data processing to surveying was exemplified by the DIGICART project. The capabilities and automatic facilities of the system were explained, covering the processes from aerial photography to the production of the topographical map. DIGICART permits the selective acquisition, processing and

output of information on the planimetric geometry and for the numerical description of a terrain by elevation points.

The chairman closed the session by suggesting the establishment of a test field for the comparison of different D.T.M.

Thursday, July 15, 1976, from 14.00 to 15.30  
Session 5 of Commission III

Topic: Use of Reseau Photography  
Chairman: Dr. H. Bauer (F.R.G.)

#### Presented Papers

Author: Mr. R. Roberts (Australia)  
Title: Test of Bundle Block Adjustment for Survey Co-ordination PP III/49

Mr. Roberts reviewed results obtained in Australia using a bundle block adjustment for third order surveys to establish control for property surveys utilizing 1:12700 scale photography taken with a camera equipped with a reseau. Tests had shown that sheet metal painted with a circular target of "blaze orange" fluorescent paint giving a negative size of 40 microns was the practical minimum size. It had been decided that all pass-points would be targeted and all survey control points would appear on 9 photographs. The overlap used had been 60% x 60%. A bundle type block adjustment program had been used.

The results show that it is possible to obtain a vertical accuracy of 2—3  $\mu\text{m}$  and a horizontal accuracy of 4—5  $\mu\text{m}$ .

Encouraged by the results from these tests full scale trials were proceeding over an area of 500 km<sup>2</sup> at Kapunda using reseau photography taken from 7,500 meters above ground level.

The presentation was followed by a lively discussion on reseau techniques.

Author: Mr. D. Brown (U.S.A.)  
Title: The State of Development and of Application of Numerical Photogrammetry Methods

Mr. Brown recommended the use of auto-regressive methods for the analysis of steroscope data. With the help of inertial systems carried by jeeps and helicopters it is possible to obtain an accuracy of 1:220000 (0.65 m) in control point extension. These systems could compete with photogrammetric methods in the future. Their use results in considerable savings in the number of control points. Mr. Brown suggested that image coordinates be weighted radially and tangentially. Control point coordinates should no longer be introduced as errorless. He also recommended a wider use of reseau cameras. Brown had developed a reseau platen of his own that should be more accurate than the others available. (49 crosses are produced with small projectors.) With suitable measuring arrangements additional measurements present no problem. When talking about self-calibration, Mr. Brown mentioned that further investigations are necessary. For this purpose several good test fields are needed. He observed that more correction terms are required for S.W.A. photographs than for W.A. ones. In particular with S.W.A. photographs a reseau can be most useful.

In the course of the intensive discussion that followed, the audience gave its support to many of Mr. Brown's theses.

Monday, July 19, 1976, from 15.45 to 17.15  
Session 6 of Commission III

Topic: Image Processing  
Chairman: Dr. G. Konecny (F.R.G.)

#### Invited Paper

Authors: Dr. F. Holdermann (F.R.G.)  
Dr. M. Bohner (F.R.G.)  
Dr. B. Bargel (F.R.G.)  
Dr. H. Kazmierczak (F.R.G.)

Title: Review of Image Processing IP III/05  
Presented by Dr. Bargel

A review of image processing was given in which various methods for radiometric and geometric corrections, image enhancement, feature extraction, and classification for feature analysis were discussed.

At the close of this presentation, Dr. F. Leberl (U.S.A.) asked whether the processing of visual images should not have been given a greater emphasis than automatic feature extraction. Dr. Bargel answered that although he himself has concentrated his efforts on feature extraction, the paper here given is not one-sided.

#### Presented Papers

Author: Dr. P. Anuta (U.S.A.)  
Title: Digital Preprocessing and Classification of Multispectral Earth Observation Data PP III/09

In Dr. Anuta's paper a computer software system concept called LARSYS for preprocessing and analysis of multivariate image data from remote sensing measurements was described. The system includes statistical analysis, data classification, image registration, geometric corrections, and ratioing principle components.

Topographic data which had been registered with four band LANDSAT multispectral scanner data was being studied to develop layered classifier and other methods of utilizing elevation, slope and aspect to improve the quality of multispectral image analysis.

In the course of the discussion that followed, Dr. A. McNair (U.S.A.) remarked that, also at his institute, a strong correlation had been observed between channels 4 and 5 and channels 6 and 7 of the LANDSAT imagery. In New York, the temporal display had been carried out with four channels using the G.E. Image-100 equipment.

Dr. E. Mikhail (U.S.A.), who read Dr. Anuta's paper, observed that due to high correlation only two channels had been used.

Dr. A. Fontanel (France) asked whether the information on slope had improved the classification results. Dr. Mikhail answered that the results had been somewhat improved.

Author: Dr. G. Kritikos (F.R.G.)  
Title: Image Processing and Multispectral Classification at the DFVLR

Dr. Kritikos gave a paper on image processing and multispectral classification at the DFVLR.

The image processing program presented was DIBIAS. Two systems were operational: one with raw data and the other with computer compatible tape. Emphasis had been on identifying changing phenomena. At the time, about 100 image processing programs (modular) were in use. The general discussion was opened by *Mr. N. Donker* (Netherlands) who asked what kind of colour display had been used and how hard copies were made. *Dr. Kritikos* described the printers used, all normal output devices. *Mr. A. Jones* (Australia) asked what sort of accuracies had been achieved with automated classification. *Dr. Kritikos* said he had rather limited experience and that the results depend on the type of object. He gave 80% as an average estimate.

Author: *Mr. W. Kreiling* (F.R.G.)  
Title: Automatic Evaluation of Stereophotographs by Digital Correlation PP III/31

*Mr. Kreiling* described an automatic digital restitution system for production of orthophotomaps with contour lines. Equipment required consists of an image-scanner/printer and digital computer. Results show a height accuracy of 0.4‰ of flying height for wellstructured areas.

Authors: *Dr. T. Keating* (U.S.A.)  
*Dr. P. Wolf* (U.S.A.)  
Title: Analytical Photogrammetry from Digitized Image Densities PP III/30

*Dr. Keating* described a digital analytical photogrammetric system which can be used to develop a framework for land-oriented resource information systems. The framework consists of three-dimensional terrain coordinates, generated entirely within, and therefore compatible directly with, a general-purpose digital computer.

*Dr. O. Hofmann* (F.R.G.) asked whether the same accuracy is obtained with a two-dimensional raster as with scanning in epipolar lines, the way *Mr. U. Helava* (U.S.A.) does it. *Dr. Keating* answered that *Mr. Helava's* method is certainly good, but costly. He added that his own system makes use of the same information as *Mr. Helava's* system, so the accuracy obtained is the same. Data processing requires much computing time, but the instruments are not too complicated. *Mr. W. Kreiling* (F.R.G.) said some kind of a compromise should be reached between scanning in rasters and in epipolar lines.

*Dr. E. Mikhail* (U.S.A.) asked how long it takes to scan a photograph with a 25 μm resolution, and when an on-line laser scanner is used. He also said that one should not believe that a digital image could completely replace a photograph. *Dr. Keating* answered that the scanning of one photograph with a resolution of 100 μm takes 30 minutes, and consequently 16 times more time is required with a 25 μm resolution. He said a laser scanner would reduce the time required to 1/10 or 1/20. He added that with a 25 μm resolution part of the information is lost, but this accuracy is sufficient for relative orientation. He said the costs were US \$200 per photograph.

Author: *Dr. S. Wu* (U.S.A.)  
Title: Stereomapping with the Viking Lander Camera Imagery PP III/63

Finally, a brief review of stereomapping with the Viking Lander imagery was presented. This presentation was timely in view of the subsequent landing of Viking Lander on Mars the next day, July 20, 1976.

*Dr. Wu* presented the Viking Lander facsimile camera system and described the stereomapping of imagery produced by it. Photogrammetric problems arise from the fact that the imagery produced actually represents a portion of a spherical surface.

Tuesday, July 20, 1976, from 10.45 to 12.15  
Session 7 of Commission III

Topic: Remote Sensing (1): Geometric Transformations of Scanner Imagery  
Chairman: *Dr. K. Rinner* (Austria)

The following Presented Paper dealing with the topic of the session had been handed in, but there was not enough time for its full presentation.

Author: *Dr. W. Schuhr* (F.R.G.)  
Title: Digital Rectification of Multispectral Imagery PP III/53

Computer programs for digital rectification of multispectral scanner imagery for both methods, the direct and indirect type, have been developed. The changing of the exterior orientation elements with the time was expressed with first and second order polynomials and with spline functions. The first paper of the day was presented by *Dr. G. Konecny* (F.R.G.).

#### Working Group Paper

Author: *Dr. G. Konecny* (F.R.G.)  
Title: Report on Activities of Working Group "Geometry of Remote Sensing" WGR III/02

This report was a very comprehensive treatment of the working group activities and results obtained by participants using satellite and aircraft supported scanner imagery and radar imagery. In the general discussion *Dr. O. Hofmann* (F.R.G.) referred to opto-electronic scanners being developed that are based on linear semi-conductive photosensors and that facilitate the analysis of remote sensing data. If, in addition to this, stabilized platforms are used — as was going to be done in the Spacelab — images with no distortion are obtained.

*Dr. Konecny* said that the system presented by *Dr. Hofmann* simplifies the geometrical problems encountered in remote sensing. He added that accuracy could be improved by registering orientation parameters.

*Dr. F. Leberl* (U.S.A.) said that photogrammetrists in general are not interested in stabilized platforms. He mentioned that plans had been made in the U.S.A. to send off Stereosat with two unstabilized scanners that are in a convergent angle of 60°. *Dr. Konecny* answered that stereosatellites are interesting, but that they are not accurate enough for the mapping of the earth.

### Presented Papers

Author: Mr. R. Bernstein (U.S.A.)  
Title: Systems for Earth Observation Sensor Data Processing

The IBM approach to processing digital data from earth observational satellites was reviewed in a paper by Mr. Bernstein and presented by Mr. D. Ferneyhough (U.S.A.) The system allows application of radiometric and geometric corrections, permits multistage registration and can utilize geodetic ground control points.

Author: Mr. H. Bähr (F.R.G.)  
Title: Geometrical Models for Satellite Scanner Imagery PP III/12

An additional paper on geometric transformation of scanned imagery was given by Mr. Bähr.

Authors: Dr. J. Trinder (Australia)  
Dr. S. Nasca (Australia)  
Title: Test on the Mapping Application of Landsat Imagery PP III/60

Tests had been made on the application of Landsat images to 1:250000 mapping within Australia, using identifiable points on existing maps as control. Polynomial and affine formulae had been used to test the accuracy of transformation of image coordinates onto ground coordinates derived from available maps at scales of 1:250000 and 1:100000. The accuracies of the coordinates after both transformations approached the local map accuracy standards.

Based on parameters derived from affine transformations of each quadrant of an image, rectified enlargements had been prepared at a scale of 1:250000. It appeared that the accuracy of such enlargements would satisfy the map accuracy standards for 1:250000 maps.

As Dr. Trinder does not go back to the digital magnetic tape recordings of the data, but uses photos produced from this data, his work corresponds to that of Mr. M. Ali (Canada) presented at the third session.

Authors: Dr. J. Anderson (U.S.A.)  
Dr. M. Nasu (U.S.A.)  
Title: A Multiseries Digital Mapping System for MSS and Photographic Remotely Sensed Data PP III/07

The objective of this investigation was to study the feasibility of a comprehensive procedure for positioning multiseries remote sensing digital data to be used in conjunction with a qualitative analysis of spectral characteristics of the information. A multistage geometric control system has been developed and studied using simulated and real multistage, multistage, and multisensor remote sensing data. This system can be used for direct, sequential, or simultaneous solution of the multiseries data. Results with simulated data indicate that the combination of photographic and scanner data in a simultaneous adjustment yields positional accuracy improved by approximately twenty per cent compared with the direct (scanner data only) and sequential (scanner and photographic data) solutions. Results of tests with real data indicate that from a theoretical viewpoint, the simultaneous multistage adjustment yields a reduction of relative

discrepancies when compared to direct and sequential solution, while in a practical sense the sequential and simultaneous adjustments are comparable.

Author: Dr. G. Otepka (Austria)  
Title: Practical Experience in the Rectification of MSS-Images PP III/43

The MSS—image, produced on the basis of digitally scanned data, is placed in one picture carried of a stereo-comparator and a line map or orthophoto of the same terrain (a "rectification master") is placed in the other picture carrier. The distortion can now be measured in a number of discrete points and a rectangular reference grid can be interpolated, for example by linear prediction. The data so obtained are written out on magnetic tape and serve as the input data to drive the Wild Avioplan OR 1.

The paper "Rectification of Multispectral Scanner Imagery" by Dr. K. Kraus (Austria) was attached as an Appendix to Dr. Otepka's paper.

Tuesday, July 20, 1976, from 15.45 to 17.15  
Session 8 of Commission III

Topic: Remote Sensing (2): Radar Imagery  
Restitution

Chairman: Dr. E. Mikhail (U.S.A.)

The following Presented Paper dealing with the topic of the session had been handed in, but there was not enough time for its full presentation.

Authors: Dr. F. Leberl (U.S.A.)  
Dr. H. Jensen (U.S.A.)  
Dr. J. Kaplan (U.S.A.)  
Title: Side-Looking Radar Mosaicking Experiment PP III/35

A block of 24 overlapping synthetic aperture side-looking radar images flown over a well-mapped area of about 90000 km<sup>2</sup> provided an opportunity to evaluate the mapping accuracy achieved in current radar mosaicking projects. The maps at scale 1:24000 that are available in the imaged area permit the study of the geometric errors of the radar mosaics and of individual radar strips. The paper shows that a successful radar mosaicking process requires the elimination of image errors of up to several kilometers. These errors are introduced as a result of the limited precision of the inertial aircraft navigation. The paper presents an example of a radar mapping effort, in which the navigation errors could be eliminated. The resulting radar mosaics have residual RMS mapping errors of planimetry of about  $\pm 150$  m.

The first paper of the session was presented by Dr. F. Leberl from the United States.

### Invited Paper

Author: Dr. F. Leberl (U.S.A.)  
Title: Imaging Radar Applications for Mapping and Charting IP III/06

This paper was a complete review of radar systems applications and capabilities. In the general discussion Dr. A. Fontanel (France) asked whether the Seasat radar could be switched



on land. *Dr. Leberl* answered that an expensive receiving station would be needed for the reception of radar data from land.

*Mr. H. Bähr* (F.R.G.) asked what the present state of interferometric radar mapping was. *Dr. Leberl* answered that five years ago much had been expected of interferometric radar mapping, but that it was no more in use. He added that investigations with single images prove that radar stereo-mapping gives better results than interferometric radar measurement.

*Dr. K. Thomson* (Canada) remarked that the problem with Seasat data is not the reception of data but data processing. According to him, only 1/8 of the Seasat data can be processed. *Dr. Leberl* commented on the problems of processing, saying that the costs of a strip covering an area of 400000 km<sup>2</sup> are US\$2000. This includes only the costs of correlation. Consequently, the costs are not high, but access to over-crowded correlators is difficult.

*Dr. P. Fagundes* (Brazil) asked whether the Seasat had also a thermal scanner. *Dr. Leberl* said he did not know, but an unidentified speaker said the Seasat had an older thermal scanner with poor resolving power.

*Dr. S. Paul* (France) asked where *Dr. Leberl* had acquired the extensive bibliography on radar-grammetry. He answered that the compilation of the bibliography had demanded great effort. NASA has a bibliographical service of its own that is freely available. However, most works carried out in the U.S.A. deal with military projects, and thus information about them is difficult to obtain.

*Mr. T. Nguyen* (France) asked whether radar imagery could be applied to oceanography, among other things. *Dr. Leberl* said he thought that radar imagery provides information that is not obtainable from conventional images. Lunar scanning is an example of this; here a penetration of 3 km under the moon surface has been obtained. On the earth there is more water than on the moon, and for this reason penetration is difficult. So far, little experience has been gained using this technique.

## COMMISSION IV

### TOPOGRAPHIC AND CARTOGRAPHIC APPLICATIONS

### APPLICATIONS TOPOGRAPHIQUES ET CARTOGRAPHIQUES

### TOPOGRAPHISCHE UND KARTOGRAPHISCHE ANWENDUNGEN

President: *Mr. G. Ducher* (France)  
Secretary: *Mr. J. Denègre* (France)

Monday, July 12, 1976, from 16.15 to 17.00  
Session 1 of Commission IV

Topic: Business Meeting  
Chairman: *Mr. G. Ducher* (France)

When discussing the work of the Commission during the congress, the meeting decided to

### Presented Papers

Author: *Mr. G. Dowideit* (F.R.G.)  
Title: A Block Adjustment for SLAR-imagery PP III/18

Here a block adjustment computer program for SLAR-imagery is presented. In addition to the geometrical relations between imagery and object space the dynamic problems of flight path and imaging process are studied. Accuracies from 20 m to 150 m had been obtained in tests.

Author: *Mr. R. Peterson* (U.S.A.)  
Title: The Correlation of Anamorphic Errors in Holographic Radar Imagery PP III/46

*Mr. Peterson* describes the coherent side-looking radar principle and the optical corrections of scale errors of anamorphic holograms obtained using an instrument based on this principle.

Author: *Dr. H. Ebner* (F.R.G.)  
Title: A Mathematical Model for Digital Rectification of Remote Sensing Data PP III/19

This last paper contained a procedure for rectifying scanned imagery in which a stochastic process, specifically the Gauss Markov process, is employed to provide a model for the variation of sensor exterior orientation with time. Simulated examples were given to make the principle of the suggested approach evident.

The President of Commission III, *Dr. F. Ackermann* (F.R.G.), closed the session by announcing that the Commission would be chaired by the U.S.S.R. up to the next Congress. He congratulated the newly appointed President, *Dr. I. Antipov* from Novosibirsk. Furthermore, he extended his thanks to all who had participated in the work of Commission III at the Congress, and in the Symposia. He expressed his gratitude especially to the supporters of Commission III, Deutsche Forschungsgemeinschaft, the Ministry of Culture of Baden-Württemberg, Deutsche Geodetische Kommission, and the U.S. Army European Research Office.

schedule a certain number of preparatory meetings to allow time for the proper preparation of the Technical Sessions.

1. July 14, 1976, at 14.00: Working Group concentrating on automation, with *Mr. M. Thompson* (U.S.A.) as reporter.

2. July 20, 1976, at 9.00: members of the panel



scheduled for July 20, Working Group IV/3 "Large-Scale Numerical Photogrammetry" chaired by *Mr. U. van Twembeke* (Belgium).

3. July 20, 1976, at 10.00: Resolutions Committee of Commission IV chaired by *Mr. G. Ducher* (France).

4. July 21, 1976, at 15.00: Working Group IV/1 "Applications of Digital Terrain Models (D.T.M.)" presided by *Dr. C. Ternryd* (Sweden).

All these sessions would take place in the meeting room reserved for Commission IV (Hall L 4). After this brief review of the congress timetable of Commission IV, the meeting proceeded to update the list of panelists for the various Technical Sessions. Furthermore, some suggestions were made concerning the resolutions of the Commission and its future Working Groups, including a redefinition of the fields to be covered by these groups.

*Dr. Ternryd* requested that all Presented Papers related to the work of WG IV/1 be announced at the Technical Session of July 22.

The following volunteered to participate in the work of the Resolutions Committee of Commission IV:

*Dr. J. Zarzycki* (Canada)

*Colonel M. Datta* (India)

*Mr. U. van Twembeke* (Belgium).

With respect to the future work of WG IV/1, dealing with applications of photogrammetry and D.T.M. to highway and railway design, *Dr. Ternryd* said the following: "WG IV/1 should not continue its work during the following intercongress period. The field now including D.T.M. and semi-automated techniques should be enlarged to cover areas outside highway and railway design. The application of photogrammetry to road construction projects is to be considered a classical application from now on, after a lapse of sixteen years.

Wednesday, July 14, 1976, from 10.45 to 12.15  
Session 2 of Commission IV

Topic: Various Reports  
Chairman: *Mr. G. Ducher* (France)

#### Invited Papers

Author: *Mr. G. Ducher* (France)  
Title: Report on Commission IV Activities 1972—1976 CR IV/01

Author: *Mr. A. Belbachir* (Morocco)  
Title: Report on the State of the Use of Orthophotography in the World IP IV/06

These two papers were followed by a general discussion, in the course of which the following observations were made.

*Mr. J. Visser* (Netherlands) said he would like to return to point four of *Mr. Belbachir's* presentation, according to which the reproduction of photomaps would be possible in only three ways:

- a) photography
- b) rastered diazotized copy
- c) raster offset.

He continued by observing that this could explain why no answer had been given by the United States at this point, as they use the random dot technique. He wished to ask the

U.S.G.S. to explain in what respects this method was superior to the classical printing method, the finely rastered offset.

In answer to *Mr. Visser*, *Mr. M. Thompson* (U.S.A.) stated that the U.S.G.S. considers the quality of print of its photomaps as one of its foremost problems. He said the U.S.G.S. had not yet reached a final solution in developing a suitable process, but that a technical laboratory had been established for continued image research in this area.

*Dr. M. Erez* (Israel) said experiments in orthophoto reproduction had been carried out at the Survey Department of Israel. He mentioned that a few examples where the raster technique was compared with the random dot technique were exhibited in the National Members' Exhibition at the Congress. He said that the random dot technique used in Israel was a variant of the one used at the U.S.G.S. He suggested that a thread counter be used in examining the results.

*Mr. T. Krimly* (Saudi-Arabia) said he was sure that *Mr. Belbachir* had done his best, but wondered whether Saudi-Arabia had been consulted at all in the course of his research. As a matter of fact, Saudi-Arabia made intensive use of orthophotomaps. Twenty-four leaflets at a scale of 1:50000, in five colors, had been produced since 1972. 300 leaflets at a scale of 1:50000 (or 1:10000) were being systematically produced. The image quality had been sufficiently improved. In the meanwhile, research was being carried out on other aspects of the problem.

*Mr. A. Sbai* (Morocco) closed the discussion by answering that it would have been impossible to consult all countries, unfortunately. The list given in the report itself included those countries for which international organizations had given the addresses of national societies of photogrammetry. As to the techniques of orthophoto reproduction, *Mr. Sbai* asked the I.S.P. to publish a description of the methods and results which had been mentioned in the course of this session.

#### Presented Papers

Author: *Mr. J. Timmerman* (Netherlands)  
Title: Report of the Commission C "OEEPE-Dordrecht" Experiment PP IV/36

The specific aim of this experiment was the determination of the accuracy with which some elements of buildings could be measured in a photogrammetric model.

At the close of this presentation, *Mr. J. Visser* (Netherlands) made it clear that *Mr. Timmerman* was not President of Commission C of OEEPE, but that he chaired one of its working groups. The President of the Commission is *Mr. Förstner*.

Author: *Dr. W. Beck* (F.R.G.)  
Title: Rapport de la Commission D de l'OEEPE sur l'établissement de cartes topographiques au 1/10000 selon le procédé photogrammétrique PP IV/03  
Presented by *Dr. F. Ackermann* (F.R.G.)

*Dr. B. Dubuisson* (France) said the results demonstrating the usefulness of orthophotography

should be supported by two further observations:

1. the low cost of orthophotography allows for frequent improvements

2. orthophotography guarantees a close contact between photointerpretation used in various special fields and geographical localization.

*Mr. H. Belzner* (F.R.G.) reported that Commission D of OEEPE was preparing a new project for the revision of maps made at the scale of 1:25000. One of the areas to be covered by this project was a comparison of the techniques of stereo-restitution with orthophotography.

*Mr. J. Kure* (Netherlands) pointed out that a comparison of the results obtained from orthophoto-interpretation and linemap interpretation is not fair as the quality of orthophotos is inferior to that of original photos. Consequently, the use of original photos should be sufficient, if interpretation is required when working with orthophotos. *Dr. M. Zolfaghari* (Iran) asked what the future of orthophotography would be in relation with classical photogrammetry on the basis of the experiments presented by *Dr. Ackermann*.

*Dr. Ackermann* answered by saying that a satisfactory result can be obtained only if the scale between the orthophotograph and the original photo does not exceed 2.

*Mr. O. Johansson* (Sweden) participated in the discussion by reporting that an economic map of Sweden had been made on the basis of orthophotos at a scale of 1:10000 produced from original photos at a scale of 1:30000, and with very good results. Orthophotography had been combined with intensive complementary work carried out in the terrain.

Author: *Mr. G. Agarwal* (India)  
Title: Accuracy of spot Heights and Determination of Minimum Contour Interval for Plotting PP IV/01  
Presented by *Colonel M. Datta* (India)

Thursday, July 15, 1976, from 9.00 to 10.30  
Session 3 of Commission IV

Topic: Checking and Up-Dating Topographic Maps

Chairman: *Mr. G. Ducher* (France)

This session was dedicated to reports on the activities of WG IV/4 "Checking of Topographic Maps" and WG IV/2 "Up-Dating of Topographic Maps".

#### Working Group Papers

Author: *Mr. D. Crémont* (France)  
Title: Checking of Topographic Maps

*Mr. Crémont* presented the main conclusions that had been reached in the course of the investigation conducted by him. He regretted that the answers received had been insufficient. With regard to the inscription of classification codes on documents, indicating their accuracy and contents, it was suggested that an international committee be established to study the problem.

The other problems involved in the said investigations concerned the nature of checking and checkers and the costs of the operations required. The costs varied between 3% and 20%.

Then *Mr. Crémont* mentioned the research work carried out by *Mr. Pichlick* (Czechoslovakia) and the experiments made with the Pečny polygon. He then reported on the experiments made at I.G.N. with the basic maps (1:25000 and 1:5000), describing the checking method used, and gave some of the results obtained.

It was recommended that the same photography be used as that for the mapping itself (or a photography at the same scale and following the same flight plan). Nevertheless, *Dr. B. Dubuisson* (France) pointed out that in this case the errors of the photography are not taken into account. The costs should vary between 8% and 10% of the total costs of the mapping process.

Author: *Dr. G. Birardi* (Italy)  
Title: Revision of Topographic Maps WGR IV/03

*Dr. Birardi* presented a report on the activities of his Working Group, which concentrates its efforts on the study of the up-dating of topographic maps. He listed the conclusions reached on the basis of a study of the answers given to the questionnaire on up-dating and concerning all aspects of the problem.

In the course of the general discussion that followed, *Dr. K. Szangolies* (G.D.R.) said it seemed that *Dr. Birardi's* appeal to the manufacturers of instruments specially designed for up-dating purposes had been heard. He added that this was true of Zeiss Jena, in particular, which brought forth the Topoflex.

Then *Mr. E. Huber* (Switzerland) reminded the audience that only a part of the information required for the up-dating of maps could be obtained by photogrammetric means, and that a number of operations was required for the transformation of this information.

To close up with, there was an exchange of ideas on the role of orthophotography in relation with linemaps and their up-dating.

Thursday, July 15, 1976, from 10.45 to 12.15  
Session 4 of Commission IV

Topic: Revision  
Chairman: *Dr. G. Birardi* (Italy)

#### Panel Discussion

Topic: Revision  
Moderator: *Dr. G. Birardi* (Italy)  
Panelists: *Dr. F. Doyle* (U.S.A.)  
*Mrs. E. Fleming* (Canada)  
*Mr. M. Thompson* (U.S.A.)  
*Mr. D. Glendinning* (Australia)  
*Mr. G. Ducher* (France)  
*Mr. L. van Zuylen* (Netherlands)  
*Dr. B. Dubuisson* (France)  
*Dr. S. Dequal* (Italy)  
*Mr. H. Yzerman* (Switzerland)  
*Mr. G. Hardy* (U.K.)

*Mr. Ducher* led off by describing the procedures for revision of basic topographic maps (1:25000)

at the Institut Géographique National. Methods vary with the terrain:

- simplified method with an instrument called "révicate", with optical rectification using facets and graphical transfer using stereoscopy
- photogrammetric method
- simplified photographic method with an instrument called "photo-révicate", with photographic rectification using facets and deferred graphical transfer

- orthophotographic method, undoubtedly the best from a technical point of view, but not from an economic, which leads to the use of photography at a smaller scale, combined with a stereoscopic study of photography at a larger scale. One of the problems to be solved is that of the centralization or decentralization of both revision personnel and instruments.

*Dr. Dubuisson* spoke on the revision of large-scale maps (urban and rural areas), noting that the maps are outdated by the time they are published. Nevertheless, the "actuality", the veracity, of a map is just as important as its accuracy. Consequently, to be of use, cadastral maps have to be duly up-dated. The cost of the revision of a map five years old amounts to 1/3 of the total costs of mapping in the first place. In suburban areas 10% of the information changes in one year, in rural areas only 5%.

*Dr. Dequal* described a three-tier hardware/software system being developed in Italy for up-dating and managing a cadastral data base (PP IV/12). The system employs computers and interactive communications terminals at local, provincial, and national levels. At the time, information was being collected from four sources of numerical data: cartographic sources (existing digitized maps), photogrammetric sources, terrestrial measurements, administrative sources (archives). The system now being established is centered on an IBM 370/168 computer in Rome. Local data bases centered on mini-computers will be connected to this computer. They, in turn, are accessible via decentralized terminals (graphical and digital consoles). An experimental station, in use at the Institute of Photogrammetry of the Polytechnical University Turin, was being exhibited in the Scientific Exhibition of the Helsinki Congress.

Plans had been made to up-date the cadastral data bases once a week.

*Mrs. Fleming* gave a talk on the use of Landsat imagery for map revision (PP IV/19). The imagery is used extensively in the unpopulated northern areas of Canada, its greatest advantage being that far fewer photographs are needed than with conventional photography. Roads show up very well (on band 5) as clearing through the forest, while water features show up well on band 6. Power lines are visible on winter imagery (as a white swath through the forest), and winter imagery is useful as an aid to relief shading because of the low sun angle. The many lakes in northern Canada are used for control, i.e., for matching the imagery to maps in a reflecting projector.

*Mrs. Fleming* observed that many outstanding results had been obtained in various fields by the revision of maps of Canada by using Landsat satellite imagery:

- determining the location of new elements

- having large dimensions (roads, power lines)

- obtaining natural shading due to low sun angle
- preparing photomaps at a scale of 1:1000000 and at smaller scale

- identifying the location of "off-shore" elements not formerly connected with the main land.

Despite their poor resolution and their dubious geometry, the multispectral images produced by the satellite Landsat are most valuable because they cover vast areas (one image may replace up to 600 photographs at a scale of 1:60000) and because they are repeatedly produced, thus making it possible to solve certain problems of interpretation. Furthermore, photographic enlargements, matched locally to existing maps, are an effective means of localization.

*Dr. Doyle* spoke of the difficulties of interpretation encountered in map revision on the basis of satellite imagery particularly in rapidly developing areas (cities, coastal areas). He cited as an example the Skylab imagery (S. 190A over Chesapeake Bay) which was good only for shorelines. Some of the photographs taken at a scale larger than 1:1000000 (S. 190B, focal length 460 mm) were of minimum quality for revision, being adequate for rural areas. At the time, further experiments in revision were being made in Columbia.

In the future system of Spacelab, planned for 1980, cartographic cameras with varying focal lengths (300 or 600 mm) will be put on board. Likewise, stellar and panoramic cameras will be put on board drones independent of the space shuttle.

As a matter of fact, the major problems to be encountered in photographing will be political, as certain countries object to their territories being photographed without control.

*Mr. Thompson* spoke on automated techniques in map revision. Though stating that no automated systems existed, he discussed digitization at the U.S. Geological Survey including digitizing old maps, generation of digital profiles, making of orthophotos from the digital profiles, and digitization of planimetry from the orthophotos. He felt that the orthophoto map was the cheapest and most rapidly produced revision (or up-date) product.

He also observed that automated techniques in map revision were certainly a current object of research, but that so far there was little to offer in practice, despite an ever increasing demand. Here cartographic automation as such is combined with research for new information and with incorporating this information: this is how revision differs from up-dating which, again, means a complete renewal of the existing map. The process of automated revision includes digitizing new information (provided by orthophotography, for example) and its introduction into existing maps: the system called DICOMED (for which experiments have been made at USA ETL, Fort-Belvoir, U.S.A.) makes it possible to observe and to manipulate on the same cathod screen information provided by both an existing map and new photography. As the intervention of an operator is necessary here, we cannot talk about complete automation; what we have is semi-automation.

*Mr. van Zuylen* said that, so far, only classical methods had been used in the revision of the

basic topographic maps of the Netherlands. However, the development of differential rectification in orthoprojection opens new views for us: it will be possible to automate the production of orthophoto maps and, consequently, to repeat it at short intervals at a reduced cost. One of the problems still to be solved is the one concerning the reproduction and printing of orthophoto maps.

*Mr. Hardy* discussed the revision of the British Ordnance Survey very large scale maps (cities and towns, 1:1250; rural areas, 1:2500; mountains and moorlands 1:10000). The methods are, in general, very conservative.

In describing the methods used, he listed the following four points:

- the collection of information concerning changes is decentralized
- continued revision is provided for rapidly developing areas
- periodical revision is provided for slowly developing areas (at intervals of 10 to 30 years)
- revised sheets are always placed at the users' disposal.

As to the methods of revision, they are the ones used in mapping, starting from direct measurements and going to aerial survey using photogrammetry.

*Mr. Glendinning* described a method of employing low-altitude, hand-held photography for revision (completion) before printing.

He described the revision of small scale maps, covering large areas, as including:

- a study of changes either from an airplane ("real-time" inspection) or in the terrain
- the changes observed in stereophotographs are recorded on copies of stereomaps.

Photogrammetric restitution is left to a minimum. Thus satellite photographs covering immense areas are a welcome aid in revision of small scale maps.

Finally, *Mr. Yzerman* described the use of the Stereofacet viewer for map revision. According to him the revision of topographic maps could be performed satisfactorily using the "stereofacet" method. The method is based on the use of an instrument that makes it possible, in stereoscopic viewing, to match with each other every facet of the model and its homologous counterpart on the map.

*Dr. Birardi* closed the session by observing that automation (digitizing elevation data, in particular) is necessary for solving the difficult problems of revision in general.

Friday, July 16, 1976, from 9.00 to 10.30  
Session 5 of Commission IV, held jointly with Commission II

Topic: Automation in Photogrammetry  
Chairman: *Mr. G. Ducher* (France)

The Chairmen of Commissions II and IV, *Dr. G. Inghilleri* (Italy) and *Mr. Ducher*, joined to open the session. They pointed out that automation in photogrammetry concerns both instruments and applications.

#### Invited Papers

Authors: *Mr. M. Thompson* (U.S.A.)  
*Dr. E. Mikhail* (U.S.A.)

Title: Automation in Photogrammetry —  
Recent Developments and Applications  
1972—1976 IP IV/09

*Mr. Thompson* gave a dictionary definition of automation as the "replacement of human labor by machines" and the "operating of machines automatically or by remote control". He then discussed various categories of automation, including: digital readout, automatic scanning and correlation, off-line orthophoto printing, manipulation of imagery, digital terrain data in engineering applications, automated control of ancillary photogrammetric operations (e.g., photo lab), optical techniques (holography, optical transforms, etc.). Finally *Mr. Thompson* mentioned what he considered to be the trends in automation, in particular: simple digitizers on available stereoplotters, stereoplotters on line with minicomputers (pooled), sample spacing for digital terrain models based on slope, correlation based on epipolar lines, sophisticated equipment for contours, orthophotos, and digital terrain models, off-line orthophoto systems, digital terrain models derived from energy-spectrum data, digital image processing and analysis, pattern recognition, automation by optical techniques, remote sensing input for automation, automated small scale mapping from space photography, automated photo lab operations, engineering applications, completely automated cartographic systems.

Author: *Dr. B. Dubuisson* (France)  
Title: Application de la photogrammétrie  
à la confection des fichiers numériques  
(urbains, en particulier) IP IV/  
08

Friday, July 16, 1976, from 10.30 to 12.15  
Session 6 of Commission IV

#### Panel Discussion

Topic: Implementation and Applications of  
Automation in Photogrammetry  
Chairman: *Mr. M. Thompson* (U.S.A.)  
Panelists: *Mr. Z. Jaksic* (Canada)  
*Mr. U. V. Helava* (U.S.A.)  
*Dr. G. Konecny* (F.R.G.)  
*Mr. H. Schöler* (G.D.R.)  
*Dr. B. Dubuisson* (France)  
*Mr. J. Denègre* (France)  
*Dr. J. Zarzycki* (Canada)  
*Mr. K. Keir* (U.K.)  
*Colonel M. Datta* (India)  
*Mr. F. Corten* (Netherlands)  
*Dr. E. Dorrer* (F.R.G.)

The Panel Discussion was led off by *Mr. Jaksic*, who spoke of the goals of automation being the improvement of cost/effectiveness and optimization of operations without, necessarily, replacing the operator. Measuring processes, using photographs, can be relatively easily automated, as with analytical instruments equipped with correlators. The contrary is true of interpretation processes that cannot yet be considered as operatively automated. Consequently, the role played by automation varies with the respective shares of measurement and interpretation in photogrammetric processes.

*Mr. Helava* spoke of digital technology being central to automation. He mentioned digital sensor systems employing semi-conductor arrays; digital processing to perform rectification, correlation, and ortho-rectification; digitizing of analogue plotter output: automated cartography: digital data banks; and remote sensing.

*Dr. Dubuisson* said the instruments, peripheral equipment and methods designed for the application of automated techniques can be flexibly adapted to a variety of uses: all the way from digitally controlled plotting tables to real analytical plotters, including semi-analytical systems registering coordinates. He observed that the use of automation seems inevitable, taking into account socio-economic development and the demands of integrated control.

*Mr. Denègre* spoke about using elevation data generated in the past along with new photography to generate new orthophotos. The potentials of automation in connection with existing cartographic data banks are twofold, depending on the permanency of the information: generally, numerical photogrammetry is a source of cartographic information; but, then again, this same information — elevation data, in particular — allows for the automation of photogrammetry (generation of orthophotos), as well as of cartography itself: relief shading, gradient maps, block diagrams, etc.

*Dr. Zarzycki* noted that objectives of automation should be reduction of manpower, increased speed, creation of data bases, and increased convenience and economy. He said that manufacturers of instruments should, however, see to it that automated methods remain interactive and that they allow a dialogue between man and instrument. The best results are obtained with an optimum amount of dialogue, not with complete automation, which is well demonstrated by the Gestalt Photo Mapper II for the semi-automated production of orthophotos and contour lines.

*Dr. Konecny* discussed automated systems under development for image processing, digital orthophotoprinting, etc. With regard to the automated systems being developed at the time, he said that it was impossible to completely automate the cartographic process (line map) due to the role of interpretation; but the orthophotographic process, in turn, can be completely automated. This is the case with numerical orthoprojection, where satellite recordings, in digital form, can be differentially rectified and orthoprojected point by point with great accuracy.

*Mr. Schöler* spoke on automation in East Germany, particularly for external sales. He advised that one should do what is necessary, not what is possible; a data bank is not an end in itself. He said that in developing automation in photogrammetry not only the demand for production must be taken into account, but also the resulting need to train specialized personnel, and operation costs. He suggested that Commission IV occupy itself in the future with the education to be given to personnel dealing with automation.

*Mr. Keir* described a digital mapping system for the commercial market which included eight Wild A-8 stereoplotters with digital output and a graphics digitizer, all on-line with a computer.

He said the digital mapping system of Hunting Survey had the following advantages:

- increased profitableness
- economy in the use of manpower
- accelerated completion of projects
- diversification of final product, thus adaptable to meet the needs of the market.

*Colonel Datta* noted that India was both suspicious and cautious regarding automation, particularly since there is such an abundance of manpower, but that automation is necessary because of the lack of trained manpower.

He said that, in India, automation in photogrammetry covers not only the areas of data acquisition (multispectral cameras and scanners), digital registration of points, and analytical aerotriangulation (programs of Schut and Ackermann), but also those of digitally controlled automated electronic tracing and large-scale orthoprojection. It should be underlined that, in India where unemployment is an acute problem, the general attitude towards automation is rather hesitant. Actually, it would seem that automation in cartography is the only possible solution, when taking into consideration the demands of economic development and the fact that the "Service géographique indien" was able to produce only 300 maps out of the 1200 requested.

*Mr. Corten* described an automated navigation system for acquiring aerial photography. He said an optimum solution is still to be reached in developing photographing techniques, which are of foremost importance in the photogrammetric process as a whole. Considerable economy can be achieved by improving the geometry of the coverage of aerial photography, as well in the field of stereomapping and aerotriangulation as in that of restitution and orthophotography. The system PHOTNAV of I.T.C. is an automated navigation system with a computer on board; it completely optimizes aerial photography.

*Dr. Dorrer* closed the panel discussion by defining the difference between automation and semi-automation in photogrammetry, the latter normally involving the human operator. He said the semi-automation processes had often been brought up in the course of the discussion at hand. The one obstacle in the way of complete automation is the superiority of the human brain over computers in interpreting bi-dimensional data. Consequently, manufacturers are to take into account the necessity of adapting their instruments to meet with human physical and psychological requirements, so as to optimize the interaction between the systems. On the other hand, users have to follow the course of development and have to state their demands with regard to new techniques, not clinging too closely to their old traditions.

The following remarks were made in the course of the general discussion.

*Mr. D. Light* (U.S.A.) asked whether photogrammetric instruments could be self-calibrated. He also asked whether the cost of instruments — of automatic data processing equipment, in particular — would be reduced in the future.

*Mr. U. Helava* answered that it is possible to use a reseau for calibration (OMI) in an analytical plotter.

*Mr. Schöler* said that automated photogrammetry

was only at its very beginnings: for example, the costs of a complete point-by-point digitization of a photograph 23 by 23 would be out of reach. *Dr. Konecny* said it was possible to think only in terms of automated "modules" serving a strictly defined and limited purpose.

*Mr. Corten* observed that scanners make the matter even more complicated as their geometry is of a rather uncertain quality.

*Dr. J. Case* (U.S.A.) reported that the U.S. Defense Mapping Agency was setting up a bank of digital terrain models so as to automate the process of revision using new photographs.

*Dr. Zarzycki* pointed out that costs of computations would remain considerable despite this.

*Dr. B. Makarović* (Netherlands) said the same experiments were being made at the I.T.C. and the problem was to produce sufficiently accurate digital terrain models.

*Dr. Case* answered by saying that models computed by interpolation between the existing contour lines are sufficiently accurate.

To conclude, *Dr. U. Rauhala* (U.S.A.) mentioned that a new linear algebra, presented in his paper (PP III/48) at the Congress, is applicable to digital terrain models.

Tuesday, July 20, 1976, from 15.45 to 17.15  
Session 7 of Commission IV

Topic: Large-Scale Numerical Photogrammetry  
Chairman: *Mr. G. Ducher* (France)

#### Working Group Paper

Author: *Dr. U. van Twembeke* (Belgium)  
Title: Le plan à buts multiples. Ses caractéristiques graphiques et numériques WGR IV/04

*Dr. van Twembeke* underlined the role of photogrammetry at large scales and the applicability of large-scale numerical photogrammetry to various purposes. Cadastre is to be considered as one of the areas concerned and, likewise, the whole body of existing information and data to be acquired is to be integrated into the notion of an ecological map.

#### Invited Papers

Author: *Mr. J. Visser* (Netherlands)  
Title: The Use of Large-Scale Orthophoto Maps in Cadastral Survey and for Rural and Urban Development Projects IP IV/10

In his presentation, *Mr. Visser* stressed the importance of multipurpose photomaps, especially for newly founded countries wishing to establish cadastrals of their own. *Mr. P. Roos* (Netherlands) asked about the up-dating of cadastral photomaps and *Dr. J. Höhle* (Switzerland) about a 30 cm focal length for available orthoprojectors.

Author: *Mr. J. Denègre* (France)  
Title: Acquisition et contrôle des données par photogrammétrie numérique à grande échelle IP IV/07

An Invited Paper on the acquisition and control of data for large-scale numerical photogrammetry was given by *Mr. Denègre*.

#### Panel Discussion

Topic: Large-Scale Numerical Photogrammetry  
Moderator: *Dr. U. van Twembeke* (Belgium)  
Panelists: *Mr. G. Ducher* (France)  
*Mr. J. Denègre* (France)  
*Mr. J. Visser* (Netherlands)  
*Dr. B. Dubuisson* (France)  
*Dr. W. Brindöpke* (F.R.G.)  
*Dr. R. Förstner* (F.R.G.)

*Dr. Brindöpke* opened the Panel Discussion by underlining the importance of large-scale numerical photogrammetry for densely populated areas.

Then *Mr. Visser* presented the audience with a few questions on the importance of the use of large-scale photo- and stereophotomaps for road construction purposes and the use of colored photos for the cartography of urban areas. He recommended the production of differentially rectified orthophotographs using a narrow-angle camera, combined with the use of simultaneous photography with a super-wide angle camera for contour lines.

*Mr. Denègre* answered the questions of *Mr. Visser* and spoke on special problems related to digitization at large scale and asked why no automated digitization systems were displayed at the Commercial Exhibition.

*Dr. Dubuisson* developed a few ideas concerning data processing and the integration of auxiliary data in large-scale cartography.

*Mr. Ducher* recalled certain special characteristics of large-scale revision, performed in as complete a way as possible, and in a continued way more often than when operating with smaller scales, as can be seen from *Dr. Birardi's* report. A combined use has to be made of terrestrial and photogrammetric methods, of local and centralized methods, and of automated digital processes and more modest classical processes.

To end with, *Dr. Förstner* observed that the importance of graphical methods should not be underestimated in relation to digital methods, especially when speaking of cadastre.

Thursday, July 22, 1976, from 9.00 to 10.30  
Session 8 of Commission IV

Topic: Applications of Digital Terrain Models (D.T.M.)  
Chairmen: *Mr. G. Ducher* (France)  
*Dr. C.-O. Ternryd* (Sweden)

#### Working Group IV/1 Reports

Authors: *Dr. C.-O. Ternryd* (Sweden)  
*Dr. H. Kasper* (Switzerland)  
Title: A Review of the Present Status of the Application of Photogrammetry, Digital Terrain Models and Semiautomated Photogrammetric Technique to Highway and Railway Design and the Trend of Further Development WGR IV/02

*Dr. Ternryd's* presentation was followed by some comments made by his co-reporters.

*Dr. K. Kraus* (Austria) said that a combination of digital terrain models and orthophotographical techniques, together with the apparition of auto-



matically controlled orthoprojectors, considerably improves the profitableness of the use of digital terrain models (D.T.M.). Although their use is limited to a few countries, the sub-products such as stereo-orthophotography introduce — at reduced cost — the third dimension, a fact that should facilitate the study of road construction projects.

*Mr. B. Cabrera* (Mexico) reported that the Mexican Ministry of Public Works makes intensive use of photogrammetric techniques in carrying out autoroute projects (300 km per year, scales from 1:20000 to 1:1000), but that the D.T.M. are not considered accurate enough.

*Mr. C. Slama* (U.S.A.) told the audience that the U.S. Academy of Sciences — in cooperation with the American Society of Photogrammetry — has published a "Summary of the Use of Photogrammetry for Highways", giving a general view of the state of affairs.

#### Presented Papers

Author: *Dr. H. Kasper* (Switzerland)  
Title: Flugaufnahmen aus Helikoptern zur Feststellung von Strassenschäden  
PP IV/25

*Dr. Kasper* said that damage done to road surfacings could be measured from photographs taken from a helicopter with an accuracy reaching 1 cm. He mentioned the paper of *Dr. K. Köthe* (F.R.G.) with similar accuracy for railway measurements.

Author: *Mr. G. Hallert* (Sweden)  
Title: The Application of Aerial Photo-interpretation to Road Design in Sweden  
PP IV/21

*Mr. Hallert* pointed out that road construction was considerably facilitated by the use of photo-interpretation. With the help of photointerpretation the types of soil are inventoried so as to determine the alinement. The scales of photography (1:30000, 1:13000) enable mapping even at 1:2000.

#### Panel Discussion

Topic: Applications of Digital Terrain Models

Moderator: *Dr. C. Ternryd* (Sweden)

Panelists: *Dr. K. Kraus* (Austria)  
*Dr. R. Murai* (Japan)  
*Mr. M. MacLeod* (Canada)  
*Mr. R. Mahan* (U.S.A.)  
*Mr. B. Cabrera* (Mexico)  
*Mr. B. Adolfsson* (Sweden)

The question of the day was the future of Working Group IV/1: should it continue its work or should it be dissolved, and this after 16 years of existence, in the course of which photogrammetry and digital terrain models have progressively become a classical procedure for highway and railway construction.

*Mr. Adolfsson* observed that orthophotography, having developed considerably (as could be seen at the Exhibition), introduces new perspectives, when combined with methods of digitization.

*Mr. MacLeod* said the development of digital maps at the Ministry of Transports in Toronto

provides good evidence of the usefulness of automated data processing, with one reservation, that is, that intensive use be made of it. The equipment may be redeemed in four years. In Toronto, the equipment is in operation 15 hours a day, on an average, and covers the scales between 1:10000 and 1:500. The degree of automation in the production of maps is 100%.

*Dr. Ternryd* asked whether this did not imply a very advanced level of training for photogrammetrists.

*Mr. MacLeod* gave a positive answer to this, but added that all this was to be done only gradually. He said that the corresponding investments were justified by the reduction of costs and also by the data processing sub-products (D.T.M.).

*Mr. Mahan* added to the preceding that all this was true on the condition that the accuracy was known (and satisfactory). *Mr. Adolfsson* mentioned the need for recommendations for accuracy of various DTM's.

*Dr. Murai* observed that digital terrain models were of interest to almost all of the Commissions of the I.S.P. As a matter of fact, D.T.M. can be used for:

- problems of civil engineering (transport, agriculture, urban planning, industry)
- topographical problems (stereo-pairs, gradient maps, perspective curves)
- analyses of natural phenomena (sunlight, snow, avalanches)
- systems embodying geographical information (land use, geology, etc.).

The cartographic output can be automatically obtained by two different types of processes: the matrix processes, or point-wise (using scanners), and the sequential processes, or line-wise (using tracing tables).

*Dr. Kasper* concluded from the audience that a rapid glance at the history of photogrammetry leads one to consider the initial task of the Working Group (promoting the use of photogrammetry in civil engineering) as completed.

*Mr. MacLeod* added that much remained to be done.

*Dr. Ternryd* closed the meeting by saying that the area covered by the Working Group could be taken up once again and extended to cover the whole body of semi-automated photogrammetric methods, not only the D.T.M.

Thursday, July 22, 1976, from 16.00 to 16.45  
Session 9 of Commission IV

Topic: Business Meeting  
Chairman: *Mr. G. Ducher* (France)

The President of the Commission read the resolutions proposed by the Resolutions Committee that had just held its meeting.

After this the resolutions, five in number, were discussed. Resolutions 2,4 and 5 were adopted without modification.

As to Resolution 1, *Dr. Ternryd* asked that the word "semi-automated" be added to the sentence dealing with digital models. After a general discussion it was decided to add a supplementary allusion to automation to the resolution, at the head of the sentence containing the D.T.M.

Then *Dr. J. Zarzycki* (Canada) asked that the expression "digital topographic data base" be

added to this resolution, so that everybody could see that the area to be covered by the proposed working group is not limited to graphical maps nor to D.T.M. alone, which for some cover only altimetry. This emendation was adopted.

After this the meeting discussed the stereo-orthophoto mentioned in Resolution 3.

Some were afraid that the resolution could be interpreted as already recommending the application of this technique. *Dr. Ternryd* thought this was a premature worry. In fact, the resolution proposed only a study of the problems related to the production and use of orthophotos and stereo-orthophotos. Consequently, only a study was being proposed. Thus the text was maintained in its original form.

Finally, *Dr. Zarzycki* proposed that "space images" be replaced by "space data" in the Recommendation. This modification was adopted.

Friday, July 23, 1976, from 15.45 to 17.15  
Session 10 of Commission IV

Topic: Conclusions  
Chairman: *Mr. G. Ducher* (France)

#### Invited Paper

Author: *Dr. W. Brindöpke* (F.R.G.)  
Title: Grosse Bildmassstabe für gross-  
massstäbige Auswertungen und  
Karten IP IV/05

*Dr. Brindöpke's* presentation was followed by a general discussion in the course of which the following remarks were made.

*Mr. J. Visser* (Netherlands) returned to the graph presented by *Dr. Brindöpke*, according to which the costs of photogrammetric methods would mount up to only 1/3 of the costs of terrestrial mapping methods. Would this hold true in the F.R.G.? Would it hold true in India where the costs of labour are not as high?

*Dr. Brindöpke* answered that the information in the graph was of a very general nature. The principle holds true for urban areas and for the mountainous areas in Europe.

*Dr. T. Blachut* (Canada) said the idea presented by *Dr. Brindöpke* would be interesting for Canada where labour is costly. He said he was sceptical about the use of analytical block adjustment and the use of mono-comparators, due to uncertain interpretation. On the contrary, he thought the analytical plotters make it possible to improve both accuracy and speed.

*Dr. Brindöpke*, again, thought that analytical plotting could be carried out in two ways: analytical plotters for the linear details and natural points; mono-comparators for targeted or artificial points offer no difficulty of interpretation.

*Dr. B. Dubuisson* (France) spoke of parameters, saying they included the choice of the number of stereo-pairs and the number of points per stereo-pair.

*Dr. Blachut* said the experience gained in Canada tends not to recommend the use of mono-comparators.

*Dr. B. Makarovič* (Netherlands) said that, to judge from the experience gained from mono-photogrammetry at the I.T.C., it was necessary not only to target in advance but also to measure the

height of the buildings. A good number of questions still need to be answered.

*Mr. H. Desportes* (France) observed that, when using very large scales, buildings tend to hide important details due to perspective.

#### Panel Discussion

Topic: Conclusions  
Moderator: *Dr. B. Dubuisson* (France)  
Panelists: *Dr. U. van Twembeke* (Belgium)  
*Dr. T. Blachut* (Canada)  
*Mr. M. Thompson* (U.S.A.)  
*Dr. G. Birardi* (Italy)

A panel moderated by *Dr. Dubuisson* then discussed conclusions arising from Commission IV's proceedings at the Congress.

*Mr. Thompson* presented a number of conclusions concerning automation in photogrammetry:

— it is possible, at a relatively low cost, to equip plotters with recording apparatuses or minicomputers and to thus automate the processes

— analytical systems, being much more sophisticated, make it possible to go further, but they require considerable investments

— systems of differential orthoprojection make possible a reduction of costs

— satellite imagery, again, provides synoptical data that can be automatically processed, and analyzed so as to extract thematical information. It is not to be forgotten that the use of automation is costly and that any success demands patient and untiring effort.

*Dr. Birardi* remarked that satellites actually provide data of use especially for revision purposes — under certain circumstances even at medium scales. Consequently, it is important to obtain photographs at shorter intervals, perhaps with the help of fixed orbits. Anyway, it can be hoped that spatial imagery will provide a solution for problems of revision.

*Dr. Blachut* said the worldwide need for cartographic services was enormous, as compared with what is already available, and, above all, as compared with the necessity of evolution in the areas of demography and economics and the necessity of an inventory of our own resources that we know so little about. Meanwhile, we should be working at a plan for the use of these resources. Classical maps and orthophotomaps (including stereo-ortho) have to be produced as quickly as possible for purposes of land use, an end that passes by far those of cadastre alone.

*Dr. van Twembeke* said he would like to make two series of remarks concerning multipurpose maps: it is important to be cautious with digital data that are not directly apprehensible, but have to be graphically converted. On the other hand, the difficulties in producing multipurpose maps are more of a psychological nature than a technical one, as far as the dialogue and consultations with users are concerned.

*Dr. Dubuisson* said a concluding word about the necessity of geographical localization to enable a correlation with socio-economic data banks. Two principles are to be taken as a basis for such data banks:

— frequent output justifies their use

— various data banks are to be connected with each other by so-called "gangways".



## Closing Report

Chairman: *Mr. G. Ducher* (France)

A closing report summarizing the Commission's activities was presented by President *Ducher*.

The Commission had met nine times during the Helsinki Congress, the arrangements of which had been successful in all ways: seven technical sessions and two business meetings had made it possible to present a general outlook on all of the items attributed to the Commission, not to speak of the smaller meetings of the Working Groups themselves. 55 oral presentations had been made, about ten minutes each, by 35 speakers (of whom several had intervened on many occasions) from 17 countries and five continents. 11 Invited Papers had been presented

(from eight countries) and five panel discussions had been held.

Had one been asked to give four keywords to describe the work of Commission IV in Helsinki, they would have been: automation, digitization, revision, orthophotography. Before closing the session, the President thanked the interpreters for their efficient and pleasant cooperation, and all attendants for their participation in the general discussions. It is only through international cooperation that effective progress in these areas can be achieved.

The President then read the five Resolutions of Commission IV together with the Recommendation concerning the use of satellites. The texts were unanimously adopted.

The meeting was adjourned.

## COMMISSION V

### NON-TOPOGRAPHIC PHOTOGRAMMETRY

### PHOTOGRAMMETRIE NON-TOPOGRAPHIQUE

### NICHTTOPOGRAPHISCHE PHOTOGRAMMETRIE

President: *Dr. H. M. Karara* (U.S.A.)

Secretary: *Dr. R. E. Herron* (U.S.A.)

Monday, July 12, 1976, from 16.15 to 17.00  
Session 1 of Commission V

Topic: Business Meeting

Chairman: *Dr. H. M. Karara* (U.S.A.)

After welcoming the delegates, *Dr. Karara* introduced the Chairmen of the Commission V Working Groups:

*Dr. K. Linkwitz* (F.R.G.) — Working Group 1

*Dr. W. Faig* (Canada) — Working Group 2

*Dr. M. Kurtz* (U.S.A.) — Working Group 3

*Dr. Karara* then outlined the program of all the sessions comprising Commission V presentations during the Congress. He also drew attention to a few last minute changes.

A Resolutions Committee was appointed by *Dr. Karara* to receive and develop resolutions concerning the activities of Commission V during the next four years. Appointed to this Committee were: *Dr. Karara*, *Dr. K. Torlegård* (Sweden), *Dr. J. Badekas* (Greece), and *Dr. R. E. Herron* (U.S.A.).

The meeting was adjourned.

Wednesday, July 14, 1976, from 10.45 to 12.15  
Session 2 of Commission V

Topic: Reports on the Activities of Commission V and Related Committees and Meetings

Chairman: *Dr. H. M. Karara* (U.S.A.)

### Reports

Author: *Dr. H. M. Karara* (U.S.A.)

Title: Non-topographic photogrammetry  
1972—1976 CR V/01

*Dr. Karara* gave a short summary of his report relating a.o. the names, members and activities of the three Working Groups, the participation of Commission V in several international meetings and symposia concerning Close-Range Photogrammetry as well as the significant progress made between 1972—1976 in various aspects of this quickly expanding technology.

Author: *Mr. M. Carbone* (France)

Title: Comité International de Photogrammétrie Architecturale (CIPA)

A report on the activities of the International Committee on Architectural Photogrammetry was given by its President, *Mr. Carbone*.

Following *Mr. Carbone's* report *Mr. J. Danko* (U.S.A.) commented on the possibility of using stable base polyester film instead of glass plates, which, as *Mr. Carbone* explained, are becoming more difficult to obtain. The latter thought that this would be an acceptable solution if more stereometric cameras which can use film become available and if the problem of film flatness is adequately resolved without adding too much weight or technical complexity.

Author: *Dr. R. E. Herron* (U.S.A.)  
Title: International Exploratory Committee  
on Biomedical Photogrammetry.

This committee I.E.C.B.P. was established in 1974 in order to try and promote relations between the communities of photogrammetry and medicine. The chairman of the Committee *Dr. Herron* and its other members *Dr. K. Torlegård* (Sweden), and *Dr. K. B. Atkinson* (U.K.) met in Washington D.C. in September 1974 during the I.S.P. Symposium on Biostereometrics.

*Dr. Herron* commented: "The outcome of this meeting as well as of subsequent correspondence between the Committee members and with national and international representatives of biomedical organizations has led to the following five conclusions:

1. There is a growing recognition of the need for a comprehensive geometrically based science of biological form. The emergence of biostereometrics, the spectral and spatiotemporal analysis of biological form and functions based on principles of analytic geometry is a timely and appropriate response to this need.

2. We need to do more on a national basis to promote the concepts of biostereometrics within the boundaries of individual countries before we can expect to gain wide interest and support of international biomedical organizations in more formal activities and commitments.

3. Photogrammetric organizations must lend support to the efforts of individuals in I.S.P. member countries to promote better communications with local and national representatives of established biomedical societies.

4. Biostereometrics is at the stage of the development comparable with that of electromyography when Galvani first discovered that muscles produce electrical activity. A tremendous amount of research and design input is needed before the breadth of potential applications can be realised to any substantial degree. Of course there will be more immediate spinoffs, but the real future of biostereometrics is still far in the future. This fact will probably limit the rate of national and international developments and leave the initiative to a small number of dedicated individuals. But for those specialists from all aspects of photogrammetry; engineers, scientists and manufacturers who devote time and energy to this mission, the personal and professional satisfaction should ultimately prove highly rewarding.

5. The applications of photogrammetric knowledge to the field of health throughout the world is not subject to some of the constraints on international communications, which affect certain other areas of photogrammetry. It is incumbent upon the I.S.P. in general and Commission V in particular to strongly support the pursuit of greater understandings and enhance the communications about biostereometrics so that the potentials can ultimately benefit humans everywhere without regard to national boundaries."

Author: *Dr. R. E. Herron* (U.S.A.)  
Title: ISP Symposium "Biostereometrics '74", Washington, D.C., 1974 IP V/15

Author: *Dr. W. Lotze* (G.D.R.)  
Title: Dreikordinatenmessung und industrielle Photogrammetrie im VI Kongress der IMEKO Dresden 1973 PP V/32

*Mr. R. Meyer* (G.D.R.) summarized a report written by *W. Lotze* on the Sixth Conference of the International Measurement Confederation held in Dresden in 1973.

Author: *Mr. K. B. Atkinson* (U.K.)  
Title: Sessions on Non-Topographic Photogrammetry, the UK Photogrammetric Society's Symposium, Birmingham, 1975

Author: *Dr. H. M. Karara* (U.S.A.)  
Title: ASP Symposium on Close-Range Photogrammetric Systems, Urbana, 1975 (Reprinted proceedings are available from the ASP)

Following the presentation of all the reports, several of those present participated in a discussion about how Commission V could help to cope with the difficult question of "plates or films".

*Dr. M. Kurtz* (U.S.A.) suggested a.o. that a solid state imaging camera, such as used for TV and monitoring and claimed that by the vendors to have the advantage of metricity, should be considered as an alternative solution in this matter.

Thursday, July 15, 1976, from 14.00 to 15.30  
Session 3 of Commission V

Topic: State-of-the-Art of Close-Range Photogrammetry

Chairman: *Dr. H. Karara* (U.S.A.)

#### Invited Paper

Author: *Dr. K. Torlegård* (Sweden)  
Title: State-of-the-Art of Close-Range Photogrammetry IP V/21

#### Panel Discussion

Topic: "State-of-the-Art of Close-Range Photogrammetry"

Moderator: *Dr. H. M. Karara* (U.S.A.)

Panelists: *Dr. V. Kratky* (Canada)  
*Mr. R. Meyer* (G.D.R.)

*Dr. Kratky* stated as his opinion that the trend of Close-Range photogrammetric systems are towards the use of analytical solutions and on-line systems in connections with non-metric cameras.

*Mr. Meyer* emphasized that the non-metric cameras are not inexpensive if complicated auxiliary equipment has to be used to get the necessary accuracy. Research institutes are generally not obliged to think on the economy, but in practice most of the solutions in Close-Range photogrammetry have to be reached using more simple equipment and methods. Therefore every problem has to be thoroughly discussed and analysed in advance together with the user of the results in order to find the less expensive but still fully satisfactory solution.

*Dr. Herron* made a comment regarding the problem of defining "metric" and "non-metric" cameras, referred to by *Dr. Torlegård*. He said: "As a user, rather than a theorist, perhaps I can be excused if I sound naïve about such matters, but shouldn't we focus on the performance of the photogrammetric system as a whole rather than on one hardware component? This would yield a more realistic appraisal of the relative costs, practicability, etc. of using cameras of different design (with or without fiducials, etc.)."

*Dr. Herron* also commented on the paper read by *Mr. Meyer* pointing out that as to biostereometrics it is often difficult or impossible for the user to state exactly what results he is looking for. A period of research is generally needed before this question can be answered by someone who has never had access to such comprehensive geometric information before.

#### Presented Papers

Author: *Dr. J. Höhle* (U.S.A.)  
 Title: On some Innovations in Close-Range Photogrammetry PP V/18

Authors: *Dr. H. Papo* (Israel)  
*Dr. B. Shmutter* (Israel)  
 Title: Tank Calibration by Stereophotogrammetry PP V/40  
 Author: *Mr. M. Gordon* (New Zealand)

Titles: Measuring Underwater Models  
 PP V/17

Authors: *Mr. C.-O. Jonason* (Sweden)  
*Mr. R. Massarsch* (Sweden)  
*Mr. G. Ivmark* (Sweden)  
 Title: A New Technique Developed to Determine the Movements of an Old Masonry Wall as a Result of Piling  
 PP V/23

Thursday, July 15, 1976, from 15.45 to 17.15  
 Session 4 of Commission V

Topic: Analytical Methods in Close-Range Photogrammetry  
 Chairman: *Dr. K. Linkwitz* (F.R.G.)

This session was devoted to the activities of Working Group V/1 "Analytical and Semi-Analytical Approaches in Terrestrial, Close-Range and Micro-Range Photogrammetry" chaired by *Dr. Linkwitz*.

*Dr. Linkwitz* opened the session with a short report concerning the activities of WG V/1 and its program during the congress (CR V/01 page 37).

#### Working Group Papers

Author: *Dr. K. W. Wong* (U.S.A.)  
 Title: Mathematical Formulation and Digital Analysis in Close-Range Photogrammetry WGP V/05

Author: *Dr. V. Kratky* (Canada)  
 Title: Analytical On-Line Systems in Close-Range Photogrammetry WGP V/04

After that *Mr. V. Lvov* (U.S.S.R.) highlighted his Presented Paper.

Author: *Mr. V. K. Lvov* (U.S.S.R.)  
 Title: Principal Works in the Field of Non-Topographic Application of Photogrammetry in the USSR for the period from 1971 to 1975 PP V/33

These papers were followed by a series of questions by *Dr. Linkwitz* to the speakers and other participants of the session.

The demand for minimizing the time laps between photography and plotting was under lively discussion. Examples of practically applied on-line photogrammetric systems including solid state stereo cameras, computer and display units were related to.

The applications of such very expensive systems to create "real time photogrammetry" has to be considered important but exceptional cases as in e.g. biostereometrics, space craft technique. In general one has to limit the application of on-line systems only in the plotting phase.

Friday, July 16, 1976, from 9.00 to 10.00  
 Session 5 of Commission V

Topic: Business Meeting  
 Chairman: *Dr. H. M. Karara* (U.S.A.)

At this meeting, the list of resolutions drawn up by *Dr. Karara* were discussed and approved for submission to the General Assembly.

*Dr. Herron* pointed out that the term "biomedical photogrammetry" is inadequate to cover the scope of Biostereometrics, which embraces the application of photogrammetry in such fields outside biomedicine as: botany, entomology and paleontology, among others. This broader base has helped the field to grow rapidly in recent years.

Friday, July 16, 1976, from 14.00 to 15.30  
 Session 6 of Commission V

Topic: Accuracy Aspects and Instrumentation in Close-Range Photogrammetry  
 Chairman: *Dr. K. Linkwitz* (F.R.G.)

Also this session was devoted to activities of Working Group V/1.

#### Working Group Papers

Author: *Mr. P. Hottier* (France)  
 Title: Précision de la photogrammétrie analytique à courte distance: Etudes expérimentales et prédiction WGP V/03

*Mr. Hottier* highlighted his paper "Accuracy of Close-Range Analytical Restitutions, Practical Experiments and Prediction".

Author: *Dr. W. Faig* (Canada)  
 Title: Calibration of Close-Range Photogrammetric Systems: Mathematical Formulation WGP V/02

A lively discussion of the two papers followed.

### Presented Papers

Author: *Dr. H. Moniwa* (Canada)  
Title: A Flexible Method of Self-Calibration for Aerial and Close-Range Photogrammetric Systems *PP V/36*

Authors: *Mr. E. Dauphin* (Sweden)  
*Dr. K. Torlegård* (Sweden)  
Title: Measurement of Displacement Using the Time-Parallax Method *PP V/11*

Author: *Mr. M. Blaustein* (France)  
Title: Une Méthode de contrôle de structures d'avion par photogrammetrie *PP V/05*

*Mr. Blaustein's* paper, which was not previously announced, dealt with the photogrammetric measurement of aircraft components, from manufacturing through structural testing. The last twenty minutes of the session were devoted to questions from the floor.

Monday, July 19, 1976, from 9.00 to 10.30  
Session 7 of Commission V

Topic: Problems Associated with the Use of Non-Metric Cameras in Photogrammetry

Chairman: *Dr. W. Faig* (Canada)

The following two sessions were devoted to the activities of Working Group V/2. To begin with, *Dr. Faig* discussed the activities of his Working Group (*CR V/01 p. 38*).

### Working Group Papers

Author: *Dr. W. Faig* (Canada)  
Title: Report of WG V/2 "Photogrammetric Potentials of Non-Metric Cameras" *WGR V/06*

Author: *Dr. O. Kölbl* (Switzerland)  
Title: Metric or Non-Metric Cameras *WGP V/07*

### Presented Paper

Authors: *Dr. V. D. Brandow* (U.S.A.)  
*Dr. H. M. Karara* (U.S.A.)  
*Dr. H. H. Damberger* (U.S.A.)  
*Dr. H.-F. Krausse* (U.S.A.)  
Title: A Non-Metric Close-Range Photogrammetric System for Mapping Geologic Structures in Mines *PP V/07*

An extensive and very interesting discussion of the two papers by *Dr. Kölbl* and *Dr. Brandow* et al. followed.

Monday, July 19, 1976, from 10.45 to 12.15  
Session 8 of Commission V

Topic: Practical Experience with Non-Metric Photography

Chairman: *Dr. W. Faig* (Canada)

During this session the discussion on the activities of Working Group V/2 was continued.

### Working Group Paper

Authors: *Dr. M. C. van Wijk* (Canada)  
*Dr. H. Ziemann* (Canada)  
Title: The Use of Non-Metric Cameras in Monitoring High-Speed Processes *WGP V/08*

### Panel Discussion

Topic: The Actual Use of Non-Metric Cameras in Photogrammetric Practice

Moderator: *Dr. W. Faig* (Canada)  
Panelists: *Dr. J. Badekas* (Greece)  
*Dr. J. Höhle* (U.S.A.)  
*Dr. Z. Sitek* (Poland)  
*Dr. J. Töppler* (G.D.R.)  
*Dr. O. Kölbl* (Switzerland)

### Presented Papers

Authors: *Dr. W. Nauck* (G.D.R.)  
*Dr. A. Lehmann* (G.D.R.)  
Title: A New Software Package for Data Reduction in Industrial Photogrammetry

Author: *Dr. M. S. Bhatti* (Pakistan)  
Title: Effect of Variation in Aperture on Photographic Images *PP I/03*

Author: *Dr. J. Kobelin* (U.S.A.)  
Title: Mapping Street Intersections Using Close-Range Photogrammetry *PP V/29*

This was followed by a lively discussion on all the papers by the panel members.

Tuesday, July 20, 1976, from 9.00 to 10.30  
Session 9 of Commission V

Topic: Architectural Photogrammetry  
Chairman: *Mr. M. Carbonnell* (France)

### Invited Papers

Author: *Mr. M. Carbonnell* (France)  
Title: Développements techniques de la photogrammétrie architecturale *IP V/14*

*Mr. Carbonnell* led off the session with a detailed report on "Technical Progress in Architectural Photogrammetry".

Author: *Dr. C. Sena* (Italy)  
Title: Use of Analytical Plotter in Architectural Photogrammetry *IP V/19*

Author: *Mr. E. Seeger* (F.R.G.)  
Title: Orthophotography in Architectural Photogrammetry *IP V/18*

### Presented Papers

Author: *Dr. Z. Sitek* (Poland)  
Title: Experiences with the Application of Orthophotos in Architecture *PP V/43*

Author: *Dr. H. Kasper* (Switzerland)  
Title: Architekturphotogrammetrie — erfüllte und offene Wünsche an die Instrumentenindustrie *PP V/28*

Author: Mr. R. Meyer (G.D.R.)  
Title: Eine Überweitwinkel-Messkammer für die Architektur-Photogrammetrie PP V/35

Authors: Dr. H. Kager (Austria)  
Dr. P. Waldhäusl (Austria)  
Title: Fassa den vermessung — eine aktuelle Aufgabe der Ingenieurphotogrammetrie PP V/25

Finally, Dr. K. Linkwitz (F.R.G.) discussed briefly his use of photogrammetry in checking and monitoring a precast concrete shell construction project.

There was no time for a general discussion.

Tuesday, July 20, 1976, from 14.00 to 15.30  
Session 10 of Commission V

Topic: Holographic and Moiré Systems and Applications in Close-Range Photogrammetry

Chairman: Dr. M. K. Kurtz (U.S.A.)

Dr. R. E. Herron (U.S.A.), Secretary of Commission V, introduced Dr. Kurtz, the chairman for the session, and congratulated him on arranging such an outstanding line-up of speakers.

This tenth session, into which also some specialists in coherent optics from Commission I had been invited, was devoted to the activities of Working Group V/3. The Chairman of the Working Group, Dr. Kurtz, reported briefly on the activities of the group.

#### Working Group Papers

Author: Dr. M. K. Kurtz (U.S.A.)  
Title: Report of Working Group V/3 "Metrical Aspects of Non-Conventional Imageries"

As to the general activities of W.G. 3, Dr. Kurtz referred to the Report of Commission V (CR V/01) by Dr. Karara and then briefly mentioned several international publications on hologrammetry, laser techniques, coherent optics in mapping, etc., which showed a lively interdisciplinary work going on in this field.

Few direct applications of hologrammetric measurement techniques have been reported until very recently. But it seems that coherent optics will soon begin to play a key role in a wide variety of non-topographic photogrammetric systems in the future. He stressed the necessity for photogrammetrists to learn about coherent optics and perhaps solid state rectangular arrays for detection and readout of data. Also the electro-optical specialists should be encouraged to learn more about photogrammetry. For this purpose appropriate disciplinary courses have been suggested in U.S. universities. The same idea is lying behind the choice of papers to be presented at this session.

Author: Dr. J. W. C. Gates (U.K.)  
Title: Three-Dimensional Location and Measurement by Coherent Optical Methods WGP V/11

Author: Dr. H. Takasaki (Japan)  
Title: Simultaneous All-Around Measurement of a Living Body by Moiré Topography WGP V/12

Author: Dr. N. Balasubramanian (U.S.A.)  
Title: Comparison of Optical Contouring Methods WGP V/10

After the presentation of this paper by Dr. E. M. Mikhail (U.S.A.) Dr. Kurtz thanked him and said that the device just described was an instant X, Y, Z image digitizer. He thought the use of a detector array to intercept the light would be applicable in the Moiré area and other techniques dealt with in the paper.

Author: Dr. J.-P. Agnard (Canada)  
Title: Canadian Contribution to Hologrammetry WGP V/09

#### Presented Papers

Authors: Dr. G. de Closmadeuc (France)  
Mr. B. Turlier  
Mr. D. Laroche  
Title: Restituteur hologrammétrique PP V/30

Dr. Kurtz gave a short summary of the hologrammetric plotter of Dr. de Closmadeuc which operates in the similar way as described by Dr. Mikhail, but in this paper there is a suggestion to extend that technology to measure the real image rather than the virtual image, which has been under focus in the past. The ability to repeatedly position a self-illuminated mark in the 3D-image space, which remains in sharp focus to your eye at all times, is of great advantage. The use of a magnifier lens just to look through at the image, in which case both image and mark are enlarged equally, is also giving a greater confidence in the 3D measurement of holograms.

Next there were two Presented Papers, both on the use of photogrammetric methods in electron microscopy. They were highlighted by Dr. S. K. Ghosh (U.S.A.) and Mrs. Stadnik (U.S.S.R.), respectively.

Authors: Dr. S. K. Ghosh (U.S.A.)  
Dr. H. N. Nagaraja (India)  
Title: Distortion in Scanning Electron Micrographs PP V/14

Authors: Dr. V. J. Finkowsky (U.S.S.R.)  
Dr. V. N. Mjelnik (U.S.S.R.)  
Title: Investigation of the Raster Electronic Microstereophotogrammetric Survey Accuracy PP V/12

Finally, Dr. Herron commented on the need for a continuing dialogue between developers of new methods of stereometric sensing and those who are engaged in day-to-day problem solving in various areas of close-range photogrammetry. The meeting was adjourned.

Thursday, July 22, 1976, from 9.00 to 10.30  
Session 11 of Commission V

Topic: Industrial Photogrammetry  
Chairman: Dr. T. Oshima (Japan)

### Invited Papers

- Author: *Mr. K. B. Atkinson* (U.K.)  
Title: A Review of Close-Range Engineering Photogrammetry *IP V/13*
- Author: *Dr. I. Newton* (U.K.)  
Title: Close-Range Photogrammetry as an Aid to Measurement of Marine Structures *IP V/16*
- Authors: *Dr. C. Sena* (Italy)  
*Dr. B. Astori* (Italy)  
*Dr. R. Chiabrando* (Italy)  
Title: Experiments on the Application of a Method for Photogrammetric Survey of Industry Models *IP V/20*
- Author: *Dr. T. Oshima* (Japan)  
Title: Recent Developments of Industrial Photogrammetry in Japan *IP V/17*

### Presented Papers

- Authors: *Mr. A. Stenberg* (Norway)  
*Mr. O. Øfsti* (Norway)  
Title: Photogrammetric Determination of Distribution and Thickness of Cavitation on Ship Propellers *PP V/44*
- Author: *Dr. J. Töppler* (G.D.R.)  
Title: Some reflections on Problems of Industrial Photogrammetry *PP V/49*

There was no time for questions.  
The meeting was adjourned.

Friday, July 23, 1976, from 10.45 to 12.15  
Session 12 of Commission V

Topic: Biostereometrics  
Chairman: *Dr. R. E. Herron* (U.S.A.)

### Invited Paper

Author: *Dr. R. E. Herron* (U.S.A.)  
Title: Biostereometrics '74 — A Report *IP V/15*

*Dr. Herron* discussed the activities since 1974 as well as the status of this field of application of photogrammetry.

### Panel Discussion

Topic: Biostereometrics  
Moderator: *Dr. R. E. Herron* (U.S.A.)  
Panelists: *Dr. F. G. Lippert* (U.S.A.)  
*Dr. K. Torlegård* (Sweden)

A panel discussion on the latest developments in biostereometrics followed. *Dr. Lippert* spoke on experimental studies of patellar motion using X-ray photogrammetry

*Dr. Torlegård*, again, considered ways of introducing photogrammetry into the field of medicine. He posed the following questions:

1. What is the best way to start — to prepare courses, or to attack problems and to try and solve them?
2. What is better — to have complicated universal and expensive equipment, or to have simple equipment for solving single problems?
3. Who should do the photogrammetry in medicine — photogrammetrists or the medical staff?

The answers to these questions were postponed until after the Presented Papers.

### Presented Papers

- Author: *Mr. J. Söderlund* (Sweden)  
Title: Children's Spectacles *PP V/46*
- Authors: *Mr. J. Larsson* (Sweden)  
*Dr. B. Almby* (Sweden)  
*Dr. T. Lönnerholm* (Sweden)  
Title: An Investigation of the Human Hip Joint Using Röntgenphotogrammetry *PP V/31*

The Chairman then returned to *Dr. Torlegård* and asked him to repeat the questions given above.

*Dr. Lippert* answered to the repeated questions: 1. With regard to the introduction of Photogrammetry, at our university we have found it favourable to arrange series of sessions, in which we have invited representatives of the medical departments concerned, and to present there what we can offer in terms of our capabilities. New questions raised were discussed there and then studied. The results have also been published in the University News Letter in order to keep the people abreast with our work.

2. As to the kind of equipment to be used it naturally depends on the problem to be solved and one should start applying the most simple available ones which gives the accuracy needed. 3. To judge from our experience, it is now possible to have technicians make the photographs and to have photogrammetrists do the data processes required.

*Dr. Oshima* said that, in his opinion, there is not enough work in the hospitals for photogrammetrists in order to have them permanently employed; it is often better to hire them. He added that in Japan they are organizing a medico-technical society to guarantee cooperation between doctors and engineers.

*Dr. H. Meixner* (Austria) asked how expensive the equipment used in Uppsala was. In answer, *Dr. Lönnerholm* said it was worth about Fmk 80.000.

The Chairman closed the meeting by observing that it was very difficult to give exact answers to *Dr. Torlegård's* questions, because so much depends on the local circumstances. It is clear, however, that a high level of education of photogrammetrists should be guaranteed in medical centres also in the future. As to equipment, much more should first be known about the problems involved.

Friday, July 23, 1976, from 14.00 to 15.30  
Session 13 of Commission V

Topic: Future of ISP Commission V  
Chairman: *Dr. H. M. Karara* (U.S.A.)

The session opened with a general discussion concerning the resolutions of Commission V.

### Panel Discussion

Topic: Future of ISP Commission V  
Moderator: *Dr. H. M. Karara* (U.S.A.)

Panelists: *Dr. K. Torlegård* (Sweden), Incoming President of Commission V  
*Mr. M. Carbonnell* (France), President 1968—1972  
*Dr. T. Maruyasu* (Japan), President 1964—1968

#### Presented Papers

Authors: *Dr. B. P. Wrobel* (F.R.G.)  
*Mr. K. H. Ellenbeck* (F.R.G.)  
Title: Terrestrisch-Photogrammetrische Punktbestimmung durch Simultan ausgleichung gemessener Orientierungsdaten und Bildkoordinaten in der Bündelblockausgleichung PP V/55

Author: *Mr. A. H. Polderman* (Netherlands)  
Title: Non-Topographic Photogrammetry at the Survey Department of Rijks-waterstaat PP V/41

Authors: *Mr. B. Ageby* (Sweden)  
*Mr. J. Larsson* (Sweden)  
Title: Complementing Basic Large Scale Maps (Primärkarta) Using Terrestrial Photogrammetry PP IV/02

Author: *Mr. J. Jaakkola* (Finland)  
Title: Verfahren zum Messen der Dicke von durch Beregnung gestörten Wasserfilmen bei Modellversuchen PP VI/20

*Mr. Jaakkola* outlined his paper "A Method for Measuring the Thickness of Water Films Disturbed by Raining in Model Experiments". The last session of Commission V was then adjourned.

## COMMISSION VI

ECONOMIC, PROFESSIONAL AND EDUCATIONAL ASPECTS OF PHOTOGRAMMETRY  
ASPECTS ECONOMIQUES, PROFESSIONNELS ET PEDAGOGIQUES DE LA PHOTOGRAMMETRIE  
WIRTSCHAFTLICHE, BERUFLICHE UND LEHRTECHNISCHE GESICHTSPUNKTE DER PHOTOGRAMMETRIE

President: *Dr. W. Sztompke* † 1972—1974 (Poland)  
*Dr. Z. Sitek* 1974—1976 (Poland)  
Secretary: *Dr. J. Jachimsky* (Poland)

Monday, July 12, 1976, from 14.15 to 15.00  
Session 1 of Commission VI

Topic: Business Meeting  
Chairman: *Dr. Z. Sitek* (Poland)

The President opened the meeting and gave the agenda of the meeting containing information of the Secretary of the Commission, the Commission Report, and reviewing the program of the Commission VI in the Helsinki Congress.

*Dr. J. Jachimski* (Poland) explained the procedures to be followed at the technical sessions. *Dr. Sitek* added that *Dr. S. Ghosh* (USA) had agreed to work in the Resolutions Committee and he asked to contact him in the matters concerning the resolutions for the next period 1976—1980.

*Dr. Sitek* then presented the Report of Commission VI (CR VI/01). He gave a list of the Working Groups and their chairmen mentioning that two of them were directed by the Commission Board as no chairmen were found for them.

WG VI/1 Education and Research  
*Dr. A. Brandenberger* (Canada)

WG VI/2 History of Photogrammetry  
Board of Commission VI

WG VI/3 Terminology

*Dr. J. Pietschner* (GDR)

WG VI/4 Information Exchange

Board of Commission VI

WG VI/5 Planning, Economy and Organization of Photogrammetric Establishments, Professional Aspects

*Mr. S. Friedman* (USA)

Then the chairmen of the sessions gave detailed accounts of the program of each individual session.

The dividing of the time for the presentation of the papers and for the discussions was agreed upon.

In the following discussion *Dr. A. McNair* (USA) said that as photogrammetry has a growing tendency to include remote sensing, it might be useful to discuss about the including of remote sensing in the bibliography and terminology of photogrammetry. *Dr. Ghosh* pointed out the quantitative nature of photogrammetry and qualitative nature of as well photointerpretation as remote sensing and that both aspects should be within the domain of work.

The President of the Commission then spoke

about the difficulty of terminology especially caused by the three official languages of ISP and finally closed the session.

Tuesday, July 13, 1976, from 15.45 to 17.15  
Session 2 of Commission VI

Topic: Terminology and Organization of  
Production in Photogrammetry  
Chairman: *Dr. Z. Sitek* (Poland)

#### Invited Paper

Author: *Dr. J. Pietschner* (G.D.R.)  
Title: Zur Problematik einer einheitlichen  
Symbolik in der Photogrammetrie  
*WGR VI/03*

The first part of this session was devoted to a discussion on terminology. *J. Pietschner* presented a list of symbols which had been compiled by Working Group VI/3 and proposed that it be used as a basis for an international glossary to be compiled by the I.S.P.

#### Panel Discussion

Topic: ISP Symbols and Terminology for  
Photogrammetry  
Moderator: *Dr. R. Wolf* (U.S.A.)  
Panelists: *Mr. P. Baetsle* (Belgium)  
*Dr. R. Burckhardt* (F.R.G.)  
*Dr. J. Petras* (Czechoslovakia)  
*Dr. J. Pietschner* (G.D.R.)

*Dr. Wolf* pointed out in his introductory remark that the work on terminology should be going on. He suggested that all national members send their comments on the present proposal to the new President of Commission VI to be forwarded to the chairman of the WG.

*Dr. Burckhardt* said that change in terminology on international level will take time. A revision of a terminology is a difficult task, but it can be made using the available literature. In Germany this is done about once in ten years. *Mr. Baetsle* was of the opinion that the work should be continued; the terminology should be standardized so that terms in different languages should correspond with each other. There is the same necessity in the field of symbols.

*Dr. Petras* added that progress had not been fast, but the results will be reached in the future.

In the discussion of the audience, *Mr. S. Möller* (Sweden), *Mr. M. Paradis* (Canada), *Dr. L. Wassiljew* (USSR), it was stressed that the German glossary was not the only one available. Numerous other countries, such as Canada, France, Poland, U.S.A. and U.S.S.R., had their own elaborations. The point made was to stop a rather lengthy and unfruitful discussion and to prepare a trilingual glossary on the basis of the German glossary, for example. It was observed that this work would have to be completed by the end of 1976, in order to be able to prepare a further version by 1978, which would include suggestions based on national standards and on recent research. Following this timetable would make it possible to present a final version of the I.S.P. glossary of terms and symbols at the XIV International Congress of the I.S.P. It was noted that keeping to the proposed timetable would quite

understandably set certain limits to the contents of the glossary.

The Board of Commission VI was obliged to continue its activities within this field and to appoint an editorial committee for the glossary to operate under the supervision of Working Group VI/3 "Terminology".

#### Invited Papers

Author: *Dr. H. Jerie* (Netherlands)  
Title: The Establishment of Cost Models  
in Photogrammetry *IP VII/11*

Author: *Dr. S. Ghosh* (U.S.A.)  
Title: Economic Aspects in Special (Non-  
Topographical) Applications in Pho-  
togrammetry *IP VI/08*

In their respective papers, *Dr. Jerie* and *Dr. Ghosh* discussed economic problems encountered in photogrammetric work. They stressed the need for a further research on standards for economic analyses of photogrammetric work.

In the general discussion that followed, in which *Mr. S. Möller* (Sweden), *Dr. A. Brandenberger* (Canada), *Dr. E. Hubert* (Switzerland) and *Dr. H. Jerie* (Netherlands) took part, it was observed that the amount of money spent on photogrammetry worldwide each year was quite considerable, and that the I.S.P. should therefore pay special attention to the development of such standards.

Wednesday, July 14, 1976, from 15.45 to 17.15  
Session 3 of Commission VI

Topic: Photogrammetric Periodicals and  
Bibliography  
Chairman: *Dr. J. Jachimsky* (Poland)

#### Invited Paper

Author: *Dr. J. Hothmer* (F.R.G.)  
Title: Do Photogrammetric Periodicals  
Have a Future? *IP VII/10*

In his paper, *Dr. Hothmer* proposed that regional photogrammetric journals be published jointly by professional organizations too small to economically publish their own journals. This would involve cooperation between closely related fields, such as surveying and cartography. Another alternative would be to publish regional-international periodicals specialized in photogrammetry.

#### Panel Discussion

Topic: Functions of Professional Periodi-  
cals in the Life of the Photogram-  
metrists and Their Societies — At  
Present and in the Future  
Moderator: *Mr. G. C. Tewinkel* (U.S.A.)  
Panelists: *Mr. K. Atkinson* (U.K.)  
*Mr. M. Carbonnell* (France)  
*Mr. J. Case* (U.S.A.)  
*Dr. J. Hothmer* (F.R.G.)  
*Dr. J. Jachimsky* (Poland)  
*Dr. A. J. van der Weele* (Netherlands)

*Mr. Tewinkel* opened the discussion by realizing that all participants of the panel, in the present or in the past, have been editors of photogrammetric journals. In the discussion *Mr. Atkinson*



said that Photogrammetric Record is a main contact of the members of the Photogrammetric Society with the Society. As the number of members in the U.K. Society is about 600 and the number of participants of meetings about 80 and of Symposium about 100, there are several hundred members, a part of them overseas, whose only contact with the Society is the journal. The Photogrammetric Record has been rather successful also financially. He doubted the success of a European journal suggested by *Dr. Hothmer*. *Mr. Carbonnell* mentioned that the position of the French journal is very similar to the Photogrammetric Record. He added that he agrees with *Mr. Atkinson's* opinion of the proposal of *Dr. Hothmer*. *Mr. Carbonnell* also made same comments on the importance of the journal to the members of the French Society.

*Mr. Case* said that the paper of *Dr. Hothmer* concerns for the most part European journals, but he gave some prospective figures of Photogrammetric Engineering. Its circulation is almost 11000 of which 20% goes overseas. *Dr. Jachimsky* had two questions: 1. Do we need and can we afford national scientific journals, and 2. Do we need and can we afford the official journal of the international Society? He then explained the system of the Polish official technical journal, which is published monthly and which contains a separate issue called Photogrammetric Review. He pointed out the importance of the exchange of information which can be done through three channels: by organizing technical meetings and congresses, by publishing technical reports, and with good bibliographical information.

*Dr. van der Weele* informed that the journal Photogrammetria can be published with the number of subscribers it has now, but the situation is critical. He agreed with *Dr. Hothmer's* opinions of the future trends of periodicals.

After the panel the audience attended the discussion. *Mr. H. S. Williams* (South Africa) told that the South African Photogrammetric Journal is supported by only 300 members of which 50 are active. He also thought that the proposal of *Dr. Hothmer* is interesting as a possible solution for the future as a compromise solution to rising printing costs. *Mr. Szorenyi* (Australia) agreed in principle with *Dr. Hothmer's* suggestion, but said that the computerised system would be the best. *Dr. S. Ghosh* (USA) said that there is a need for a hard look in the "Photogrammetria" as there is a need for an international journal for continuing the dialogue amongst all colleagues.

*Mr. L. Stoch* (Israel) asked for the assistance of the editors in drawing attention to novel ideas which are presented clearly in the publications. *Dr. Hothmer* then answered and agreed with *Dr. Jachimsky* that Photogrammetria should be the greatest journal. Until now it has not succeeded. He made a proposal of the future content of the international journal.

It could contain scientific articles 60%, book reviews 10%, miscellaneous 10%, and local news 10%, about 1/3 in English, 1/3 in French and 1/3 in German.

*Colonel Datta* of India added that this international publication could be published as a monthly journal and at the same time be economically successful.

#### Presented Papers

Author: *Mr. H. Williams* (South Africa)  
Title: Contributions by South Africa to the International Bibliography of Photogrammetry 1972—1976

Authors: *Mrs. N. Wentink* (Netherlands)  
*Mr. H. Rogge* (Netherlands)  
Title: The ITC International Bibliography of Photogrammetry (IBP) PP VI/12 Presented by *Mr. J. van der Veer* (Netherlands)

Author: *Dr. Z. Sitek* (Poland)  
Title: Presentation of the ISP National Bibliography — Photogrammetry and Photointerpretation, Volume I (distributed in the session)

*Dr. Sitek* discussed the results of a Working Group which had prepared an ISP Bibliography. This Bibliography, which was distributed at the session, was derived from material received as a result of solicitations made to national member societies. Although only seven member nations — Australia, Belgium, Finland, Poland, Romania, Turkey, U.S.A. — had responded in time to have their bibliographical data included in this first ISP Bibliography, *Dr. Sitek* expressed the hope that all nations would contribute soon so that a comprehensive Bibliography could result.

Author: *Dr. Z. Sitek* (Poland)  
Title: Presentation of the Multilingual Geodetic, Photogrammetric and Cartographic Dictionary in English, Romanian, German, French and Russian edited by the Romanian Committee of Photogrammetry

In the discussion *Dr. van der Weele* stated that the ITC Bibliography, which is published in the form of cards, has to rely on the information provided by different countries. Therefore it would be of benefit if Commission VI would look into the matter during the next period to find the best solution in the coordination of the Bibliography and avoid duplication. *Mr. J. Case* (USA) asked whether the exploration of information causes difficulties also for the bibliographies. *Dr. van der Weele* answered that in the ITC the bibliography is done by two persons and the price of the bibliography does not cover the real costs. *Mr. Beatsle* (Belgium) pointed out that there is a lot of duplication as also the FIG is doing the same effort in Dresden.

*Dr. Jachimsky* added that the computerizing of information would provide a bigger file of information for geodesy, cartography, photogrammetry, and geography. He adjourned the meeting by thanking the panelists and the audience.

Friday, July 16, 1976, from 15.45 to 17.15  
Session 4 of Commission VI

Topic: Organization of Education and Research in Photogrammetry  
Chairman: *Dr. A. Brandenberger* (Canada)

## Working Group Report

Author: Dr. A. Brandenberger (Canada)  
Title: A World-Wide Analysis on Photogrammetric Education and Photogrammetric Research Policy and Organization WGR 1 VII/02

### Invited Papers

Author: Dr. J. Badekas (Greece)  
Title: Modern Methods of Education in Photogrammetry IP VII/06

Dr. Badekas suggested that modern audiovisual equipment be used and that good handbooks be translated to make them accessible on a world-wide basis. He stated that it is possible for students to acquire a good knowledge of photogrammetry in training laboratories despite certain deficiencies in the equipment available. What is most important, however, is the proper programming of courses.

Dr. Wassiljev and Dr. Hothmer participated in the discussion. Dr. Hothmer put forward the terms "active photogrammetrist" and "passive photogrammetrist" the later being a person who can make use of photogrammetry but is not able to use it. Dr. F. Heimes (Netherlands) then commented the question raised in Dr. Badekas' paper: "What to teach, how much to teach?" Dr. H. Rib (USA) drew the attention to the short courses and workshops which might also belong to the future subjects of WG VI/1. Dr. Hothmer then asked whether there existed any textbook not too large-scale for the passive photogrammetrists. He got answers from Mr. K. Atkinson (United Kingdom), Mr. A. Adamek (Australia) and Mr. J. E. Colcord (USA) suggesting the books of Kilford, Wolf and Moffit as suitable for teaching passive photogrammetrists. Dr. A. J. McNair then informed about the 4th edition of Manual of Photogrammetry as well as about textbooks of Hallert, Moffit, Wolf and Ghosh, the last three of which are being published in new editions. Finally Dr. Hothmer pointed out that it is not reasonable to teach the student too many details of individual instruments but more important to teach them how to study in order to enable them to keep themselves up-to-date later on.

Author: Dr. O. Jerabek (Czechoslovakia)  
Title: Education of Photointerpretation and Remote Sensing IP VII/12

Author: Dr. S. Ghosh (U.S.A.)  
Title: Photogrammetric Research Organization, Coordination and Policies IP VII/07

Dr. Sitek then announced that there would be an additional meeting of Commission VI on Monday 19.7. at 1—2 p.m. The terminology and information exchange would be discussed and everyone interested would be welcome. The chairman closed the session by thanking the attendants and the interpreters.

Tuesday, July 20, 1976, from 10.45 to 12.15  
Session 5 of Commission VI

Topic: Photointerpretational Education and Problems of Photogrammetric Education and Production in the Developing Countries  
Chairman: Dr. A. J. Brandenberger (Canada)

### Invited Papers

Author: Mr. J. Szorenyi (Australia)  
Title: Photointerpretation and Remote Sensing Research Policy and Organization IP VII/13

Dr. S. Paul (France) gave a speech of some minutes before the opening of the discussion (PP VII/05). He raised the question how the commission could arrange a permanent training and retraining of engineers and technicians in photogrammetry and remote sensing. He told about the course in interpretation and remote sensing of about 600 h arranged in Paris 1975—1976. In the following discussion Dr. C. Olson (USA) explained the remote sensing training program in EROS Data Center and in several universities in USA. Dr. J. Hothmer (FRG) asked about the experience in photointerpretation for civil engineers. Dr. A. McNair (USA) answered explaining the program of Cornell University. Mr. G. Salman Gonzales (Mexico) made a comment on Mexican experience in training at the National Mapping Agency CETENAL. Mr. J. Clement (France) said that in teaching photointerpretation and remote sensing, photointerpretation of images and more advanced methods of analysis should be separated to different levels of courses.

Mr. F. Hilwig (Netherlands) informed about the remote sensing course in ITC February/March 1977.

Author: Mr. S. Härmälä (Finland)  
Title: The Developing Countries As an Objective of ISP Activity IP VII/09

Mr. Härmälä delivered this Invited Paper prepared by himself and by the late Dr. R. S. Halonen (Finland).

### Presented Papers

Author: Mr. R. Coker (Nigeria)  
Title: Photogrammetric Education and Research in Developing Countries WGP VII/03

Presented by Mr. C. T. Horsfall  
Author: Dr. G. Roy (India)  
Title: Analysis of Photogrammetric Education in Developing Countries IP VII/08

Presented by Colonel Datta  
Author: Dr. L. Wassiljev (U.S.S.R.)  
Title: Photogrammetrische Ausbildung der Fachleute für die Entwicklungsländer in der Sowietunion PP VII/11

Following the papers by Mr. Härmälä, Mr. Coker, Dr. Roy and Dr. Wassiljev, there was considerable discussion about ways in which developed countries and I.S.P. might assist developing countries in upgrading their photogrammetric education and production. A need for help from the more

advanced countries was expressed by representatives of the developing countries. Also, a strong desire to deliver such help was expressed by representatives of the more advanced countries. In the opinion of the representatives of the developing countries, such help should consist mainly of experts and instructors coming to the developing countries. The instructors should assist the local staff in organizing courses on a basic and a postgraduate level, as well as in designing guidelines for the development of photogrammetry and photointerpretation. The desire to train staff in local rather than in foreign training centers was specially emphasized.

Thursday, July 22, 1976, from 10.45 to 12.15  
Session 6 of Commission VI

Topic: History and Development of Photogrammetry — People and Technologies  
Chairman: *Dr. Z. Sitek* (Poland)

#### Invited Paper

Author: *Dr. M. Albotă* (Romania)  
Title: Short Chronological History of Photogrammetry *IP VII/05*

#### Panel Discussion

Topic: Could and Should ISP Publish a History of Photogrammetry?  
Moderator: *Dr. T. Blachut* (Canada)  
Panelists: *Dr. M. Albotă* (Romania)  
*Dr. F. J. Doyle* (U.S.A.)  
*Dr. B. Dubuisson* (France)  
*Dr. K. Rinner* (Austria)  
*Dr. Z. Sitek* (Poland)  
*Dr. L. Solaini* (Italy)  
*Dr. J. Jachimsky* (Poland)

The general consensus of the panelists and other speakers was that I.S.P. could and should publish a history of photogrammetry and that it should begin right away. A presentation of the history of photogrammetry would not only guarantee excellent publicity for the field itself, but would also provide useful material for the younger generation.

In order to prepare a good history of photogrammetry, the I.S.P. should form a team of knowledgeable authors headed by a coordinator. It was considered advisable to consult historians in matters concerning the methodology involved.

The editorial board thus established would consult or even cooperate with authors representing areas where languages other than the official I.S.P. languages are spoken. It should also consult the national societies, and use all available printed material, including chapters on the history of photogrammetry printed in various handbooks.

To make team work possible, the book should be divided into chapters to be written by different authors. The chapters should be written chronologically and should treat the main aspects of the subject.

The book should consist of no more than 200 to 250 printed pages. It should be written in English, i.e., its first edition.

It is advisable to publish photographs of deceased photogrammetrists only. It would also be advisable to supplement the book with a short chronological list of events.

The discussion concluded with the observation that, although history needs to be filtered by time in order to be objective, the work should be undertaken immediately and accomplished within the following inter-congress period.

Thursday, July 22, 1976, from 14.00 to 14.45  
Session 7 of Commission VI

Topic: Business Meeting  
Chairman: *Dr. Z. Sitek* (Poland)

*Dr. Sitek* asked the secretary *Dr. Jachimsky* to read the resolutions of Commission VI to be presented at the Final Plenary Session.

After the reading of the proposed resolutions *Dr. Sitek* thanked *Dr. Ghosh*, who was a representative of Commission VI in the Resolution Committee and who formulated the resolutions in English, and *Dr. Pietschner*, and *Dr. Paresi* for the translations into German and into French.

Then *Dr. Sitek* informed about the Working Groups planned and their chairmen.

*Dr. Brandenburger* asked for the chairmanship of the Working Group VI/1 concerning Education and Research of Photogrammetry in developed countries and outlined the work to be done.

Working Group VI/2 is History of Photogrammetry and *Dr. Blachut* has been asked to act as the chairman of the Working Group.

Working Group VI/3 Notation and Terminology, *Dr. Wolf* (USA) as a chairman.

Working Group VI/4 Bibliography and Information Dissemination, the chairman not yet nominated. Working Group VI/5 Planning, Economy, and Professional Aspects. *Dr. Ghosh* (USA) has been asked to chair it.

Working Group VI/6 Education in the Developing Countries. *Col. Datta* (India) had offered to be the chairman.

Working Group VI/7 Photogrammetric and Remote Sensing Periodicals, chairman *Dr. Hothmer* (FRG).

Working Group VI/8 Co-operation with Pertinent Associations, chairman *Dr. A. McNair* (USA).

A discussion concerning the resolutions and Working Groups followed.

The chairman closed the meeting by welcoming all participants to the Symposium of Commission VI in Poland in 1978.

## COMMISSION VII

### INTERPRETATION OF DATA

### INTERPRETATION DES INFORMATIONS

### INTERPRETATION DER INFORMATIONEN

President: *Dr. L. Sayn-Wittgenstein* (Canada)

Secretary: *Dr. A. Aldred* (Canada)

Monday, July 12, 1976, from 16.15 to 17.00  
Session 1 of Commission VII

Topic: Business Meeting

Chairman: *Dr. L. Sayn-Wittgenstein* (Canada)

#### 1. Commission VII Technical Program

The mechanics for running the technical sessions and extra sessions given out by the Congress organizers were reviewed.

#### 2. Resolutions Committee

A committee, chaired by *Mr. R. Heller* (U.S.A.), was set up to receive Commission VII resolutions and to transmit them to the I.S.P. Council.

#### 2. Report by *Dr. G. Hildebrandt* (F.R.G.) on the International Union of Forest Research Organizations Subject Group on Remote Sensing

The objectives of the Subject Group are the promotion of the application of remote sensing in forestry, the dissemination of information on new methods of remote sensing, and the exchange of information. In addition, the Group advises international organizations on remote sensing applications. For example, five members of the Group participated as consultants to FAO in the formulation of the tropical forest cover monitoring project.

The Subject Group has an active core of forty experts and approximately two hundred interested participants. Interest within IUFRO in remote sensing is rising and ties with Commission VII are facilitated by the fact that the President of Commission VII is a member of the IUFRO Group. In 1973, a remote sensing symposium was organized in Freiberg (F.R.G.). Proceedings were published and are still available for DM 26 from *Professor G. Hildebrandt*. Proceedings of a 1976 Oslo symposium will be available from the same source.

At Oslo it was proposed that time and location of the next meeting of the IUFRO Group should be coordinated with Commission VII. Close ties with Commission VII will be maintained in the future.

Wednesday, July 14, 1976, from 15.45 to 17.15  
Session 2 of Commission VII

Topic: Water and Wetlands

Chairman: *Dr. L. Sayn-Wittgenstein* (Canada)

### Invited Papers

Author: *Dr. R. McEwen* (U.S.A.)

Title: Remote Sensing and Mapping of Coastal Wetlands IP VIII/07

Presented by *Dr. R. Welch* (USA)

Limitations of line maps presently used to portray coastal information were reviewed. The advantages and disadvantages of aerial photographs (black and white and color) for interpreting wetland vegetation were discussed. Color ortho-photo maps were considered to be a better means of presenting coastal wetlands information than line maps.

Author: *Dr. C. Olson* (U.S.A.)

Title: Remote Sensing of Water and Wetlands IP VIII/09

Applications of remote sensing in water and wetland inventory and monitoring programs are growing rapidly. This growth parallels the earlier development of remote sensing of terrestrial features. Techniques for accurately mapping location and outline of water bodies and discriminating between different types of wetland vegetation are operational. Progress is being made in remote determination of water quality, dynamics of wetland circulations, and standing plant biomass. Greater attention needs to be placed on the development of quantitative methods, on understanding wetland dynamics, on determining the spectral characteristics of water and wetland materials, and on adapting remote sensing techniques to needs of decision makers.

### Panel Discussion

Topic: Assessment of Water Quality and Wetlands

Moderator: *Dr. C. Olson* (U.S.A.)

Panelists: *Mr. D. Kolouch* (F.R.G.)

*Dr. U. Wiczorek* (F.R.G.)

*Dr. K. Thomson* (Canada)

*Dr. Thomson* observed that more data are required on the effects of atmospheric conditions on interpretation.

*Mr. Kolouch* reported that an experiment had been carried out: 1) to find the optimum spectral bands for discriminating turbid and clear water, 2) to find out whether there are spectral signatures which could be indicators of suspension and 3) to determine if the degree of turbidity could be quantified. Spectral bands in the 600, 850 and 1085 nm zones were found to be the best. At these optimum turbidity could be quantified, though further testing is needed before generalizations can be made.

*Dr. Wiczorek* said the use of aerial photographs for interpreting tidal currents characteristics inferred from aerial linear patterns left behind in eroded and deposited material had been studied. Some of the morphological and pattern characteristics had been investigated through mathematical representations based on density gradients. The statistics generated on large computers had contributed to automatic mapping of tidal currents and assisted human interpretation. In the general discussion that followed, *Dr. G.*

*Hildebrandt* (F.R.G.) agreed with *Dr. Olson* that generalizations had been made before methods and techniques had been fully verified or corroborated. *Dr. Hildebrandt* asked *Dr. R. Welch* (U.S.A.) why orthophotos were needed on flat delta areas. *Dr. Welch* pointed out that only rectification for tilt was done — not the full orthophoto process.

*Dr. Hildebrandt* asked *Mr. Kolouch* if he agrees with him in that the type of pollution influences in the spectral signatures and that it is not possible to choose certain spectral bands. *Mr. Kolouch* replied that the results apply only to the Jade. *Dr. Thomson* commented further that the particles should be measured before generalizations were made. *Mr. R. C. Heller* (U.S.A.) added that values giving the degree of successful detectability should also be accompanied by confidence statements such as the standard deviation of detectability.

*Dr. Thomson* then asked *Dr. Wieczorek* how costly it was to use large computers for classification work. The latter agreed that the cost and efficiency of computer operations were important considerations in commercial applications but felt that research experiments, though done on expensive large computers, should be continued, especially when the computer was available for no charge.

*Mr. J. Speight* (Australia) felt that there had been little discussion of dynamic models which might present a more complete picture of the circulation and productive characteristics of marshes, and the relationships between vegetation patterns and water depths, flow patterns, velocity, frequency of inundation, etc. *Dr. Olson* agreed with this statement.

*Mr. J. Skorve* (Norway) enquired about the effect you can get on any kind of image use with sediments springing from sweet water into salt environment. *Dr. Wieczorek* replied that little work can be done in this area and that remote sensing was capable of only general differentiation — the finer ones had to be left to chemical analysis, spectral analysis and other laboratory techniques. *Dr. Olson* added that better luck may be had with floating materials.

*Dr. A. Fontanel* (France) asked if the quantification of chlorophyll content was possible in the spectral bands mentioned. *Dr. Olson* did not think so because small quantities close to the surface have the same appearance as greater quantities at some depth. *Dr. Fontanel* asked further what resolution was achieved in the computer studies carried out by *Dr. Wieczorek* who replied 5—10 lines per millimeter and continued with a detailed explanation of the method of analysis used.

When adjourning the session the chairman established that there is a great deal of material concerning remote sensing also in the Papers of other Commissions, especially in those of Commission I.

Friday, July 16, 1976, from 9.00 to 10.30 and from 10.45 to 12.15

Session 3 of Commission VII

Topic: Natural Resource Surveys  
Chairman: *Dr. L. Sayn-Wittgenstein* (Canada)

#### Invited Paper

Author: *Mr. R. Heller* (U.S.A.)  
Title: Natural Resource Surveys IP VIII/06

#### Panel Discussion

Topic: Applications in Resource Inventories  
Moderator: *Mr. R. Heller* (U.S.A.)  
Panelists: *Dr. P. M. Fagundes* (Brazil)  
*Dr. S. Baker* (U.S.A.)  
*Dr. C. Girard* (France)  
*Dr. L. K. Kauranne* (Finland)  
*Mr. J. Speight* (Australia)  
*Mr. E. Amadesi* (Italy)

*Mr. Fagundes* presented part of Working Group Report VII/4: "Resource Inventories in the Tropics" WGR VIII/02.

*Dr. Baker* gave a brief review of his paper: "A System of Remote Sensing and Mapping for Developing Countries" PP VIII/04.

The title of *Dr. Girard's* paper was "Utilisation de la télédétection dans la connaissance des dommages causés aux cultures" PP VIII/16.

The next to speak on applications in resource inventories was *Dr. Kauranne*. He reported that the results of engineering geological interpretation of black and white (1:6000), color and false color (1:8500) stereo airphotos from a 3 km<sup>2</sup> area in glaciated terrain in South Finland had been compared with the results of field observations and with each other.

The constant error in repeated measurements of area of formation had been  $\pm 5\%$  and difference (error) in repeated interpretation about 8% except for silt, which had been greater. The reliability of the geological interpretation for black and white airphotos controlled by field observations had been from 67 to 86 per cent; that for colored airphotos from 69 to 89 per cent; and that for false color airphotos from 70 to 88 per cent, depending on drift formation PP VIII/19.

*Mr. Speight* then summarized his paper: "Description of Landform Patterns on Air Photos" PP VIII/36.

*Mr. Amadesi* spoke on the "Use of False Color Photos for the Concrete Utilization Territory Map" PP VIII/03.

The following observations were made during the general discussion:

*Mr. Heller* was not certain how cameras were used in conjunction with orthophoto maps. *Dr. Baker* explained that supplementary photos from such cameras could be used to update or change the maps directly by registering on common image data.

*Dr. S. Ihemadu* (Nigeria) asked *Mr. Heller* if filters could be selected for the high definition color infrared films referred to (SO-131) which would be appropriate for prevailing photographic conditions. He replied that none is required since the film has a special, built-in filtering (minus blue).

*Mr. A. Jones* (Australia) remarked that in the same way that developing countries learned analytical aerial triangulation through trial and error, so should they experiment with new remote sensing techniques, especially with photographic image enhancement techniques. In response, *Dr. C. Olson* pointed out that digital methods would prove superior in the long run because the

Landsat contained more information than the human eye can discern on the photographic products. Computer methods will also prove faster.

*Dr. G. Hildebrandt* (F.R.G.) emphasized that three sources of trouble occurred in vegetation interpretation: 1) phenological causes, 2) effects of varying slopes and aspects on shadow effects, and 3) different spectral responses due to varying illumination across the scene. *Mr. Heller* felt that the effect of these sources of variation had been well established from spectral radiometric and phenology studies and other experience. More work is required to account for these effects in visible interpretation work.

*Dr. S. Schneider* (F.R.G.) asked *Mr. Speight* if the system of land classification was based only on morphological characteristics. He replied that the analysis was based mainly on morphological characteristics, but vegetation attributes, especially the forest, were included. Some fifty or sixty attributes describing the forest based on species composition, average height and density were used. *Dr. Schneider* asked *Dr. Girard* if carrying out photographic flights at different seasons was important in order to cope with the effects of vegetation when classifying soils. He replied affirmatively and added that the timing of flights also depended on what application was to be made of the soils information.

*Mr. J. Colcord* (U.S.A.) recommended: 1) complete calibration ( $x$ ,  $y$ ,  $z$ , and  $\gamma$ ) to remove some unknowns, 2) use of stereo orthophoto maps for recording original interpretation data, and 3) questioning the use of "non-metric" small-format cameras. To the first and last remarks, *Dr. Baker* felt that the degree of precision or accuracy depends greatly on user requirements and the kind of data collected, especially qualitative versus quantitative data. In relation to the second question, it was pointed out that an excellent example of a stereo orthophoto map produced by *Mr. Kalensky* (Canada) had been demonstrated at the Congress.

*Dr. U. Wolf* (Italy) asked *Dr. Girard* about the importance of vegetation when using thermal infrared imagery to interpret soil conditions. He replied that vegetation was very important in the interpretation of soil conditions and that the selection of the correct time of day for collecting the imagery was important.

Friday, July 16, 1976, from 14.00 to 16.30  
Session 4 of Commission VII

Topic: Special Session 1  
Chairman: *Dr. L. Sayn-Wittgenstein* (Canada)

#### General Discussion

*Dr. P. Fagundes* (Brazil) continued with the Working Group Report: "Natural Resources Inventory (Amazon Radar)" *WGR VIII/02*. The Radar Project was described as being extended beyond the Amazon Basin and has been renamed Radar Brazil. The progress made was outlined and the practical problems with high transportation costs, accidents and disease were covered. The mapping program is far advanced and many

maps, reports and statistics have been published. Radar imagery, combined with Landsat data and aerial photography has proved most valuable. It has allowed the mapping of areas which could not be photographed because of weather; it has indicated topographic relief not recorded on photographs and has thus pointed the way to geologic structures associated with commercially interesting mineral deposits.

The discussion dealt with sampling accuracy, which is still being evaluated and a question from *Mr. R. Heller* (U.S.A.) concerning the forest classification used. Broad classes are recognized and illustrated by keys. *Dr. H. Rib* (U.S.A.) enquired about the control system used. In the absence of known ground stations a Shoran system and coordinates provided by satellite transmission were used.

*Dr. V. Dehai Kulkarni* (India) and *Mr. G. Farhoudi* (Iran) presented their papers "The Significance of an ARC Shaped Dark Patch on the Nimbus III (HRIR) Imagery of India" *PP VIII/22* and "Nutzung des durch Abdeckung eines Auges entstehenden räumlichen Effekts zur Betrachtung von Einzelbildern bei Photointerpretationen" *PP VIII/14*, respectively. *Mr. B. Sorensen* (Italy) described the use of Landsat data, color infrared film and other sensors for water studies. This led to a discussion of the effects on scanner data of the exhaust of aircraft and in particular of the disturbance of the atmosphere by the propeller blades of helicopters; serious disturbances appear to be involved in the latter case. The session concluded with a presentation by *Mr. F. Hilwig* (Netherlands) in which he explained how one should approach the problem of selecting imagery, what agencies are involved, what data are available and what other inputs (crop calendars, phenological and meteorological data) should be considered.

Monday, July 19, 1976, from 9.00 to 10.30  
Session 5 of Commission VII

Topic: Environmental Monitoring  
Chairman: *Dr. S. Schneider* (F.R.G.)

*Dr. Schneider* introduced the topic of the session by observing that two kinds of monitoring could be identified; one related to following the progress of natural processes and the second treating man's influence. The latter is sometimes referred to as surveillance.

#### Working Group Report

Authors: *Dr. A. Aldred* (Canada)  
*Dr. L. Sayn-Wittgenstein* (Canada)  
Title: Environmental Monitoring: Role of Remote Sensing *WGR VIII/03*

Some definitions and concepts related to environmental monitoring were discussed and examples of the role of remote sensing were drawn from such disciplines as agriculture, forestry, wildlife studies, ice reconnaissance, shorelines, air pollution and disaster monitoring. The concept of using a network of permanently established sample points for environmental monitoring was described and illustrated.

## Panel Discussion

Topic: Role of Remote Sensing in Environmental Monitoring  
Moderator: Dr. S. Schneider (F.R.G.)  
Panelists: Dr. R. Ellefsen (U.S.A.)  
Mr. V. Zsilinszky (Canada)  
Mr. T. Nguyen (France)

Dr. Ellefsen described and illustrated the use of computermap produced on the basis of Landsat data in the monitoring of changes in land use. When comparing computermaps produced at various times to contemporaneous manual maps the results proved to be good. He further established that by comparing computermaps of various age with each other it would be possible to follow the changes in land use PP VIII/11.

Mr. Zsilinszky described and illustrated the use of NOAA and Landsat imagery at the Ontario Centre for Remote Sensing. Applications, based on visual photointerpretation techniques had been effective in monitoring changes in the following areas: flooding, progress of melting snow and ice, water pollution, fume damage, effect of highways on water courses and surrounding vegetation, forest harvesting and forest fires.

Dr. Schneider gave a synopsis of his paper "Monitoring of Polluted Rivers by Remote Sensing Methods" PP VIII/34.

Mr. Nguyen described a warning system based on remote sensing for monitoring marine pollution from oil spills and other causes. The system developed for French waters has three main functions: 1) detection of oil spills and layers of hydrocarbon derivatives in sea water, 2) alerting controlling authorities, and 3) alerting ships or other sources in order that corrective action may be taken. The sensors used are: microwave, laser, aerial photographs, high altitude radar, low altitude infrared detectors.

The following remarks were made in the course of the subsequent general discussion: Dr. G. Hildebrandt (F.R.G.) asked Dr. Schneider if thermal and other emissions at the water surface could be used to characterize water beneath the surface. He replied that elevated temperature and the presence of chemical pollution may affect vegetation which can then be used as an indicator of the condition of water. Otherwise water samples are required to verify the interpretation based on surface emissions.

Dr. A. Fontanel (France) asked Dr. Schneider if it is possible to quantify water surface temperature. He replied that it was possible within 0.5°C but the temperature 50 cm below the surface is usually 1—1 1/2°C higher because of the effect of evaporation at the surface.

Mr. R. Heller (U.S.A.) asked Mr. Nguyen if solid state, charged couple detectors are used in the French system and if routine surveys based on the method were being used. He replied that standard military infrared scanners were used and, in reply to the second question, that some routine missions are being used now and that by 1977 the system should be fully operational. Dr. S. Paul (France) asked Dr. Schneider what he considered the best electromagnetic window for infrared scanners used to collect water data, what was the angular and thermal resolution

that can be expected, and the best means of disseminating the results. In reply to the first question, Dr. Schneider indicated the 3 to 5 or 8 to 12 micron bands, for the second the thermal resolution was about 0.5°C, and in response to the last question the results should go directly to the local planning authorities.

Mr. A. Boberg (Sweden) asked Mr. Nguyen what luminescence methods and what sensors he used. He replied that a 2KW ultraviolet source was used to illuminate and excite the hydrocarbons resulting in a fluorescence in the visible spectrum which is recorded by the TV system.

Dr. Schneider asked Dr. Sayn-Wittgenstein if it would be desirable for the definition of "monitoring", "inventory" and "surveillance" to be put in the Commission VII records. Dr. Sayn-Wittgenstein subsequently provided the following definitions: Monitoring, as defined in the Report of the Study of Critical Environmental Problems (MIT Press) is "The systematic observation of parameters related to a specific problem designed to provide information on the characteristics of the problem and their change with time". Surveillance is a specific form of monitoring in which the objective is to establish if limits and standards set by legislation or agreements are adhered to.

Monday, July 19, 1976, from 10.30 to 12.15  
Session 6 of Commission VII

Topic: Vegetation Damage  
Chairman: Dr. L. Sayn-Wittgenstein (Canada)

### Invited Paper

Author: Dr. P. Murtha (Canada)  
Title: Vegetation Damage and Remote Sensing: Principle Problems and Some Recommendations IP VIII/08

### Presented Paper

Author: Dr. C. Girard (France)  
Title: Utilisation de la télédétection dans la connaissance des dommages causés aux cultures PP VIII/16

A general discussion on vegetation damage resulted. The following remarks were made: Mr. A. Jones (Australia) remarked to Dr. Murtha that he seemed to close the question of the ideal film/filter combination. In Australia the question is still very much alive. The conclusions based on experience in cool temperate latitudes therefore are not universally applicable. Also, the role of season should not be down-played. In reply, Dr. Murtha suggested that remote sensing should include the background idea of the sensing system. He also stated that in the use of IR-films there appear certain difficulties the cause of which is not fully known.

Mr. S. Möller (Sweden) remarked to Dr. S. Schneider (F.R.G.) that many factors affecting classification based on photointerpretation are not well understood. This affects especially the detection of changes in the landscape. Dr. Schneider replied that greater use should be made of indicators of condition — that is an indirect method of interpretation and classification would be called



upon. Therefore, interpreters should come into closer contact with specialists in water, soils, plants, diseases etc. to appreciate better what indicators may be used. *Dr. Murtha* added that keys and catalogues should be used to decide whether or not to treat a situation as a crisis. *Dr. Girard* agreed that close liaison between remote sensing specialists and specialists in various disciplines was important to better understand symptoms and manifestations.

*Mr. T. Nguyen* (France) remarked to *Dr. Sayn-Wittgenstein* that Commission VII should broaden its scope into such areas as medicine and mineral exploration who suggested submitting this idea as a resolution to Commission VII.

Tuesday, July 20, 1976, from 9.00 to 10.30  
Session 7 of Commission VII

Topic: Urban Surveys  
Chairman: *Dr. L. Sayn-Wittgenstein* (Canada)

#### Invited Paper

Authors: *Dr. C. de Bruijn* (Netherlands)  
*Mr. W. de Haas* (Netherlands)  
*Mr. P. Hofstee* (Netherlands)  
*Mr. V. Pollé* (Netherlands)

Title: Urban Surveys with Aerial Photography: a Time for Practice *IP VIII/04*

#### Presented Papers

Authors: *Dr. R. Welch* (U.S.A.)  
*Mr. C. Lo* (U.S.A.)  
*Mr. C. Pannel* (U.S.A.)

Title: Land Use in Northeast China 1973, a View from Landsat-1 *PP VIII/40*

Author: *Dr. T. Blachut* (Canada)  
Title: Use of Orthophotos in Urban Areas

Generally orthophoto techniques are least suitable for urban areas because of subject and because some difficulties occur in the ortho-projection of tall buildings. Nevertheless, the approach is still useful and can provide a good basis for assessing change and recording dynamic effects. The conventional line maps are still best where high precision is important. The stereo orthophoto procedure was described and illustrated.

The following comments were made in the course of the general discussion:

*Dr. Blachut* asked *Dr. Bruijn* if ITC offers a course in urban surveys. He replied yes — two courses, a 9 month and a 15 month photointerpretation course were offered to people from developing countries.

*Mr. J. Visser* (Netherlands) commented that the sophisticated equipment available for differential rectification should not detract from the value of conventional means of rectification.

*Dr. Blachut* commented that orthophotos, especially stereorthophotos, have certain advantages in planning and interpretation due to the higher planimetric accuracy in comparison with air-photos.

*Mr. T. Nguyen* (France) commented to *Dr. Blachut* that he agrees with the accuracy statements for the orthophoto maps especially for highway

surveys. *Mr. Nguyen* then asked *Dr. de Bruijn* if orthophotos have a place in environmental planning and impact assessment. *Dr. de Bruijn* replied that not a great deal has been done.

*Mr. S. Möller* (Sweden) remarked that geometric and "semantic" information (classifications) must be combined. Manufacturers are not convinced of the advantages and have done little about it.

*Dr. Blachut* commented that there is usually about a 10 year lag between completed research and implementation but that we should press ahead anyway.

*Mr. P. Datta* (India) asked *Dr. Blachut* what scale is best for city surveys. He replied 1:1200 to 1:5000 but scale should also be considered in relation to cost.

*Dr. S. Ihemadu* (Nigeria) asked *Dr. Blachut* if orthophoto maps could be used to locate property boundaries. He replied that orthophoto products are capable of accuracies in the order of 20—30 microns compared with 10 microns for the best line maps. Thus the orthophoto maps would be sufficiently accurate for many applications.

*Mr. E. Amadesi* (Italy) asked what was the best scale of orthophotomaps for urban surveys. *Dr. Blachut* replied that for urban work scales of 1:1000 to 1:5000 probably were the best.

Thursday, July 22, 1976, from 15.00 to 17.00  
Session 8 of Commission VII

Topic: Business Meeting  
Chairman: *Dr. L. Sayn-Wittgenstein* (Canada)

#### 1. Resolutions

*Mr. R. Heller* (U.S.A.), Chairman of the Resolutions Committee, received the resolutions both pertaining to Commission VII and I.S.P. in general. Some were reorganized, condensed or combined with others. The resulting resolutions were read to this session. The detailed original resolutions have been given to the incoming Commission VII President, *Dr. G. Hildebrandt* (F.R.G.), for consideration in the next four years.

#### 2. Role of Remote Sensing

A resolution to change the name of I.S.P. to recognize remote sensing was submitted to I.S.P. A committee chaired by *Dr. F. Doyle* (U.S.A.) is to propose a suitable name in the next year for consideration by the I.S.P. Council. The committee was also to study the structure of the commissions to adequately cover remote sensing. The above is a continuation of work already done by *Dr. E. Welander* (Sweden).

#### 3. Remarks of Incoming Commission VII President

*Dr. Hildebrandt* expressed appreciation for work done by *Dr. L. Sayn-Wittgenstein* in the past four years. No specific program has been worked out for the next four years yet. *Dr. Hildebrandt* indicated that the presently active Working Groups will be maintained; some others will be reactivated. A request was made for ideas for three or four themes for the next Commission VII Symposium. The intention would be to concentrate efforts in a few areas. It was hoped that the

Working Groups can better represent Latin America, Africa and Asia. *Dr. Hildebrandt* asked that the plans for the Commission VII program be advertised widely by the delegates. It was hoped that there could be more working group activity between now and the next Symposium and Congress. The next Commission VII Symposium will most likely be held in Freiburg, Germany.

#### 4. General Discussion of Technical Program for Next Four Years

*Mr. F. Hilwig* (Netherlands) proposes that Commission VII take up a comparative study of visual and computer assisted analysis of satellite data for natural resource studies with respect to accuracy, time and cost. *Dr. Hildebrandt* had received some suggestions for tests of computer assisted methods and felt that these might be combined with the above. *Dr. C. Olson* (U.S.A.) pointed out that such comparative studies had already been carried out by the World Bank and contact should be made with them. Similar work is also being undertaken under one of the United Nations environmental program projects.

*Mr. R. Heller* suggests that the working groups be organized by discipline with the exception of Interpretation Methods.

*Dr. P. Fagundes* (Brazil) felt that crop yield prediction and airborne geophysical exploration should be added to the Commission VII activities.

*Dr. A. Fontanel* (France) commented that oil and mining exploration historically have evolved separately and therefore are difficult to fit into I.S.P.

*Dr. L. Sayn-Wittgenstein* felt that more attention should be given to standardization, especially concerning accuracy measures.

*Mr. T. Nguyen* (France) asked what became of his resolutions. *Dr. Sayn-Wittgenstein* replied that it had been read to this meeting before *Mr. Nguyen's* arrival.

*Dr. A. Fontanel* remarked that we should reflect on the best means of informing remote sensing specialists, who are not now members of I.S.P., on the activities and plans of Commission VII. *Dr. Hildebrandt* commented that he would act as the Chairman of a selection committee and would use the Working Group Chairmen as a means for reaching further into the remote sensing community. *Dr. Sayn-Wittgenstein* added that the outgoing Secretary will make available mailing lists and other contacts established during the past four years.

*Dr. S. Ihemadu* (Nigeria) asked what practical steps Commission VII would take to ensure the participation of developing countries. *Dr. Hildebrandt* replied that he had no certain means but would encourage all Commission VII members to try to establish contacts for him and that the National Correspondents would be relied upon.

Friday, July 23, 1976, from 14.00 to 17.00  
Session 9 of Commission VII

Topic: Interpretation Methods  
Chairman: *Dr. L. Sayn-Wittgenstein* (Canada)

#### Invited Paper

Author: *Dr. A. Fontanel* (France)  
Title: Quelques problèmes d'interprétation en télédétection IP VIII/05

#### Panel Discussion

Topic: Interpretation Methods  
Moderator: *Dr. A. Fontanel* (France)  
Panelists: *Dr. F. Quiel* (F.R.G.)  
*Mr. L. Graham* (U.S.A.)  
*Dr. D. Peruzzi* (U.S.A.)  
*Mr. N. Donker* (Netherlands)  
*Mr. D. Stellingwerf* (Netherlands)  
*Dr. Ö. Radai* (Hungary)

*Dr. Quiel* presented his paper "A Branched Classification System Offering Additional Possibilities in Multispectral Data Analysis" PP VIII/30.

*Mr. Stellingwerf* outlined his work done on the use of 1:5000 and 1:10000 photos for estimating mean annual growth of forests. Two approaches were involved: one based on finding the regression relationship of the volume of individual trees and corresponding photo measured crown diameter; the second based on the linear relationship of stand volume with crown closure density.

Repeated measurement at five year intervals was used to assess growth ("Optimum Ratio of Photo-field Plots for Aerial Volume and Aerial Volume Growth Regression Construction" PP VIII/37).

*Mr. Graham* presented his paper "Landsat-Radar Synergism" PP VIII/17. *Dr. Peruzzi's* paper was part 2 of the paper given by *Dr. Ellefsen* (U.S.A.) ("Land-use Change Detection from Landsat and Skylab Satellites" PP VIII/11) in the session on environmental monitoring. Part 2 dealt with the use of Skylab imagery to show changes in land use. The change in urban development over a four-year period was used to illustrate the approach. A matrix approach was used to show changes in several land use classes from one period to another.

*Dr. Radai* summarised his paper "Recent Crustal Movements Registered by the Aid of Airphoto-interpretation" PP VIII/31. He told about the use of aerial photographs to interpret and detect fault lines related to tectonic activities. The information obtained from the photointerpretation could then be used to find sites for ground instrumentation for detecting and predicting earthquakes.

*Mr. Donker* discussed the use of principal component analysis to optimize contrasts and otherwise improve the accuracy of classification based on Landsat data in his paper "Analysis of MSS Digital Imagery with the Aid of Principal Component Transform" PP VIII/09.

*Mr. T. Nguyen* (France) asked *Mr. Stellingwerf* if tree height had been studied as a variable for tree volume prediction. He replied that only crown diameter and crown closure were tested.

*Mr. Nguyen* asked *Dr. Quiel* what the cost of using Bendix scanners was. He replied that the cost was around \$100 per hour.

*Dr. S. Schneider* (F.R.G.) asked geologists if they needed imagery only once or on a repeated basis and further asked if too much information was already had from Landsat. *Dr. Schneider* yet

inquired from *Dr. Radai* whether the use of Landsat and airphotos together would be useful. *Dr. A. Fontanel* (France) answered that repeated coverage is sometimes required to adequately deal with the effect of vegetation. Furthermore, it was found that the use of Landsat bands 6 and 7 viewed stereoscopically is helpful. Other combinations including bands 4 and 5 are also useful depending on climatic zones and topography. *Dr. Radai* added that Landsat and air photos together may be useful in finding fault lines for locating the best sites for ground measurements. *Mr. A. Boberg* (Sweden) asked *Mr. Donker* why no improvement was evident in the "feature space". He replied that all information should be used from the start and worked through. *Mr. Boberg* wondered if straightforward image interpretation might be used just as effectively. *Mr. Donker* said that he found his principal component analysis improved classification significantly. *Dr. Fontanel* added that the first principal component is a weighting (containing 70 to 80

per cent of the information) which is like a panchromatic image of the 400—900 nm range. The second principal component (containing 10 to 15 per cent of the information) is the sum of bands 4 and 5 plus the difference between bands 6 and 7. It looks like a black and white infrared photo. It shows water detail well. An unidentified speaker from F.R.G. remarked that he would like to have seen color used to enhance the principal component analysis results. *Mr. Donker* replied that printing techniques available to him were primitive and color reproduction was difficult. *Dr. Fontanel* added that examples of color rendition can be found in various NASA publications.

*Dr. Schneider* closed the session by expressing appreciation for the work done by the outgoing President and Secretary of Commission VII and, on behalf of *Dr. G. Hildebrandt* (F.R.G.), invited all to participate in the next four years of Commission VII.



Commercial Exhibition in the sports hall Otahalli.