

DELIBERATIONS OF THE TECHNICAL COMMISSIONS – DELIBERATIONS DES COMMISSIONS  
TECHNIQUES – VERHANDLUNGEN DER TECHNISCHEN KOMMISSIONEN

Each Technical Commission held its own business session in addition to the technical sessions. The discussions of these meetings have been compiled by the Commission Presidents and their Secretaries as follows:

COMMISSION I

PRIMARY DATA ACQUISITION  
RECUEIL DE L'INFORMATION PRIMAIRE  
GEWINNUNG DER AUSGANGSINFORMATIONEN

President: *Dr. Iwao Nakajima* (Japan)  
Secretary: *Dr. Shunji Murai* (Japan)  
Reporter: *Mr. Takeshi Hirai* (Japan)

Tuesday, July 15, 1980, from 9.00 to 10.45  
Session 1 of Commission I (Working Group I/1)

Main Topic: Image Quality Analysis  
Chairman: *Dr. Roy Welch* (USA)

The session opened with a report by *Dr. I. Nakajima*, the president of Commission I, on the activities of Commission I during the period 1976–1980. Of particular interest was the description of the "Symposium on Data Acquisition and Improvement of Image Quality and Image Geometry", held in Tokyo in 1978.

*R. Welch* (USA) presented a report on the activities of the Image Quality Working Group (WG I/1).

Three principal areas of investigation described:

1. tests of photogrammetric camera lenses and systems,
2. performance characteristics of optical and electro-optical sensor systems, and
3. measures of image quality.

Efforts for the 1980–84 period should be directed towards assessment of satellite sensor performance required for the compilation of map products and the interpretation of thematic data.

A panel chaired by *Manfred Schroeder* (FRG) described Quality Analysis Methods for Spacelab Mission Film Selection. *G. Ducher* and *J. Pinson* of the IGN (F) discussed the acquisition, processing and visual analysis techniques employed to evaluate different films exposed in Zeiss RMK A 30/23 and 60/23 cameras. *Madame Togliatti* (I) presented the results of photogrammetric analysis of the  $\gamma$ -parallax residuals in the different films, and *J. Sievers* and *M. Schroeder* (FRG) described MTF and resolution test procedures. Based on these studies, panchromatic films such as EK 2405 and a color infrared film are recommended for use in the Spacelab experiments.

*W.M. Strome* (CDN) requested that the ISP consider possible new measures of resolution which consider both the spatial and radiometric characteristics of sensor performance.

The last paper of the session was presented by *Mrs. Noukka* (SF) who described tests to determine the optimum colors for ground targets. Based on these tests yellow or white on a black background were considered optimum.

Wednesday, July 16, 1980, from 9.00 to 10.45

Session 2 of Commission I (Working Group I/2)

Main Topic: Image Geometry  
Chairman: *Dr. Hartmut Ziemann* (Canada)

The session was introduced by the chairman with a short review of the WG report (published in Part B on pages 215–232). The chairman then read a short statement by *Prof. Dr. K.-J. Rosenbruch* about the revision of the ISP document "Recommended Procedures for Calibrating Photogrammetric Cameras and for Related Optical Tests"; the announced invited paper on the same subject was not available. *Dr. Rosenbruch's* statement suggests that a revision of the document be deferred until two working groups of the ISP dealing with the standardization of OTF, veiling glare and distortion have completed their work (probably in 1982), and that ISP should then consider accepting these standards as a base for further revision of the document.

The meeting then continued with the presentation of the announced papers by *Hirai* and *Kaneko* (B1: 34–41), *Mathieu* (the paper was distributed during the session), *Hakkarainen* (B9: 24–34), *Juhl* (B1: 57–63), *Mauelshagen* (B1: 64–73), and *Ziemann, Loosberg* and *Pekelsky* (B9: 126–137). The discussion on the first two of these papers clarified several instrumental aspects. *Mauelshagen* and *Loosberg* presented material not included in the respective papers: *Mauelshagen* additional results from the photography flown over the Rheidt test field as part of the WG project, *Loosberg* slides displaying and/or explaining recent KC-technology products. The discussion on the last paper was moved to the booth of the WG in the scientific exhibit, where further KC products were displayed.

In addition, the session featured a short statement by *Dr. Sievers* in regard to the performance of Agfa-Gevaert aerial films as reported during the preceding session of Commission I: he pointed out that later tests gave better results possibly indicating that the original tests were carried out under somewhat adverse conditions.

Thursday, July 17, 1980, from 9.00  
Special Session I

Main Topic: Specifications for Air Photography  
Chairman: *F.L.J.H. Corten* (Netherlands)

A standard document "Specifications for vertical air photography" has been adopted by the U.K. Royal Institute of Chartered Surveyors.

A special session has been arranged, chaired by F.L.J.H. Corten, in order to find out what is the general opinion about this document — specifically the opinion of the other countries. It has become obvious that in principle there is a unanimous agreement.

It has been decided

- a. to make a start in using this document,
- b. to update it periodically, and
- c. to try and make it acceptable to the ISP at the next congress.

**Thursday, July 17, 1980, from 16.00 to 17.40**  
**Session 3 of Commission I (Working Group 1/3)**

Main Topic: Image Quality with Environmental Factors

Chairman: Mrs. Clarice Norton (USA)

Mrs. Clarice Norton (USA) reviewed the purpose of the "Image Qualities with Environmental Factors" committee which was to determine the environments of the aerial survey and to investigate the effects of these environments on the image quality and image geometry of cartographic cameras. The former was obtained by means of a questionnaire sent to all member nations of ISP. The latter took the form of individual studies. Carman (CDN) reported on the effects of vibration in Commission I meeting in Tokyo. Meier (FRG) analyzed the effects of temperature and pressure for Zeiss mapping lenses. Worton (GB) reported on the measurement of a large temperature gradient along the camera, during survey.

Norton then discussed the results of a simulated environmental test of 15,000, 20,000 & 25,000 feet altitude on a KC-1B military camera, operating normally with film. Changes due to pressure were negligible but the temperature differential of  $-47^{\circ}\text{C}$  showed a change in distortion to 19 micrometers.

Tests under cold conditions of one wide angle Wild Heerbrugg lens reported by Borman (CH) were conducted visually. A  $50^{\circ}\text{C}$  decrease in temperature resulted in a reversal of the distortion curve and an increase to 9 micrometers at the edge of the wide fields lens.

Wood (USA) (invited paper) discussed the design characteristics of the NASA Large Format Camera to maintain  $21^{\circ}\text{C}$  temperature and controlled pressure for the purpose of assuring high image quality.

Hakkarainen (SF) studied the progress in image quality and image geometry of the Wild RC-8 and RC-10 cameras. He concluded that significant gains in quality had been made.

Peck (USA) presented the paper by Haley and Gliatti "Evaluating the Performance of Sensor Systems by Simulation". This description of environmental test equipment made the point that the cost of such equipment was recoverable in saving of flight test costs and redesign of cameras.

Norton suggested that the study of the effects of the environment on cameras was important and complex, but although expensive needed to be continued.

**Friday, July 18, 1980, from 11.00 to 12.30**  
**Session 4 of Commission I (Working Group 1/4)**

Main topic: Sensor Orientation and Navigation

Chairman: Mr. F.L.J.H. Corten (Netherlands)

Invited Paper:

F.L.J.H. Corten (NL): "Sensor orientation and navigation"

It is stated that methods have become available to measure the six elements of exterior orientation in flight, in real-time.

These methods have developed to become of adequate accuracy, even for photogrammetric purposes. The methods are being used and exterior orientation elements are being recorded at the instants of exposure and/or at scanning.

The author urges that investigations should be made

- 1st. to evaluate the performances in sensor orientation,
- 2nd. to establish useful methods for applying these performances in practice, and
- 3rd. to establish cost and benefit models.

Presented Paper:

- 1) S. DeCamp (USA): "An inertial guidance and control system for aerial photogrammetry"  
The Photogrammetric Integrated Control System (PICS) is based on an Inertial Navigation System (INS) which is integrated with the aerial camera and which records on each photograph at the instant of exposure the following data: position in latitude and longitude; altitude; pitch and roll angles; heading and drift; time instant; and manual input data.
- 2) R. Audi (BR): "Orientation of stereo models obtained from aircraft equipped with Inertial Navigation System PICS."  
The use of in-flight data obtained by means of a PICS system can lead to appreciable savings in relative orientation time.
- 3) R. Audi (BR): "Practical results obtained by means of the inertial system PICS."  
Photographic survey navigation of areas 30,000 km<sup>2</sup> and 40,000 km<sup>2</sup> in Brazil has shown that the efficiency of photographic flight can be improved by a factor up to 5x.
- 4) R. Brossier and M. Pinson (F): "Communication sur le système APR-laser de l'IGN".  
Altimetry is measured by means of a laser altimeter which is integrated with the aerial camera and with a statoscope. This is performed over large area of Saudi Arabian desert. The results will be published after the survey will have been finished.
- 5) L. Scott (GB): "Specification for vertical air photography".

A standard document has been set up by the British Association of Air Survey Companies. It has been accepted by the Royal Institute of Chartered Surveyors.

Friday, July 18, 1980, from 16.00 to 17.00  
Special Session 2

Panel: Image Quality and Image Geometry  
– Future Prospects 1980 – 1984  
Chairman: *Dr. Roy Welch* (USA)

This panel included members of the Commission I Working Groups, interested in both aerial and satellite data acquisition/evaluation.

Participants primarily involved with aircraft photography included *J. Hakkarainen, C. Norton, J. Sievers, J. Trinder, F.J. Worton* and *H. Zieman*, whereas those primarily concerned with satellite data included *A.P. Colvocoresses, W.M. Strome* and *R. Welch* (chairman).

Each panel member briefly presented his (or her) views on the subjects of image quality and image geometry for the period 1980–84, noting the requirements and research problems which appear most critical at this time.

Those involved with aerial photography urged that attempts be made to evolve standards for film processing and coordinate measurement procedures. Additional subjects for further investigation included the calibration of acquisition systems under operational conditions and the analysis of changes in image quality/geometry induced by variations in the environment. It was also noted that the increases in the cost of silver may accelerate the research for alternative emulsion materials.

Those participants concerned with satellite image data discussed the possibilities of deploying targets which could be used to compare the imaging parameters of optical, electro-optical and electronic sensor systems.

Combinations of edge targets, spatial resolution targets (e.g. Siemens Star) and radiometric resolution targets were mentioned. It was also recommended that greater attention be given to developing measures of resolution which incorporate both spatial and radiometric resolution parameters.

Friday, July 18, 1980, from 17.00 to 18.00  
Special Session 3

Main Topic: Sensor Orientation and Navigation  
Chairman: *F.L.J.H. Corten* (Netherlands)

Advanced techniques of sensor orientation and navigation, and the related institutions or organizations were introduced.

Direction for the period 1980–1984 was also discussed.

Monday, July 21, 1980, from 16.00 to 17.30

Session 5 of Commission I (Working Group I/5)

Main Topic: Space Sensing  
Chairman: *Dr. Robert B. McEwen* (USA)

The session included a brief report on the activities of the Working Group and four presentations highlighting major space data acquisition systems under development by different nations.

These are the MOS-1 and LOS-1 Projects in Japan, reported by *Dr. S. Murai*; investigations in Europe and the Spacelab Missions, reported by *Dr. E.H. Velten*; the U.S. Orbiter Camera Payload and the Large Format Camera, reported by *Dr. F.J. Doyle*; and the SPOT System Concept, reported by *Mr. M. Courtois* of France.

It was noted that the launch of ERTS-I occurred almost exactly eight years ago on July 23, 1972, just prior to the ISP Congress in Ottawa, *Dr. William Fischer*, Chairman of the Working Group until his recent retirement from the U.S. Geological Survey, had presented major reports in 1972, in 1976 in Helsinki (also published in Photogrammetria) and in 1978 at the Commission's Symposium in Tokyo.

The topics presented in the session ranged from the most advanced film camera systems to the latest multispectral developments using charge-coupled devices (CCD). It is significant that spatial resolutions much higher than Landsat are necessary and will reach in this next generation of spacecraft to a range of 10 – 20 m. Also true stereo coverage is planned in many situations. Greater attention is being given to system geometric and radiometric calibration. High system performance will be necessary for major applications in the production of thematic, planimetric, and topographic maps at the scales of 1:50,000 to 1:100,000.

Approximately 150 persons attended the session and several questions were raised and discussed before the session closed.

Monday, July 21, 1980, from 19.00  
Special Session 4

Main Topic: What is new in Aerial Photography Instrumentation?  
Chairman: *F.L.J.H. Corten* (Netherlands)

A special session has been arranged - chaired by *F.L.J.H. Corten* – in order to give an opportunity to all exhibitors of photographic materials and equipment to give a presentation about what is new since the last Congress.

Sixteen five-minute talks were given; an interesting discussion has concluded the session.

Wednesday, July 23, 1980, from 9.00 to 10.45

Session 6 of Commission I (Working Group I/6)

Main Topic: Underwater Photogrammetry  
Chairman: *Mr. Gomer McNeil* (USA)

*Dr. L.E. Merten* could not be in Hamburg. His paper on *In-water Photogrammetry-Acquisition* was given by *Dr. V.A. Seifert* (USA). He discussed the difference between aerial and underwater photography, and talked about analytical techniques for prediction of accuracy. He also talked about techniques to improve image contrast and extend maximum ranges.

*Dr. Seifert* could not show actual results which must be included in his paper on *Underwater Acquisition Systems*, because of sensitive nature of his work, but he showed several slides. He also discussed

requirements in future systems for underwater photography.

Mr. J.C. Blankenburg presented his paper on *Off-shore Photogrammetry and Remote Sensing*, including in-water photogrammetry. He discussed some of his problems, mainly the lack of metric camera available.

Mr. N. Welsh (GB) in his paper on *Photogrammetric Procedures for a North Sea Oil Rig Leg Repair*, discussed the photogrammetric procedures used, and predicted a good future for photogrammetry in underwater mode.

Mr. McNeil (USA) in his report on *Activities of Working Group 6/1*, discussed the future of underwater photogrammetry, and where it will be conducted: WG 1/V, WG 6/1 or something else?

Dr. Gates, incoming President of Commission V is very interested in cooperating with Commission I. Prof. Karara mentioned that Commission I should be in charge of acquisition, but Commission V should start working on the problems of data reduction of underwater photogrammetry.

Thursday, July 24, 1980, from 16.00 to 17.30

Session 6 of Commission I (Working Groups 1,2,3,4,5)

Main Topic: Data Acquisition and Corrections  
Chairman: Dr. Iwao Nakajima (Japan)

The session was introduced by the chairman with a short review of the presented papers and reporters careers. The meeting continued with the presentation of the announced paper by T. Oka (J) on *A Simple method of correcting the geometric distortion of airborne multispectral data*. He discussed an experimental study to correct the geometric distortion

of airborne multispectral imagery. Distortion images were corrected using measured attitude angle by means of the newly developed program. Comparing the corrected images with the corresponding photographs clearly proved the advantage of this simple method for correction.

J.-P. Antikidis (F) presented a paper on *Introduction to image quality definition and requirements for remote sensing*. He discussed the differences of the space data elements and quantities between Landsat and Seasat, and also the definition for evaluating the quality and requirements.

Y. Emori (J) presented a paper on *Radiometric correction of infrared aerial color film*. He discussed a method of correcting those radiometric distortions such as of an infrared color film, such as Cos<sup>4</sup> law failure, overlaps of spectral sensitivity of multilayer film, and unwanted absorptions of photographic dyes. The correction gives useful results for digital analysis of aerial infrared color photography.

Comment on Poster Session

Commission I, I. Nakajima (Japan)

1. Poster Session should be continued for future.
2. Poster Session should be based upon the disciplines of each Technical Commission. Papers of different Technical Commissions should not be mixed.
3. The posters should be separated from the posters of scientific exhibition.
4. The arrangement of the booths should be parallel instead of the cross type which was arranged at this Congress. Moving line or flow of the audience should be taken into account. Any visual obstruction should be removed.
5. The papers which are submitted to the poster session should be treated with as same as the the priority to the papers for oral presentation in the Congress Hall.

## COMMISSION II

INSTRUMENTATION FOR DATA REDUCTION  
APPAREILLAGES D'EXPLOITATION DES DON-  
NEES  
AUSWERTEINSTRUMENTE

President: Ing. M. Baussart (France)  
Secretary: Dr. A. Fontanel (France)

Tuesday, 15 July 1980, from 16.00 to 17.30  
Hall 2

Session 1 of Commission II, (Working Group II/3)

Main Topic: Correlation  
Chairman: Z. Jaksic (Canada)

The meeting started at 16.00 by the opening address of Z. Jaksic (CDN), the chairman of the Working Group II/3 on "Automated Instruments and Systems".

He then proceeded with a comprehensive report about the activities of the working group during the last for years. Following were two Invited Papers analyzing and evaluating the principles of the correlation techniques applied in photogrammetry:

B. Makarovic (NL): "Image Correlation Algorithms"  
G. Konecny, D. Pape (FRG): "Correlation Techniques and Devices"

In the latter paper presented by both coauthors, G. Konecny concentrated on a review and comparison of correlation systems in general whereas D. Pape reported on the recent development of a correlator at the TU in Hannover.

In the final presentation of the session G. Lindig (FRG) informed about the methodology and results of the ISP Correlation Test.

There was no discussion to any of the presented papers. The meeting adjourned at 17.35.

Thursday, 17 July 1980, from 9.00 to 10.40  
Session 2 of Commission II (Working Group II/1)

Topic: A System Evaluation of Analytical Plotters  
Chairman: *Dr. B. Makarovic* (Netherlands)

*Introduction:*

The President welcomed the participants to the meeting; he mentioned and apologized for the absence of Mr. McKenzie (USA). He thanked Mr. Baussart (F), the president of Commission II as well as the members of the working group and all those who took part in the work. He also thanked Commission II and the I.T.C. for the financial support received. The chairman points out how both meetings will be carried out (the main and the supplementary meeting).

*Invited Papers:*

- Author: *Dr. B. Makarovic* (NL)  
Title: "A System for Evaluation of Analytical Plotters"
- Authors: *M.L. McKenzie* (USA) and *Dr. B. Makarovic* (NL)  
Title: "An Introduction to the Analytical Plotters Evaluation Guide"
- Author: *Z. Jaksic* (CDN)  
Title: Evaluation of Functional and Structural Characteristics of Analytical Plotters"
- Author: *L.W. Fritz* (USA)  
Title: "Testing Procedures for Analytical Plotters"
- Author: *Dr. B. Dubuisson* (F)  
Title: "Comparative Economics and Analytical Expansion"

*Presented Papers:*

- Author: *Dr. M. Rüdener* (FRG)  
Title: "An Analytical Plotter Programme for Objective On-Line Determination of Point Density in Digital Terrain Models"

*Announcement:*

The Secretary of the Working Group informed the audience about the possibility to obtain the "Guide to Analytical Plotters Evaluation".

Thursday, July 17, 1980, from 11.00 to 12.30

Supplementary Meeting

Topic: A System for Evaluation of Analytical Plotters  
Chairman: *Dr. B. Makarovic* (Netherlands)

The chairman states more deeply on how the two meetings would be carried out.

*Part 1:* Short lectures  
*Dr.-Ing. D. Hobbie* (FRG): "Testing Procedures for the C-100 Planicom"  
*Ch. Vigneron* (F): "Industrial Applications of the Analytical Stereoplotter Traster"

*Part 2:* Discussion  
Members: *Dr. Larry Fritz* (USA)  
*Dr. Zarko Jaksic* (CDN)  
*Prof. Dr. Bob Forrest* (AUS)  
*Dr. Sherman Wu* (USA)  
*Dr.-Ing. W. Lichtner* (FRG)

*Comments:*

*Mr. Ijzerman* (NL) comments on the inability of stereoscopic view when the place is quickly changing.  
*Mr. Vigneron* (F) asks a question referring to the microprocessors and made remarks on the integration of analytical plotters in large systems.  
*Mr. Grabmaier* (NL) asks a question on "numbered cards".  
*Mr. Dowman* (GB) remarks on the possible spreading of the use of analytical plotters.  
After that *Dr. Makarovic* thanked the participants in the discussion, the commentators and the participants in the meeting.  
He then closed the meeting.

Friday, July 18, 1980, from 9.00 to 10.30  
Session 3 of Commission II, (Working Group II/3)

Main Topic: Automation in Photogrammetry  
Chairman: *Z. Jaksic* (Canada)

The meeting was opened by the chairman *Z. Jaksic* (CDN) at 9.00.

The first invited paper "Automation in Photogrammetry" was presented by *J.B. Case* (USA), who analyzed how automation elements affect the main technological phases of a photogrammetric map production.

The second presentation "Implementation of Automated Photogrammetric Systems in an Analog Mapping Organisation" was given by *R. Mullen* (USA) on behalf of the author, *L.E. Starr* (USA) who was not present.

*M.M. Allam* (CDN) continued in the series of invited papers by his analysis of "Recent Trends in the Development of Automated Photogrammetric Instruments".

The following invited paper "The Epipolar Scanner Stereoplotter in an Integrated Photogrammetric Processing Environment", prepared by *F.A. Scarano* (USA), was in his absence briefly reviewed by *J.B. Case* (USA).

Finally, *G. Inghilleri* (I) in his paper "Analysis and Comparison of the Working Principles of the Digital Geometry Stereoplotters" elaborated on details of analytical systems controlled through image coordinates.

All discussions were transferred into the panel discussion on the subject held in the following session. The meeting adjourned at 10.35.

Friday, July 18, 1980, from 11.00 to 12.30  
Panel Discussion of WG II/3

Main Topic: "Automation of Photogrammetric Processes — Needs and Feasibilities"

Moderator: *Z. Jaksic* (CDN)

Panel members: *M.M. Allam* (CDN), *J.B. Case* (USA)  
*U.V. Helava* (USA), *G. Hobrough*  
(CDN), *B. Makarovic* (NL), *C.C. Slama* (USA)

*Z. Jaksic* opened the meeting at 11.00 and asked each of the panelists to enter a short statement.

*B. Makarovic* (Definition of Automation) emphasized in his review the basic difference between the automation affecting the processing of geometric information, and the automation dealing with the interpretation of the semantic content of images. *G. Hobrough* (Capabilities and Limitations of Correlation) reviewed and compared stereo correlators capable of controlling flat, undulating and discontinuous types of terrain.

*U.V. Helava* (Digital Correlation) made a distinction between general image matching and stereo correlation. He stressed that the main problems in photogrammetry are encountered in handling discontinuities of non-topographical details and abrupt changes of man-made objects.

*J.B. Case* (Evaluation of an Automated System) discussed the extraction of features and of geometric information as developed at DMA (USA). *M.M. Allam* (Automated Interactive Systems) demonstrated the integration of the GPM-2 and the automated cartography system of EMR (CDN).

*C.C. Slama* (Development of Automatic Mensuration) described the evolution of the NOAA automated centering system for high precision photogrammetry using density centroids of targets and digital centering with CCD elements.

In the general discussion *Z. Jaksic* asked about and *G. Hobrough* explained some details of the multi-surface correlation which could potentially distinguish the top and bottom features of a terrain. *C.C. Slama* answered a question on what target shape was suited best for automated centering. It was not a circle or a cross, but rather some more complex pattern.

*E. Mikhail* (USA) recommended an annulus and *J.B. Case* expressed his positive experience with rotating the réseau cross slightly. *U. Rauhala* (USA) recommended a special array modelling for an efficient and accurate réseau interpolation.

*Z. Jaksic* then diverted the discussion towards the interpretation of features via correlation as needed, e.g. for line digitization. *U.V. Helava*, *J.B. Case* and *G. Hobrough* contributed by emphasizing the three-dimensional aspect of interpretation. In response to the comment of *M.M. Allam* on the slope limits in stereocorrelations *G. Hobrough* explained this to be rather a problem of raster shaping. The new RASTAR development should be more effective.

The moderator *Z. Jaksic* then emphasized the problem of interdisciplinary overlaps and invited the cartographers to express their points of view. *Pinkas Yoeli* (SR) compared problems of automated cartography with those of photogrammetry. He felt that little had been said about what is done with the

data after they are automatically extracted from a photogrammetric procedure, and also about the format of photogrammetric data bases.

In the ensuing discussion *U.V. Helava*, *J.B. Case*, *C.C. Slama* and *Z. Jaksic* pointed out that a great care and consideration is indeed given to the intended use of extracted data and to the formats of related data bases at the data acquisition phase.

Since the time allotted for the discussion had long run out the moderator had to interrupt the discussion and adjourn the meeting at 13.00.

Friday, July 18, 1980, from 14.00 to 15.30  
Poster Session  
Commission II

Comments by the Commission President:

The idea of the sessions is very effective for allowing a small group of interested people to talk more directly with the authors of the topics of interest.

However, perhaps a "moderator" or "chairman" would be useful to oversee the set of poster sessions for each commission to enable the timing to be kept a little better and to give notification when speakers are not appearing.

If the individual talks are kept to around 10 mins, it would give plenty of time later for discussion instead of those later authors being more hurried.

One disadvantage of the sessions was that if the groups became larger e.g. 10–15 people, it was somewhat difficult to hear the speakers — perhaps they could be given small boxes to stand on, also small microphones to hear them a little better.

Overall, I think the idea of poster sessions is very good and well worth while incorporating into future congresses.

Monday, July 21, 1980, from 14.00 to 15.30  
Session 4 of Commission II

Topic: Processing of Remote Sensing Data  
Chairman: *J.C. Cazaux* (France)

Summary:

The different speakers were:

*J.V. Taranik* (USA); *J.C. Cazaux* (F); *J. Wiesel* (FRG); *J. Braçonne* (F)

*J.V. Taranik* presented the report of Working Group II/4 which will be published in the Congress Archives. The meeting referred mainly to presentation and comparison of different specialized calculators, which also are adapted to remote sensing image processing, i.e. which are capable of accumulating large quantities of data.

Thursday, July 24, 1980, from 9.00 to 10.30, Hall 2

Session 5 of Commission II

Main Topic: Processing of Remote Sensor Data,  
Image Display and Storage

Chairman: *J.P. Guignard* (France)

Speakers: *J.C. Cazaux* (F), *A. Hourani* (F),  
*J.C. Deigan* (USA), *J.N. Street* (USA)

The first paper (*J.C. Cazaux*) was concerned with the definition of different quality levels for the SPOT images and the format of the corresponding products.

Results of simulations aimed at evaluation of the SPOT processing system have been reported.

*Mr. Alif Hourani* presented the remote sensing activities which are now initiated at the Electronic Applications Laboratory in Strasbourg.

Various manipulations of images of the Strasbourg area have been commented upon.

### COMMISSION III

MATHEMATICAL ANALYSIS OF DATA  
ASPECTS MATHÉMATIQUES DU TRAITEMENT  
DE L'INFORMATION  
MATHEMATISCHE GESICHTSPUNKTE DER  
INFORMATIONSVERRARBEITUNG

President: *Dr. I.T. Antipov* (USSR)

Secretary: *Mr. S.S. Nekhin* (USSR)

Wednesday, July 16, 1980, from 11.00 to 12.30

#### Session 1 of Commission III

Main Topic: Methods and Accuracy of Aerial Triangulation

Chairman: *Prof. F. Ackermann* (Fed. Rep. Germany)

Author: *Dr. I.T. Antipov* (USSR)

Title: On the Development in the Field of ISP Commission III during 1976–1980 (the Commission III President's Report)

The report referred to the results of the intermediate symposium and its state of information. Definition and compensation of systematic errors, detection and elimination of blunders and development of analytical plotters software were mentioned as the most attractive achievements in aerial triangulation. Among the theoretical aspects of remote sensing the digital methods of image processing were considered in the report as ones where the progress was essential and fast. But still there are large potential possibilities for further advance of Photogrammetry into new fields of practical applications.

Author: *Ch. de Vegt, H. Ebner* (FRG)

Title: Adjustment Projects in Photographic Astrometry

The authors informed about long collaboration between astrometry and photogrammetry at Hamburg Observatory. As a result a programme package for the rigorous least squares adjustment of thousands of photographic plates was developed at Hamburg observatory and successfully applied to the material of AGK 2 and AGK 3 catalogues, both covering whole the northern hemisphere.

*Mr. J.C. Deigan* presented the principle of the calibration of the OPTRONICS devices. Examples of user-oriented enhancements highlighted the potential benefit of an accurate calibration.

*J.N. Street* presented a summary of a technology survey aimed at assessing the potential advantages of new scanning principles to be implemented in cathode ray tubes. Consequences at the level of multispectral images have been discussed as a conclusion to the session.

Author: *J.J. Talts* (S)

Title: Research on Aerial Triangulation in Commission A of OEEPE

The paper gave an overview of present activities within the Commission, which worked with aerial triangulation. Two research projects were recently started. One was dealing with the accuracy of point transfer and projection centers. The other studied the effect of auxiliary geodetic measurements on photogrammetric block adjustments.

Author: *A. Grün* (USA)

Title: Internal Reliability Models for Aerial Bundle Systems

The author defined the reliability of a photogrammetric system as its quality with respect to gross error detection and location. The elements of the inverse matrix are crucial for the internal reliability. For large linear systems the complete inversion becomes very costly. The author applied approximate diagonal elements of the  $Q_W$ -matrix obtained from developed reliability models and investigated the main parameters influencing the values of diagonal elements.

Authors: *M.M. Leupin, I.H. Hausammann* (CDN)

Title: An Extended Approach for Photogrammetric Point Determination in Geodetic Nets

The authors presented an extended mathematical model for photogrammetric point determination. It features additional parameters for systematic errors, allows to include geodetic observations and makes use of collocation. The paper presented practical results obtained from the NRC Sudbury test on a block flown with a reseau-camera and gave suggestions in view of extensive application of the method for the densification of urban and semi-urban nets.

Author: *M. Molenaar* (NL)

Title: S-transformation and Artificial Covariance Matrices in Photogrammetry

The paper based on a supposition that at present the aerial triangulation seemed to reach a precision comparable to the precision of terrestrial methods. This requires another attitude with respect to ground control, which in future cannot be considered as

non-stochastic anymore. The author discussed the concept of criterion matrices to describe the precision of given control points and applied S-transformation to link up photogrammetric blocks with geodetic point fields.

Wednesday, July 16, from 14.00 to 15.30  
Poster session 1 of Commission III

Main Topic: Algorithms of Aerial Triangulation

Author: *U.A. Rauhala* (USA)  
Title: Experimental Array Algebra Modelling Algorithms

The author discussed the implementation of principles of Array Algebra to evaluate different mathematical models for digital terrain model and image processing, applied them in unbiased self-calibration triangulation methods and gave specialization to solve the problem of on-line aerial triangulation.

Author: *F. Steidler* (FRG)  
Title: On Solution Algorithms for Large Sparse Systems of Normal Equation in Photogrammetry

The author investigated algorithms for the solution of normal equation with different structures. Among them there were mentioned direct solution for banded or banded-bordered matrices, a special direct solution technique for arbitrary sparse systems of equations and the method of conjugate gradients. The algorithms were applied to photogrammetric bundle adjustment and to calculation of digital height models.

Author: *M. Kazamzadeh* (CDN)  
Title: Interactive Adjustment of Very Large Blocks of Independent Models with Minicomputer and K-Block Program

In this paper the major problems of independent models block adjustment were discussed and then the basic concepts of K-Block, on adjustment program and some of its features were briefly explained. It was shown that K-Block or similar programs were more efficient in solution of the problems when processing was carried out interactively preferably with minicomputers.

Author: *R. Larsson* (S)  
Title: Efficient Design of a System for Simultaneous Adjustment of Photogrammetric and Geodetic Observation and Additional Parameters

Here the author outlined ideas and procedures for a program system designed exclusively for the minicomputer. A general data structure was proposed here that simplified the manipulation and sorting of information in a way optimizing the data flow through the computer due to an essentially sequential access to the secondary storage. It was shown that principles were equally applicable on direct-solving methods and on conjugate-gradient methods.

Author: *J.E. Julia* (RA)  
Title: A Fortran Block Adjustment Program by Independent Models and Least

Squares Suitable for Arbitrary Blocks and Small Computers

The author described the development of a programme suitable for large arbitrary blocks and small computers. The programme was based on a direct solution of the reduced normal equations and on the Anblock formulation with iterations between planimetry and altimetry.

Thursday, July 17, 1980, from 14.00 to 15.30

Poster Session 2 of Commission III

Main Topic: Reliability of Photogrammetric Systems

Author: *L. Molnar* (A)  
Title: An Extended Blunder Elimination Procedure

In this paper the author introduced a procedure to consider the functional dependence of observations and the corresponding residuals. Based upon the  $Q_{VV}$ -matrix the procedure includes location and elimination the most erroneous observation. It was applied in software for relative and absolute orientations, model connection and spatial resection.

Author: *P. Stefanovic* (NL)  
Title: Pitfalls in Blunder Detection Techniques

This paper represented a trial to scrutinize numerous recent publications on the problem of blunder detection and discussed the prerequisites, potentials and limitations of blunder location in practical applications in aerial triangulation.

Author: *W. Förstner* (FRG)  
Title: The Theoretical Reliability of Photogrammetric Coordinates

Here the author analyzed internal and external reliability of photogrammetric coordinates in dependence on different block parameters. It is shown that photogrammetric point determination can reach a high reliability. But there are weak parts in photogrammetric blocks and they are the geodetic control, the perimeter of the blocks and the points with 2 or 3 rays. The predominant part of the observations can be checked by traditional means. For the control points it seems to be really necessary to apply a statistical test.

Author: *T. Bouloucos* (NL)  
Title: Error Detection and Reliability Studies in Analytical Formed Strips

The author examined the reliability of observations and described a method for gross error detection during the process of strip formation and a check for the connection of the strips. If applied before block adjustment the method has proved to be effective. Errors of a magnitude 6 to 9 units of  $\sigma_0$  can be readily located.

Authors: *J. Juhl, K. Kubik* (DK)  
Title: Götterdämmerung over Least Squares Block Adjustment



The authors based on the situation that with inclusion of systematic image errors and automatic technique of gross error detection the least squares photogrammetric adjustment had reached an end stage in development, in which an objective determination and separation of "systematic" and "gross" errors became impossible. In the paper they proposed new lines of thought which allowed the direct allocation of various error sources.

Thursday, July 17, 1980, from 16.00 to 17.30

### Session 2 of Commission III

Main Topic: Compensation of Systematic Errors  
Chairman: *Dr. J. Pietschner* (German Democratic Republic)

Author: *F. Ackermann* (FRG)  
Title: Blockadjustment with Additional Parameters (invited paper)

*Prof. F. Ackermann* reviewed the theoretical status of the selfcalibrating blockadjustment method and results of the available experience. It was shown that current research was concerned with the problems of selection, reliability, determinability and statistical assessment of the additional parameters. The author made an attempt to draw the conclusions about conditions of selfcalibrating method application.

Author: *E. Kilpelä* (SF)  
Title: Compensation of Systematic Errors of Image and Model Coordinates (report of Working Group III/3)

The author presented a review of working group activity in which he underlined that an effort had been made to evaluate different approaches in compensating systematic errors in aerial triangulation. The main object of interest was the comparison of component calibration, test field calibration and selfcalibration. The study was carried out empirically. Several institutions participated in the measuring and computing works. The author summarized the obtained results.

Authors: *J. Juhl, O. Brande-Lavridsen* (DK)  
Title: The AUC Selfcalibrating Block Adjustment Method and its Results from Jämijärvi Testfield

In this paper an information was given about a program system developed at Aalborg University Center. This program system was used for analytical treatment of photogrammetric data for the Jämijärvi test block. The block was computed with various control and flight situations. The results proved an accuracy improvement of 15 - 40 % for methods of systematic image errors corrections as compared to a conventional bundle adjustment.

Authors: *G. Kupfer, L. Mauelshagen* (FRG)  
Title: Correlation and Standard Errors in Bundle Block Adjustment Including Additional Parameters

This paper dealt with an investigation of standard error distribution and correlations for blocks of synthetic data. Standard errors and correlation coefficients resulting from bundle solutions were presented numerically and graphically. The authors also made an attempt to find out the influence of point density and variation of parameter sets.

Author: *G. Inghilleri* (I)  
Title: Experiments of Post-Calibration in the Block Adjustment

The author expressed the firm belief that those systematic errors could be eliminated which influence could be detected as one of the results of photogrammetric data adjustment. He informed about attempts to connect differences of coordinates of common points of independent models obtained after adjustment with the parameters of systematic errors.

*J.J. Talts* (S) underlined that the results of self-calibrating block adjustment seem to have the same level of accuracy as compared with aerial triangulation taking into account the correlations between adjusted observations. He also expressed a doubt whether the good definition and high reliability of additional parameters could be achieved at all.

*Prof. F. Ackermann* (FRG) agreed that it is possible to replace the selfcalibration method by another based upon correlations between measured image coordinates. But now there are no computer programs for such a treatment of photogrammetric data. As to reliability of additional parameters is concerned that it is one of the problems of further investigations.

*Mr. Agarwal* (India) asked what results could be achieved for large blocks adjusted with selfcalibration if the geodetic control would be sparse.

*Prof. F. Ackermann* (FRG) answered that all the practical experiments were obtained from large scaled blocks with targeted control points. But there is a reason to expect improvement of accuracy even for large blocks of small scaled photos.

Friday, July 18, 1980, from 14.00 to 15.30  
Poster Session 3 of Commission III

Main Topic: Compensation of Systematic Errors

Author: *M.M. Abdel Rahim* (GB)  
Title: The Terrestrial/Photogrammetric (TP) Technique for the Detection and Compensation of Systematic Height Errors in Block Aerial Triangulation

The paper contained the description of technique for detecting and eliminating uncompensated systematic height errors in adjusted photogrammetric blocks. The adjustment consists of a few steps and in each of them different sets of ground control points are used. The residuals indicate the systematic errors and they can be removed with TP technique shown to be a simple and unexpensive method.

Author: *K. Jacobsen* (FRG)  
Title: Attempt at obtaining the Best Possible Accuracy in Bundle Block Adjustment

Using data of two test blocks the author investigated the possibilities offered by the Hannover Bundle Block Adjustment Program for identification and consideration of systematic image errors. He compared different sets of additional parameters and gave the corresponding numerical results. At the end he came to the conclusion that the practically obtained accuracy for the tests agreed very well with the theoretically expected accuracy up to 1.5  $\mu\text{m}$  of image coordinates in planimetry and 2.7  $\mu\text{m}$  in height.

Authors: *J. Kure, M.M. Radwan* (NL)  
Title: The Use of Refined Auxiliary Data in Strip and Block Adjustments

Here the authors analysed the residuals of auxiliary data after an adjustment and used the method of least squares interpolation to refine the data which then were used in an additional adjustment. The paper described the potentials of the method and gave an indication for optimum configurations of ground and auxiliary control in strip and block aerial triangulation.

### Friday, July 18, 1980, from 16.00 to 17.30 Session 3 of Commission III

Main Topic: Geometric of Remote Sensing  
Chairman: *G. Konecny* (Fed. Rep. Germany)

Authors: *J.M. Anderson, E.M. Mikhail* (USA)  
Title: Metric Aspects of Remote Sensing Data (report of Working Group III/1)

The report contained an information on working group activity and a summary of the results given in the papers presented at the Moscow Symposium. Recommendations concerning future efforts of the working group were also introduced.

Authors: *F. Leberl* (A), *E. Clerici* (AUS)  
Title: Current Status of Metric Reduction of Passive Scanner Data (invited paper)

The authors understood active scanner images to either be Side Looking Radar (SLR) or underwater Side-Scan-Sonar (SSS) images.

*F. Leberl* characterized the current status of SLR images with an emphasis on the Seasat system and reviewed photogrammetric works with airborne SLR images during recent years.

*E. Clerici* described principles of operation of SSS, rectification of SSS-imageries, and geometry of depth determination by interferometric methods.

According to both authors the technological development in these fields will enhance usefulness of active scanner images and reduce costs dramatically. Therefore a requirement will continue to exist to explore radargrammetric aspects of mapping with single images, stereomodels, image blocks and to present radar data in conjunction with other data.

*Prof. G. Konecny* questioned about a resolution power of SLR images in comparison with ordinary photographs and an accuracy of depth determination. *F. Leberl* answered that such a comparison has to be continued.

*E. Clerici* said that at present time the possibilities for accurate determination of depths by an interferometric method are rather small.

Authors: *E.M. Mikhail, J.S. McClone* (USA)  
Title: Current Status of Metric Reduction of Passive Scanner Data (invited paper)  
Passive Scanner Data

In this paper the general discussion of extraction of metric information from scanner (particularly multispectral) data was presented. Consideration was given to: data from both aircraft and spacecraft; singly scanned areas and areas with multiple coverage; various mathematical models used up to the present time; published numerical results. Future trends were also discussed.

*Prof. G. Konecny* said he had a doubt whether it was necessary to apply scanner images for determination of heights and depths.

*E.M. Mikhail* agreed but supposed that there might appear problems where determination of single points would be useful.

Authors: *B. Cabrières, P. Keller, M. Rayssiquier* (F)  
Title: Méthodes de correction géométrique des images fournies par le système SPOT

*A. Boudoin* presented this paper. Here a review of the SPOT mission was specified. A method of geometrical corrections of imageries was developed based upon peculiarities of the SPOT such as an equipment, orbit etc. The paper discussed a procedure to simulate image and its rectification for obtaining needed cartographic information.

Author: *S.S.C. Wu* (USA)  
Title: Topographic Mapping with Side-100-King Radar imagery

The author explained two approaches for radar mapping using analytical plotters. The off-line approach used current digital image-processing technology to compute-rectify and correct geometric distortions of side-looking radar imagery so that analytical plotters can be used for map compilation. The on-line approach directly programs all computations of geometric corrections into an upgraded analytical plotter so that corrections can be performed in real-time during map compilation. Along with test results this paper discussed the off-line processing of radar system data and introduced the development of the on-line approach.

*F. Leberl* asked who sustained the project. *S.S.C. Wu* answered: that is Venus orbiter Imaging Radar (VOIR).

### Monday, July 21, 1980, from 9.00 to 10.30 Session 3 of Commission III

Main Topic: Digital Image Processing  
Chairman: *F. Leberl* (Austria)

*F. Leberl* briefly summarised what was done in the current period by the Working Group III/2. The main problems considered by the working group were pre-processing, pattern recognition and correlations. The working group had three meetings: in Graz (1977), Moscow (1978) and Stuttgart (1979).

Author: N. Mulder (NL)  
Title: A View on Digital Image Processing

In the first part of his paper the author gave a top-down structured view of image processing as a decision making procedure. The second part of the paper involved examples of applying the concept of mapping to the intensity, multispectral and temporal domains. It was shown that image processing for automated decision making and human decision making was essentially the same.

Authors: M. Ehlers, B. Wrobel (FRG)  
Title: Digital Correlation of Remote Sensing Imagery from Tidal Lands

The paper developed a concept for correlation of remote sensing photographs. This concept was applied for processing mud-flats photographs. Quality and accuracy of two target functions were presented by examples for autocorrelation as well as unitemporal and multitemporal correlation. It was shown that a pre-handling of the data by geometric or densitometric treatment was necessary for increasing the available information from the image signals.

Author: W. Mehl (1)  
Title: Automatic Noise Removal and Contour Mapping on Low Gradient Imagery

The author presented a series of algorithms for improvement of low gradient features of digital imagery obtained from multispectral scanner data over water bodies. These algorithms included procedures for reducing random line offset variation, a random noise, and generating the contour curves. Applications on Coastal Zone Colour Scanner data were shown.

F. Leberl asked if colour images obtained from satellites were used.

W. Mehl answered affirmative.

Author: H.P. Bähr (FRG)  
Title: Analog Versus Digital Image Processing of Photogrammetric Imagery

Here there was a record of operational methods developed for remote sensing in the field of conventional photogrammetry. It was underlined that restoration of photographic imagery's resolution connected with large data sets, which could not be handled economically on today's computer generation. So photographic image processing continues to play an important role in photogrammetry, but digital procedures extend the scale of powerful photogrammetric methods. The author demonstrated the flexibility of digital image processing for applications of terrestrial photogrammetry.

Author: B. Bargel (FRG)  
Title: Automatische Klassifikation durch Textur- und Formmerkmale in Multispectraldaten für die Fernerkundung

The paper contained some examples of statistic analysis for a digitized sensor image. The demands were formulated to classify automatically terrestrial objects by means of their texture and forms.

F. Leberl announced that a discussion of presented papers will be held on Thursday, July 24, at a joint session of Commission II, III and V.

Wednesday, July 23, 1980, from 11.00 to 12.30

#### Session 4 of Commission III

Main Topic: Rectification, Correlation and Change Detection

Chairman: E.M. Mikhail (USA)

Author: Ph. H. Swain (USA)  
Title: Pattern Recognition for Remote Sensing: Progress and Prospects (Invited paper)

Mr. Ph. H. Swain presents an overview of current state in automatic image pattern recognition. The four aspects of remote sensing problem are discussed, namely: scene information content, characterization of scene information, information extraction methods and the net value of extractable information. The impact of increasingly complex data bases and the rapidly evolving digital computer technology are highlighted.

Dr. F. Leberl was interested in the value of pattern recognition techniques for topographic tasks.

Mr. Swain answered that he is not a photogrammetrist and cannot give the exact estimation of these techniques value with regard of topographic application.

Author: J.C. Deigan (USA)  
Title: Digital Colour Calibration Technique

Here Mr. Deigan explained a new calibration procedure and technique for the generation of a digital colour image from either magnetic tape or an unenhanced photograph. This technique and procedure have been developed to cope with a large amount of information containing millions of pixels. A common Landsat scene can be recorded in about half an hour with colour balance under total digital control.

Authors: P.M. Teillet, B. Guindon, D.G. Goodenough (CDN)

Title: Integration of Remote Sensing Data Sets by Rectification to UTM Coordinates with the Use of Digital Terrain Models.

Mr. Teillet presents the paper. It deals with requirements for digital rectification of the data sets to a common geographical coordinate system. The universal transverse Mercator projection was selected as the standard in an experiment to compare Landsat 4-channel synthetic aperture radar data for agricultural and forest test sites. For the aircraft imagery a geometric correction scheme has been developed to model the flight path of the sensor relative to the ground. Digital terrain elevation models have been incorporated into the rectification process in order to correct for positional distortions due to topographic relief.

Author: P.E. Anuta (USA)  
Title: Geometric Representation Methods for Multi-type selfdefining Remote Sensing Data Sets

Mr. Anuta points out that the use of digital remote sensing data from aircraft and satellite-borne sensors is becoming widespread in land use, environment, and agricultural monitoring. In addition to sensor

data, a wide variety of auxiliary data types are being used. The requirement for creation of multi-dimensional digital data types has led to a number of approaches for transformation and merging of various data types. The paper presents the basic concept of the self-defining data set which contains all information needed for correct geometric and radiometric representation of all samples. The paper also gives a description of a software system and examples of application of this technique including a Landsat, earth surface gamma ray and magnetic combination for mineral exploration.

Authors: *E. Clerici, I.A. Harley* (USA)  
Title: Two Methods of Planimetric Restitution of Landsat Imagery Using Analogue Instruments

*Mr. Clerici* presents the paper. He points out that rectification technique for Landsat imagery has generally been restricted to digital approaches which are costly to apply and to operate and which require access to large computers. The paper describes two simple methods of plotting planimetric detail using a Zeiss Stereotop and Kern PG2. These methods are based on a general affine transformation which has been shown to give an accuracy of the same order of magnitude as the normal resolution element of Landsat. *Mr. Clerici* considers the proposed methods should be particularly attractive because of their simplicity and the wide availability of used instruments.

Author: *M. de Masson d'Autume* (F)  
Title: Le modèle de déformation un outil universel pour le traitement géométrique d'images quelconques

The paper was presented by *Mr. P. Hottier*. He discussed a universal procedure for the geometrical processing of images of any kind of sensors. The procedure is based on a generalization of the concepts of image and ray, and the systematic use of digital models for all the functions of n-variables occurring in the processing. Special consideration is given to the problem of object reconstruction from multiple images in the case of objects with variable opacity, and a simple solution, featuring automatic detection and plotting of discontinuities is outlined. The procedure is basically the same as in the modelling of a surface by an elastic grid.

Wednesday, July 23, 1980, from 16.00 to 17.30

### Session 5 of Commission III

Main Topic: On-Line Aerial Triangulation  
Chairman: *G. Inghilleri* (Italy)

Authors: *T.J. Blachut, V. Kratky* (CDN)  
Title: Working Group II/4 Report

*Mr. Kratky* presents the report in which the authors briefly outline the main problems studied during the current 4 years and the results of the symposia held in Moscow and in Canada.

Author: *V. Kratky* (CDN)  
Title: Present Status of on-line Analytical Triangulation (invited paper)

*Mr. Kratky* applies basic concepts of spectral analysis to interpret interpolation, smoothing and parametric transformation based on uniform sampling, as different types of discrete convolution. Spectral properties of interpolation are discussed with main emphasis on their linear least squares version. This method is shown to be a close approximation to the interpolation with a low-pass filtering effect. An operator derived in a functional form performs direct least squares interpolation avoiding the usual inversion of the covariance matrix. Finally *Mr. Kratky* demonstrates advantages of spectral analysis by examining the accuracy and stability of the procedure.

Author: *E. Dorrer* (FRG)  
Title: Real-time Orientation as Integral Part of on-line Analytical Aerial Triangulation

The author considers orientation of stereopairs as the fundamental process for analytical stereoplotters and as an integral part of aerial triangulation. Hence an orientation and bridging should be solved as rigorously, automatically, logically and naturally as possible. The paper describes an attempt to specify such a solution by means of a structured program of the real time orientation loop. The main features of this program are: no distinction between relative and absolute orientation, avoidance of point identification entries, simple distinction between different types of points, automated positioning according to available information, lazy switching between plotter and comparator mode. At the end of his paper *Mr. Dorrer* shows preliminary results based on APL simulations which seem to justify the relevance of the approach.

Author: *Ch. S. Slama* (USA)  
Title: On-line Applications of an Analytical Plotter for Densification of Geodetic Control

*Mr. Slama* reviews application of analytical photogrammetry of densify geodetic nets. The system developed by the National Ocean Survey uses pre-marked ground targets with a reseau camera. Model pairs from photography are "relatively oriented" in the analytical plotter in addition to the measurement on a monoscopic comparator of the targetted points. The exterior orientation parameters from the relative orientation are then used as constraints for the adjustment of the targetted points. According to the author this method will reduce field costs for targetted points needed for photogrammetric geometry only. In addition the method should increase the final accuracy through the use of optimum geometry in relative orientation.

Author: *G.R. Dowditch* (USA)  
Title: On-line Bundle Block Adjustment for Analytical Plotters.

The paper describes an approach to the solution of the adjustment problem for normally distributed data utilizing the Bayesian estimator applied to photogrammetric bundle block adjustment. The author argues that under the assumption of uncorrelated observations this approach does not require the inversion of matrices and it also allows a sequen-

tial introduction of single consecutive observations as well as the implementation of an error-shoooping algorithm. The paper gives the results of an attempt at extrapolation of timing requirements.

Wednesday, July 23, 1980, from 14.00 to 15.30

Poster Session 4 of Commission III

Main Topic: Digital Image Processing

Authors: *H. Goßmann, P. Haberäcker* (FRG)  
Title: Image Processing of HCMM-satellite Images for the Superposition with other Satellite Imagery and Topographic and Thematic Maps

The paper informed that a consortium of several European investigators conducted studies of soil moisture for agricultural and environmental interests. It was examined how exactly a regionally bounded HCMM-scene could be rectified with respect to a preassigned coordinate system. Related to this problem the question was how large natural topographic structures might be in order to be identified accurately in a satellite thermal image. The attempt was made to superimpose computationally point for point the HCMM-image data with other information obtained from thematic maps which had been derived from Landsat data. The theoretical requisite methodological steps and the accompanying difficulties as well as some evaluations of the resultant data-structures were presented in the paper.

Authors: *F. Leberl, W. Kropatsch* (A)  
Title: Experiments with Automated Feature Analysis Using Maps and Images

*Mr. W. Kropatsch* presented the paper. He outlined that the authors conducted experiments with part of a digital Landsat image and a map data base established from topographic maps at scale 1:50000. For this purpose a cartographic data bank suitable for map guided image analysis was developed. In the test scene 13 features were recognized and the resulting image rectification left residual point errors of less than  $\pm 1$  pixel. The emphasis in this paper was made on organisation of digital map data, analysis of aerial features, analysis of linear features.

Author: *M. Ehlers* (FRG)  
Title: Filter Techniques and their Application in Digital Correlation

Filter techniques for noise reduction and amplification of desired information are of great importance in digital image analysis. Two dimensional filter theory is shortly presented in the paper. The effects of some designed filters are described. The results of digital correlation after image filtering are compared to those received without filtering. It is shown that especially a low pass filter increases exactness and efficiency of the objective function at the correlation process in a high degree.

Author: *S. Braçonne* (F)  
Title: Propal II et le traitement d'images

The author submitted a brief introduction of the Propal II system especially its architecture. Then he reviewed the most important problems of methodology of application of image processing with the Propal II system.

Authors: *I.J. Dowman, M.A. Mohammed* (GB)  
Title: Photogrammetric Application of Landsat MSS Imagery

The paper was presented by *Mr. Mohammed*. It summarised some results of research carried out at University College London aimed at developing new mathematical techniques and modifying the conventional ones to rectify MSS imagery. It also tested the possibility of obtaining height information from Landsat MSS images and checked the possibility of using these images for topographic mapping, map revision and thematic mapping.

Author: *R. Jeansoulin* (F)  
Title: Influence des parametres physiques de prise de vue dans la correlation automatique d'images

An investigation of an automatic rectification procedure was carried out by means of comparison of different algorithms (filtrage, detection of contours, definition of resemblance) as a function of conditions for obtaining images. This study allows to choose the optimal strategy of image processing for real physical conditions.

Thursday, July 24, 1980, from 11.00 to 12.30  
Session 7 of Commission III

Main Topic: Digital Terrain Models  
Chairman: *J.M. Anderson* (USA)

Author: *K. Tempfli* (NL)  
Title: Spectral Analysis of Terrain Relief for the Accuracy Estimation of DTM's

The accuracy of representation of topographic surface by a DTM depends on the density of sampling related to the roughness of the surface, the measuring precision, and the interpolation procedure employed for its reconstruction. The transfer function of sampling and interpolation provides an excellent means for studying different interpolation methods and the influence of sampling density. Making use of the concept of the transfer function and the spectra which describe the terrain relief and the measuring error, makes it possible to express the performance of DTM in terms of accuracy. The author selected a few typical terrain types. They are represented graphically by contour plots and characterised by their respective spectra. The dependence of the mean square error of reconstruction on the sampling density is illustrated for several interpolation methods.

Authors: *M.M. Allam, B.A. Low* (CDN)  
Title: Software Package for the Contouring of Massive DEM in Mini-Computer Environment

*Mr. Allam* presented the paper. He reviewed automatic photogrammetric systems developed in the Topographic Survey, Canada for producing dense

digital elevation models and for the generation of contours from dense DEM's. A linear interpolation technique was adopted. The basic scanning mechanism allows an optimal number of passes according to cartographic representation. A description of the basic algorithms, program requirement, limitations, outputs, options and special machine dependency features are given in the paper.

Author: *R. Winter* (FRG)  
Title: Vergleich digitaler Geländemodelle

The author submitted a brief illustration of results obtained in 1977-1979 by the working group "Digital terrain model" which was established in accordance with a decision of governmental bodies of FRG.

Author: *E. Wild* (FRG)  
Title: Interpolation with Weight Functions – a General Interpolation Method

*Mr. Wild* makes a comment regarding analysis of existing methods which show that interpolation can be described by weight functions decomposing an interpolation surface in components related to the reference points. They trace the effects of variation of reference values onto the interpolation. Alternatively a rather general interpolation method can be developed based on weight functions. By specifying certain features the method is adopted to various applications, in particular to high accuracy DTM interpolation. The important features of the method are shown in this paper. A few examples of derived contour lines are presented.

Thursday, July 24, 1980, from 14.00 to 15.30

#### Session 8 of Commission III

Topic: Business Meeting  
Chairman: *I.T. Antipov* (USSR)

*Dr. Antipov* reports that in accordance with the ISP by-laws some persons were appointed to isolate during the Congress the more important problems and to prepare drafts of resolutions which will be guidelines for the Commission III activity for the next 4 years. The most important contribution in preparation of resolutions was made by *Prof. Kilpelä, Prof. Ebner, Dr. Leberl* and *Dr. Kratky*. The six preliminary distributed resolutions were submitted for consideration. Some were condensed, reorganized, reworded or combined. Finally the business meeting approved five resolutions. They deal with:

- identification of gross and systematic errors,
- combined adjustment of photogrammetric and non-photogrammetric data,
- on-line photogrammetric triangulation,
- digital height model,
- image processing and pattern recognition.

The original resolutions have been given to the incoming Commission III President, *Prof. E. Kilpelä* (SF) for consideration in the next four years.

Friday, July 25, 1980, from 9.00 to 10.30

#### Session 9 of Commission III

Main Topic: Digital Differential Rectification  
Chairman: *H.P. Bähr* (Fed. Rep. Germany)

Author: *R. Hössler* (FRG)  
Title: Differential Rectification of Digital or Digitized Imageries (invited paper)

First of all *Mr. Hössler* gives a short introduction of the problem describing the direct and indirect method for differential rectification of digital or digitized imageries. Ensuing the application of these two methods to the rectification of digital satellite images, digital aircraft images and to digitized two dimensional images is discussed with regard to various aspects of the exterior orientation, implementation of digital height models, post-processing of output image. In the last part of the paper *Mr. Hössler* deals with data handling problems.

Authors: *M. Nasu, K. Shimamoto, H. Kano* (J)  
Title: Digital Differential Rectification of Airborne MSS Data for Geothermal Mapping

*Mr. Nasu* presents the paper. It points out that an analytical positioning system for scanner remote sensing imagery has been developed. The fundamental geometric model in the system is a collinearity condition of scanned data. The system is presently being used practically, mainly for geothermal mapping of mountainous areas. Accuracy studies of the analytical positioning system have been carried out with experimental as well as practical MSS strip data. The test results show an accuracy of about 3 pixels in standard deviation of residual errors after exterior orientation of MSS strips. Preparation of DTM data still remains the most time consuming and tedious work in the digital differential rectification system. Further study and development are required in this field and further utilization of the DTM related information is expected to produce more advanced processing of the MSS remote sensing data.

Author: *W. Schuhr* (FRG)  
Title: Analysis and Application of Algorithm for Digital Orthophotos

The author discussed a program system developed under Prof. Konency at the Institute for Photogrammetry of the Hannover University. Investigations were carried out especially with modular multispectral scanner data and Landsat data. Instead of manual counting in the lineprinterimage, image coordinates were gathered by PSK comparator measurements. For detecting gross errors second order polynomial approaches have been successfully applied. Owing to the availability of simultaneous conventional aerial photographs, map coordinates and exterior orientation data were gained from conventional bundle block adjustment. A development of this inflight data using fifth order polynomials resulted into a position accuracy for X, Y and Z of about  $\pm 10$  m. Subsequently a bundle block adjustment approach for scanner imagery including additional parameters in the collinearity equations was applied. This method resulted into an accuracy of about  $\pm 1.4$  pixels, using 41 independent checkpoints.

Authors: *R. D. Düppe, W. M. Göpfert* (FRG)  
Title: Geometrical Rectification of Overlapping Scanner Imagery Using a Modified Anblock Method

The authors employ a suitable modified block adjustment program for the rectification of strips and blocks of overlapping aircraft or satellite scanner imagery. They present practical experiences and results. First scanner image coordinates are automatically combined to models, using a triangular mesh-algorithm. Then a block adjustment with the Anblock method is performed introducing additional fictitious observations for the transformation parameters. In a final processing step digital geometrical rectification using the pass-point method applied to multiquadric equations is employed to yield final outputs such as scanner-mosaics of cartographic accuracy.

Author: *J. Jansa* (AUS)  
Title: Rectification of Blocks of Multispectral Scanner Images

*Mr. Jansa* determines and describes geometric distortions of MSS images by applying an interpolation function. This is made possible by involving data on control points. The solution can be improved by adding data on the points so to assure a possible good continuity of the rectified image. The rectification itself can be performed either digitally or optically. The block is created in the process of re-arranging pixels in the digital case, and by manual mosaicing of the individual rectified images in the optical case. The capability of dividing the block into sub-blocks enables the handling of large quantities of data.

## COMMISSION IV

### TOPOGRAPHIC AND CARTOGRAPHIC APPLICATIONS

### APPLICATIONS TOPOGRAPHIQUES ET CARTOGRAPHIQUES

### TOPOGRAPHISCHE UND KARTOGRAPHISCHE ANWENDUNGEN

President: *Dr. J.M. Zarzycki* (Canada)  
Secretary: *Mr. J.H. O'Donnell* (Canada)

Tuesday, July 15, 1980, Hall 2, from 9.00 to 10.30

#### Session 1 of Commission IV (Working Group 1)

Main Topic: Digital Map Compilation and Cartographic Treatment of Digital Data

Chairmen: *J.M. Zarzycki* (USA)  
*J.R.R. Gauthier* (France)

*Dr. Zarzycki* opened the session with a brief review of the Commission's activities and organization, based on the decisions (recommendations) adopted at the 1976 ISP meeting in Helsinki. The resolutions adopted at the inter-Congress meeting of Commission IV, held in Ottawa, October 1978, were outlined by *Dr. Zarzycki*. The cooperation with international organizations, FIG and ICA were briefly mentioned by *Dr. Zarzycki*. This led to the introduction of the first speaker of the session, *Mr. C. Eidenbenz*. The title of the presentation of *Mr. Eidenbenz* was "Report of first Joint ICA-ISP-FIG". *Mr. Eidenbenz* summarized the joint meeting held in Switzerland and stated that FIG will deal with Data Banks, ICA with Feature Classification and ISP with Cartographic and Topographic Systems.

The second speaker was *Dr. A.A. El Assal* who presented a paper entitled "Status of Software in Digital Mapping". The format of the "question-

naire" and the review and analysis of the results obtained were presented. In particular the following topics were addressed: Format, System Classes, Contents, Nature of Operation and Encoding/Editing.

*Mr. G. Petrie* presented a paper on the Hardware Aspects of Digital Mapping. *Petrie* classified the systems in terms of single/simple of multiple/complex systems and reported on the available hardware.

*Mr. G.H. Ligterink* presented a paper on Photogrammetric Mapping Systems supported by computers. *Mr. Ligterink* classified them into aerial triangulation acquisition systems and map digitization and interactive graphic systems.

Wednesday, July 16, 1980, Hall 4, from 16.00 to 17.30

#### Session 2 of Commission IV (Working Group 1)

Main Topic: Digital Map Compilation and Cartographic Treatment of Digital Data

Chairman: *J.R.R. Gauthier* (France)

*Mr. Gauthier* opened the session with an invited paper entitled "Accuracy and Time Comparison of Digital Maps - an International Test". *Mr. Gauthier* described the basic concept of the test, the input material and data prepared for the participants in the large scale and small scale tests, and the techniques developed for the analysis of the accuracy aspect. Results of the analysis of participants' submissions were reported, and conclusions.

The next speaker, *Mr. F.S. Kröll* presented a paper on "Data Banks and Information Systems for Digital Topographic Photogrammetry".

*Dr. H. Ebner* presented a paper on "A Mini-Computer Program Package for Height Interpolation by Finite Elements". The mathematical model and the basic algorithm of several programs were described. Samples of output options (DEM's, Contour, Profiles) were shown.

The next speaker was *Mr. Socholo* who read a paper prepared by *Mr. P. Asmoro*.

The next speaker, *Mr. F. de Carvalho* from Brazil presented a slide-show (with sound) on "The Dynamization of Cartography-DINCART in Brazil". The philosophy, organizational chart, objective, budget estimate, implementation plan were clearly presented.

The next paper was given by *Mr. C.S. Gonzales* from Mexico on "Topographic Cartography Systems for Non-Developed Countries".

The final paper in the session was presented by *E. Derenyi* on behalf of *A. Hamilton*. The paper dealt with "Non-Technical Problems in the Evolution of a Renewable Resource Information System".

Wednesday, July 16, 1980, Hall 4, from 17.00 to 18.00

### Session 3 of Commission IV (Working Group 7)

Main Topic: Integrated Resource Mapping

Chairman: *Mr. Socholo* replacing *P. Asmoro* (RI)

Papers presented:

1. *P. Asmoro's* paper – Transmigration Program – was read by *Mr. Socholo*.
2. Dynamization of Cartography DINCART-Brazil. *Mr. F. de Cavalho* presented a film on Brazil's Surveying and Mapping Programs.
3. Topographic Cartography Systems for Non-Developed Countries was presented by *C.S. Gonzales*.
4. Non-Technical Problems in the Evolution of a Renewable Resource Information System was presented by *E.E. Derenyi*, replacing *A.C. Hamilton*.

Thursday, July 17, 1980, from 11.00 to 12.00

### Session 4 of Commission 4 (Working Group 4)

Main Topic: Mapping from space-borne Photography and non-Photographic Imaging Systems

Chairman: *Dr. A. P. Colvocoresses* (USA)

*Dr. Zarzycki* introduced the chairman and first speaker of the session:

*Dr. A.P. Colvocoresses* (USA) who discussed the "Status and Future of Electro-Optical Mapping Systems in Space". The appropriateness of array detection to a MAPSAT satellite providing stereoscopic imagery was indicated.

*G. Konency* (FRG) covered the history and present development plans for the large Format camera and the ESA RMK 23/30 film cameras in space in a paper entitled "Earth Orbiting Camera Systems".

*R.M. Batson* (USA) outlined the magnitude of the program to map the solar system of which the earth comprises only 10 %. He showed examples of photomaps and radar maps of various planets. The title of his paper was "Status and Future of Extraterrestrial Mapping Programs".

*E.A. Fleming* (CDN) described a method of position determination (30 m RMS) for offshore features from geometrically corrected Landsat imagery, in a paper entitled "Determination of the Geographic

Position of Isolated Islands Using the Digital Image Correction System for Landsat MSS Imaging".

*A. Baudoin* (F) in a paper "Utilization des images SPOT pour la cartographie topographique des pays industriels et des pays neufs" postulated reductions in map revision cycles from 5 years to 3 in both industrialized and developing areas by the utilization of imagery from SPOT.

*S. Murai* (J) "Three-Dimensional Representation for LANDSAT MSS Data" showed three-dimensional computer processed LANDSAT images combined with information from Digital Terrain Models.

Friday, July 18, 1980, from 11.00 to 12.30

### Report on Joint Session of Working Group 1 and Working Group 3

Chairman: *Dr. J.M. Zarzycki* (USA)

Invited papers from representatives of the ICA were presented. *Dr. Gottschalk* spoke on behalf of Commission III of the ICA.

- *Dr. R. Boyle* presented his paper entitled "The Present Status and Future of Scanning Methods for Digitization, Output Drafting and Interactive Display and Editing of Cartographic Data".
- *J. Leatherdale* presented his paper entitled "Digital Map Production" which gave an up-date of the Hunting digital mapping system.
- *W. Staufenbiel* presented his paper entitled "Das topographische Databanksystem TOPSY".
- *Dr. J.G. Linders* presented his paper entitled "Geo Reference Data Base Design".
- *Mr. Pelletier* presented a paper on the subject of "Integrated Digital Data Base for Forestry Applications".

Monday, July 21, 1980, from 11.00 to 12.30

### Session 5 of Commission IV (Working Group IV 5)

Main Topic: Orthophotography and Photomapping

Chairman: *D. Glendinning* (Australia)

The speakers in this session were:

*Mr. D. Glendinning*, Australia, Chairman

*Prof. K. Kraus*, Austria

*Ing. G. Ducher*, France

*Mr. J. Karalus*, Great Britain

*Mr. R. Mullen*, USA

*Dr. S. Murai*, Japan

*Dr. M. Erez*, Israel

*Mr. Glendinning* presented the report of WG IV/5. The aims of the Working Group were:

To consider the problems of production relating to orthophotographic procedures, especially automated procedures, reproduction use or cartographic documents of all kinds.

The work was completed in three stages

- an Australia OPM user survey
- preparation and distribution of a questionnaire – worldwide
- compilation on microfiche of a collection OPM's and photomaps.



Unfortunately the report and microfiche (2000 copies) have been lost, however the original 62 sample black, white and colour OPM's are on display in the technical exhibition and the paper is being printed for distribution during the congress.

*Prof. Kraus* presented an invited paper on: "Recent Trends in the Production of Orthophotos and Stereo Ortho-Photos." Prof. Kraus reviewed recent trends in aerial photography including the substantial coverage obtained each year and the increasing use of colour, colour infrared photography. Also the use of scanner imagery is increasing.

Environmental consideration can hardly be managed without aerial photography and much of this output is in the form of OPM's with scientific experts worldwide generally supporting the use of OPM's. Examples of development and trends in the use of Austrian OPM's were given with the aid of slides including details of the "TOPIAS" Topographical Information System.

Details were given of the "Stereograph" instrument for viewing and compiling from stereo orthophotos.

It is now possible to produce stereo orthophotos cheaply by using digital methods.

*M. Ducher* provided details of various ways of restituting orthophotographs by using the associated stereomate, one side or the other — pairs or triptych.

Details were given of possible systems of producing stereo OPM's, including space imagery, provided there is a digital elevation data file.

*M. Ducher* gave details of the IGN use of OPM's for map revision and a test stereo OPM has been run for revising a 1:25,000 map.

A prototype simple instrument for stereo observations including parallax measurements in OPM's was described. Attention was drawn to the need to supply a range of inexpensive devices for use by users with computing facilities.

*Mr. J. Karalus* of Clyde Surveys, better known previously as Fairey Surveys, has produced about 500 OPM's since 1969 using a Jena Topocart, Orthophot & Orthograph system. Scales range from 1:1,000 to 1:50,000.

To avoid production problems and loss of quality, resulting from overlapping responsibilities between divisions, a set of guidelines has been found essential to control the quality from original aerial negatives to final reproduction.

Details are shown in Mr. Karalus' paper.

*Mr. R. Mullen* of the U.S. Geological Survey, which produces about 3,000 quadrangle OPM's a year, gave details of 3 basic areas of development:

1. Colour OPM's
2. Screenless printing
3. Photomechanical mosaicing

A series of slides showed details of the 3 separations of colour infrared Kodak 2443 film to produce the colour OPM. Thus, from a single camera/film combination an unlimited variation of colour presentations is available.

Successful printing of OPM's has been obtained using a screenless plate produced by Howson Holography Group of Vickers Ltd., England. Costs of screenless printing are running at 40 % less than Contone. A series of slides showed the mosaicing procedure.

*Dr. Murai* presented results of his recent research activities in producing orthophotos using digital

methods. The government of Japan already has established a digital elevation data base on a grid of 250 metres.

Examples were shown of a small scale orthophoto from digitised high altitude aerial I/R film using a single film and DTM. (2) A digitised mosaic of colour orthophoto and (3) digital rectification of oblique photo and space photo.

*Dr. Erez* reported getting reliable and consistent results from the Random Dot Technique of printing which he obtained from the U.S. Geological Survey in 1972.

Slides of enlarged Random Dot compared with Half Tone were shown and the resulting printed OPM's compared.

The Random Dot method is particularly useful for geological mapping when combined with duotone printing. Samples of these maps are on display in the Israel exhibit. Needless to say very good production control is essential.

Unfortunately there was no time for discussion on any of the many interesting matters raised during this session.

Wednesday, July 23, 1980, from 9.00 to 10.50

#### Session 6 of Commission IV (Working Group 3)

Main Topic: Large Scale Integrated Mapping for Urban and Rural Planning and Engineering Surveys

Chairman: *K. Lester* (South Africa)

The session was held under the chairmanship of *Mr. K. Lester* — Director of Mapping, Republic of South Africa and the following speakers participated:

*Mr. B. Adolfson*, Sweden; *Col. G.C. Agarwal*, India; *Mr. P. Fagerholm*, Sweden; *Mr. G. Gros*, France and *Mr. P. Waldhäusl*.

The first speaker, *Mr. B. Adolfson* of the National Swedish Road Administration described the photogrammetric activities and especially the system developed for on-line stereoplotting in that organisation.

The system DOSP (Digital Online Stereoplotting) comprises a number of stereoplotters equipped with digitizers and other digital output devices linked through an HP9825 computer to a Wild Aviotab TA. The system can operate in two working modes — Digital online plotting and the Direct mode and is not designed to create a databank. In the direct mode the numerical measurements made can serve as input for relative and absolute model orientation, aerial triangulation, longitudinal profiles and cross sections, reference points for setting out road centre lines and for resection of oblique photographs in the presentation of proposed road projects.

In a second paper dealing with the application of photogrammetry in the management of roads in Sweden, *Mr. P. Fagerholm* described the preparation of low-cost strip maps at scales varying from 1/2500 or 1/5000 in the urban areas to 1/10000 or 1/20000 in the rural environment. Prime requirements are low cost, ease of handling in a motorcar and the ability for the user to locate himself quickly and easily to an accuracy of 5 metres without accurate

measurement. To meet these requirements, strip maps formed from an approximately scaled strip of aerial photography derived from existing 1/30000 photography are prepared to A4 format and additional symbols added by indicator lines to facilitate location. These additional symbols are added by local offices and to restrict the use of these maps for other than road management purposes, the strip should be kept as narrow as possible.

In a comment on *Mr. Adolfson's* paper, *Mr. B. Jefferys* described a similar system that his company had developed in South Africa, comprising a B8+ digitizing equipment connected through interfaces to a Wang computer and Aviotab table.

*Col. Agarwal* reviewed the development of the traditional methods of a cadastral/land revenue registry in India. Scientific surveys were confined to the boundaries of villages only and the ruling by a competent court that surveys and registration for land revenue do not confer title to land have led to a reassessment of the basic surveys required to depict the individual parcels of land. Experiments using rectified aerial photographs and mosaics gave satisfactory results with impressive savings in time compared to simple ground survey methods. The method is now being introduced in a large state in India to give an improved basic cadastral and land revenue survey, to ensure speedier development of one area and assist in expediting social reform.

*M. Gerard Gros* then introduced two papers, one in his own name and the other on behalf of *M. J. Bompas* — Large Scale Numerical Cartography adapted to the study of road and route projects.

Stressing that the map must be a non-emotional reproduction of reality, the speaker gave the prime requirements of the product as an accurate display of the land use, correct geometric definition and its ability to meet the needs of the road engineer. To assist the user amplified symbols are employed and the automatic plotter completes the map with the exception of the place names. Wherever possible existing photography at 1/30000 is used together with field updating and data from existing maps to produce the 1/5000 maps for road projects. In his own paper *M. Gros* discussed the development of numerical models to handle terrain data including sub- and superterrain data. He sketched the various data acquisition methods and sources that were possible and mentioned the feasibility of a universal mathematical model including its ability to interpolate contours and produce perspective drawings as well as maps.

The last speaker *Mr. P. Waldhäusl* (A) described the experimental work undertaken on behalf of the OEEPE/C during the investigation of accuracy performance using large-scale photogrammetric techniques for signalized points and nine types of natural detail points in urban areas using a variety of photo scales, terrain illuminations, optics and camera lenses, plotting methods, equipment etc. Surveys using classical geodetic methods were also compared with the photogrammetric surveys.

The session closed with the chairman expressing his thanks to the speakers for their papers and to the translators for their assistance.

Thursday, July 24, 1980, 14.00 h

Minutes of the Business Meeting of Commission IV

1. Present at the meeting:

Name	Organisation	Country
<i>K.J. Lester</i>	Director of Surveys	South Africa
<i>R. Brossier</i>	Institut Géographique National	France
<i>F.S. Kröll</i>	Hochschule der Bundeswehr, München	FRG
<i>Karl Heiland</i>	Landesamt für Flurbereinigung Baden-Württemberg	FRG
<i>M. Roule</i>	Czechoslovak Scient. Techn. Soci., Prague	CSSR
<i>W. Marckwardt</i>	Jenoptik Jena	GDR
<i>J.R.R. Gauthier</i>	Topographical Survey, Ottawa	Canada
<i>J.M. Zarzycki</i>	Topographical Survey, Ottawa	Canada
<i>Roy R. Mullen</i>	USGS-National Mapping Div., Reston, Virginia	USA
<i>D.I. Glendinning</i>	9 Lawley Cr., Mt Lawley, Western Australia	Australia
<i>G.H. Ligterink</i>	Techn. Univ. Delft	Netherlands
<i>J. Kure</i>	ITC, Enschede	Netherlands
<i>J. Timmerman</i>	Phot. Dept. Cadastre; Apeldoorn, Waltersingel 1	Netherlands
<i>Roger T. Pelletier</i>	Forest Service — USDA, Geometronics Development Group, Rosslyn/Va.	USA
<i>Michel Bacchus</i>	I.G.N., 2, Avenue Pasteur, St. Mandé	France
<i>G. Gros</i>	Service d'Etudes Techniques des Routes et Autoroutes, 38 rue Liancourt, Paris	France
<i>M. Bakkar</i>	Direction de la Conservation, Fouciere-Rabat	Maroc
<i>Ch. Eidenbenz</i>	Bundesamt für Landestopographie, Seftigenstrasse 264, CH-3084 Wabern	Switzerland
<i>H.G. Jerie</i>	ITC	Netherlands
<i>G.C. Agarwal</i>	Cadastral Survey of India	India
<i>K. Kraus</i>	University of Vienna	Austria

2. The meeting was chaired by *Dr. J.M. Zarzycki*, President, Commission IV. *Dr. Zarzycki* introduced the new President of the Commission, *Mr. R.R. Mullen*, National Mapping Division, USGS.
3. The Chairman then explained the new scope of the Commission IV. The new title of the Commission will be: "Cartographic and Data Bank Applications of Photogrammetry and Remote Sensing".

Its responsibilities will include:

- a) Photographic, analog, and numerical mapping procedures;
- b) Compilation and revision of planimetric, topographic, thematic and special maps;
- c) Digital terrain models, cartographic data banks, and geographic information systems.

#### 4. Proposed Resolutions of Commission IV

##### 4.1 Resolution 1

The Congress,

*noting*

- a) that the Return Beam Vidicon (RBV) system has been successfully flown on Landsat-3 in relatively high resolution (30 m) mode,
- b) that the RBV system has relatively high geometric fidelity and provides data suitable for mapping
- c) that RBV data are complementary to that of the lower resolution (80 m) Multispectral Scanner (MSS) which is scheduled to fly on Landsat D
- d) that the higher resolution (30 m) Thematic Mapper (TM) will, in all probability, not be available for the Landsat-D spaceflight.

*recognizing* the widespread use of Landsat data and its importance to various programmes throughout the world,

*recommends* to the government of the United States of America that the RBV system as designed for Landsat-3 be adapted for and flown on the Landsat-D spacecraft.

Resolution 1 was unanimously approved.

##### 4.2. Resolution 2

Joint Meeting with ica and FIG

The Congress,

*noting*

- a) that digital mapping technology is becoming increasingly important as a mapping tool,
- b) that digital topographic data bases are being recognised as the foundation on which other geographic reference systems are based,
- c) the resolution passed at the joint meeting of Commission IV I.S.P., Commission III, I.C.A. and Commission V, F.I.G. in June, 1979 at Zurich,

*realizing* the common interest of I.S.P., I.C.A. and F.I.G. in digital mapping and data base technology,

*recommends* that contacts be maintained with the appropriate commissions of I.C.A. and

F.I.G., that arrangements be made for joint meetings and symposia in conjunction with the normally scheduled conferences of these societies, and that joint investigations be performed.

Discussion:

*Mr. K. Heiland* recommended that Commission IV cooperate with Commission VI for the preparation of a Dictionary of Terms. A discussion followed about the meaning of such a dictionary. It was further agreed that such a dictionary should be prepared in cooperation with ICA.

Resolution 2 was unanimously approved.

##### 4.3. Resolution 3. Presented by *Mr. D.I. Glendinning*.

Quality Control on Photomapping

The Congress,

*noting* the emphasis which has again been generated for the retention of high resolution imagery in the photomap or space imaging products, *realizing* the loss of such resolution which is taking place in many of the present production processes, *recommends* the preparation of suitable guidelines for maintaining the resolution of imagery, whether from air-borne or space-borne platforms, throughout the photomap production process.

Discussion:

*Mr. K.J. Lester* remarked that any specifications for aerial photography should include a part dealing with photography for photomapping. It was agreed that this task belonged to Commission I who should consult Commission IV for the preparation of specifications for photography for photomapping.

Resolution 3 was unanimously approved.

##### 4.4. Resolution 4. Presented by *Mr. J. Kure*.

Mapping Specifications

The Congress,

*noting* the importance of specifications in the mapping process, and *realizing* that there are great differences in specifications used throughout the world, *recommends* that standardization of specifications be investigated.

Resolution 4 was unanimously approved.

##### 4.5. Resolutions 5. Presented by *Mr. H.G. Jerie*.

Cost Models of Photogrammetric Processes

The Congress,

*noting* that the evaluation of — and decisions concerning existing and proposed photogrammetric techniques and methods require sound and detailed information about the cost aspects of technological alternatives,

*referring* to the expressed desire of the ISP, to cooperate with other scientific organizations within the field,

*realizing* that the OEEPE has recently set up a Working

Group on the "Establishment of Cost Models for Photogrammetric Processes" in which a considerable number of mapping organizations and experts from within and outside the OEEPE area have agreed to cooperate, recognizing that the main interest for this subject falls within the domain of Comm. IV of the ISP, invites the above mentioned Working Group of the OEEPE to report the finding to Comm. IV of the ISP.

Discussion:

The Chairman remarked that there was some overlap between Commissions IV and VI regarding this resolution, but that he had discussed the matter with the Chairman of Commission IV who was ready to cooperate with Commission IV.

Mr. Ch. Eidenbenz commented that this type of study was quite complex and that the results would vary from country to country and would be difficult to apply to all mapping organizations. For instance while the particular economic model might well apply to countries belonging to the OEEPE it might not meet the needs of developing countries. Mr. Jerie explained that the OEEPE will invite countries outside that organization to participate in the activity of the proposed working group. Furthermore he explained that while absolute values for the model may be difficult to establish, it may be possible to obtain relative values. Mr. D.I. Glendinning also remarked that cost modes add to the credibility of cost studies made in support of request for funds required by any governments.

The resolution 5 was approved with two abstentions.

4.6. Resolution 6. Presented by Mr. Gros.

Road and Highway Projects

The Congress, stating

- a) that research in the field of street planning because of its linear condition delineates a very special branch of application of all topographical and cartographical techniques,
- b) that the many phases of studies of different kinds of projects for motorways and roadmaking in industrial countries as well as in developing countries demand complex and simple techniques,
- c) that within the ISP there are no commissions or working groups dealing with these questions,

considering the interests of clients and users to provide methods and products that are especially adjusted to their needs, recommends to found a working group that has to study the needs of road building engineers and consequently collect all essential elements for large-scale maps, remote sensing, photogrammetry, gyroscopical measurements, etc.

Discussion:

Mr. Eidenbenz remarked that a similar working group of Commission IV had existed since 1964 until 1976 when it was decided not to re-establish it because of lack of interest.

Mr. Mullen answered that new technologies, and the evolution of old ones made the activity of such WG useful at this time.

Mr. Lester indicated that it would not be proper for a Commission to establish highly specialized working groups, the activity of which could be included in WG with general terms of reference.

The Chairman commented that WG are created to answer specific problems and may have a limited life.

Resolution 6 was approved with 1 abstention.

4.7. The Chairman then asked if anyone wished to present another resolution.

Mr. G.C. Agarwal presented the following resolution:

Needs of Developing Countries

The Congress,

realizing that the principal impact of development in mapping technology is directed towards the needs of industrialized countries and may therefore not always be applicable under specific socio-economic and cultural circumstances of developing countries, recommends that a special Working Group be established to identify the said problems with regard to developing countries and to suggest possible solutions for mapping in its wider perspective.

Discussion followed on the need for such a working group. Mr. Agarwal stressed that methods and technologies developed for industrialized countries may or may not be suitable for developing ones and that an in-depth evaluation of all technologies would facilitate decisions of managers of developing countries.

Mr. Jerie supported such a systematic effort to study the circumstances and specifically define the needs of developing countries.

The Chairman noted that this investigation would be of interest to several Commissions but that Commission IV could take the leading role.

Resolution 7 was unanimously approved.

5. Mr. Lester spoke of the excellent work done by Dr. Zarzycki as President of Commission IV, stressing that it had been a pleasure to work with him during the last four years. On behalf of all those present he expressed his sincere appreciation for Dr. Zarzycki's efforts and contribution to Commission IV.

Friday, July 25, 1980 from 9.00 to 10.30

Session 8 of Commission IV

(Working Group 2)

Main Topic: Revision and Accuracy of Topographic Maps

Chairman: G.C. Agarwal (India)

- Col. G.C. Agarwal presented M.M. Datta's paper on "Map Revision in Developing Countries".
- J. Leatherdale presented the Specifications for Mapping at Scales between 1:1,000 and 1:10,000 prepared by the Royal Institute of Chartered Surveyors of Great Britain.
- K.J. Lester presented his paper entitled "The Use of Ultra Small Aerial Photography in Medium Scale Mapping and Revision".
- E. Spiess presented his paper entitled "Revision of Topographic Maps: Results of the Fribourg Test by Commission D of the OEEPE".

- *E.A. Fleming* presented her paper entitled "Change Detection by Landsat as Guide to Planning Aerial Photography for Revision Mapping".

#### WG 6 Littoral Mapping

- *R. Brossier* reported on the activity of WG 6, more specifically on the work done in France in coastal mapping.
- *S. Murai* presented his paper entitled "Littoral Mapping from Digitized Oblique Aerial Photograph".

## COMMISSION V

### NON-TOPOGRAPHIC PHOTOGRAMMETRY PHOTOGRAMMETRIE NONTOPOGRAPHIQUE NICHTTOPOGRAPHISCHE PHOTOGRAMMETRIE

President: *Prof. K. Torlegard* (Norway)  
Secretary: *Mr. E.L. Dauphin* (France)

Monday, July 14, 1980, from 15.00 to 16.00  
Session 1 of Commission V

Topic: Business meeting  
Chairman: *Dr. K. Torlegard* (S)

After welcoming the delegates, *Dr. Torlegard* presented some last minute changes to the program. The sessions were outlined, chairmen and secretaries were definitely appointed. Information was also forwarded on how the poster sessions were organized.

The session was adjourned.

Tuesday, July 15, 1980, from 16.00 to 17.30

#### Session 2 of Commission V

Topic: Report on the activities of Commission V and related committees and meetings  
Chairman: *Dr. K. Torlegard* (Sweden)

#### Reports

Author: *Dr. K. Torlegard* (S)  
Title: ISP Commission V Report 1976 – 1980, CR

*Dr. Torlegard* gave a short summary of his report relating a.o. the names, members and activities of the six Working Groups, the participation of Commission V in several international meetings and symposia concerning Close-Range Photogrammetry and publications on this subject.

Author: *Mr. M. Carbonnell* (F)  
Title: Comité International de Photogrammétrie Architecturale (CIPA). Compte rendu d'activité pour la période 1976 – 1980, IP

A report of the activities of the International Committee on Architectural Photogrammetry was given by its President, *Mr. Carbonnell*. He stressed the rapid development in Analytical Photogrammetry and Orthophoto methods now used in this field.

He also noted the need for training and education of users and operators in Architectural Photogrammetry. During this period, as a result from discussions at the Congress 1976, a supplier of photographic emulsions had secured the future availability of glass plates for metric cameras.

Author: *Mr. K. Atkinson* (GB)  
Title: A Bibliography of Non-Topographic Photogrammetry, IP

*Mr. Atkinson* made a brief review over the scope, contents and sources of the bibliography. The primary use for it, he stated, was to serve as a starting point in research. He was also asking for views on the need for a continued work of this kind in Commission V.

Author: *Mr. W. Wester-Ebbinghaus* (FRG)  
Title: Numerische Verfahren für die Architektur-Photogrammetrie, IP

*Mr. Wester-Ebbinghaus* mentioned the areas of possible applications of numerical techniques in Architectural Photogrammetry. He then demonstrated a number of projects which were undertaken with these methods.

*Dr. Bähr* (FRG) commented on the use of digital image processing techniques using procedures developed for remote sensing in Architectural Photogrammetry.

*Dr. Krauss* (A) mentioned that the methods for differential rectification of photos onto surfaces of different forms could be improved in the future.

Author: *Dr. H. Foramitti* (A)  
Title: Rural and Urban Sites in Seismic Areas, IP

*Dr. Foramitti* illustrated his paper with a number of examples of damages to buildings, caused by earthquakes.

*Dr. Kupfer* commented that the analytically derived differential rectifications could be used in this application.

*Dr. Foramitti* stressed the continuous need for manually produced line drawings.

*Dr. Bay* asked whether the technique of Anastylose had been used on these destroyed buildings.

*Dr. Foramitti* explained that Anastylose meant the reconstruction of a destroyed building stone by stone.

It is a very laborious technique and it is almost impossible to perform without the use of Stereo Photogrammetry.

The meeting was adjourned.

Wednesday, July 16, 1980, from 11.00 to 12.30, Hall 4

### Session 3 of Commission V

Main Topic: Dissemination of Information (WG V/4)

Chairman: *J. Badekas* (Greece)

Introduction by the Chairman as to the activities of the WG for the past four years. After considerable effort and time, three main tasks were undertaken by the WG V/4. It was soon realized that the work for the first task, bibliography for close range photogrammetry, was overlapping with the work carried out by *K.B. Atkinson* (UK). The same holds for the second task, compilation of a text book on non-topographic photogrammetry, *S. Karara* (USA) and more recently *K.B. Atkinson* (UK), edited a book each under this title. Special difficulties were reported on the third task, namely the standardization of software, relevant to the Commission V field of interest.

Then five papers were presented, as follows:

1. Authors: *J. Badekas, E. Peppes, E. Stambouloglou* (GR)  
Title: Low Altitude Aerial Photography (Invited Paper)
2. Authors: *G. Lubowski, P. Waldhäusl* (A)  
Title: Ballonphotogrammetrie, PP
3. Author: *K. Kimata* (J)  
Title: The Rope-way Camera System for Archaeological Sites, PP
4. Author: *C. Sena* (I)  
Title: Use of elevation special equipment for terrestrial cameras for particular photogrammetric operations, PP  
  
(Note: This paper replaced the initially scheduled one by *Astori* and *Chia-brondo*)
5. Author: *W. Wester-Ebbinghaus* (FRG)  
Title: Fernlenkflug mit Modellhubschrauber, PP

The presentation of the papers was followed by a discussion. A general question, by *Prof. Oshima* (J), referring to accuracy limitations and cost in general of the various systems described was posed to all the speakers. While the prices quoted differed considerably, the answer to the first part of the question was rather unique, since no computations or any other form of processing were reported. Then a question by *I. Newton* (UK) of wind speed limitation was raised. Again the answers stressed, more or less, the vulnerability of the systems presented.

Prompted by a relevant question, again by *I. Newton* (UK) work with a system of kites in UK was reported by *A. Georgopoulos* (GR). Then work with telescopic masts was also reported from UK by *R.W.A. Dalles*. Then a question was posed to *W. Wester-Ebbinghaus* concerning the camera calibration results he presented. Finally *R. Oelofse* (SA) commented on the change of the camera attitude as the film is wound on.

Wednesday July 16, 1980, from 14.00 to 15.30

### Poster session

Main Topic: CIPA examples

J1 *Wrobel* et al (FRG):

Photogrammetrische Bestandsaufnahmen als Grundlage für die Stadtbildanalyse und Gestaltungssatzung der Altstadt Hamelns. Presentation and discussion, 15 – 20 attending.

K2 *Waldhäusl* (A):

Stereomontagen als Entscheidungshilfe für Hochbauprojekte.

No presentation but reprints and posters were available in the stand.

K3 *Jonasson* (S):

Relief of the spoils on the Arch of Titus. A photogrammetric survey. Presentation and discussion, 10 – 15 attending.

K4 *Vozikis/Jansa* (A):

Photographic Way of Laying out Elliptical Cupolas. Presentation and discussion, 5 – 10 attending.

L1 *Stambouloglou* (GR):

Releve photogrammétrique partiel du théâtre de Dionysos avec simple méthode de réduction pour l'évaluation des images non métriques. Presentation and discussion, 8 – 12 attending.

L2 *Simonkovic* (H):

Komplexe Aufmessung einer mittelalterlichen gotischen Kathedrale. Presentation and discussion, 10 – 15 attending.

L3 *Vojnovic/Marceta* (YO):

Photogrammetrische Meßaufnahme von Skulpturen. Presentation and discussion, 6 – 10 attending.

L4 *Canella* et al (I):

Photogrammetric Survey of the Dome of the Orthodox Baptistery of Ravenna. Presentation and discussion, 15 – 20 attending.

Wednesday, July 16, 1980, from 16.00 to 17.30, Hall 8

### Session 5 of Commission V/VI

Main Topic: Dissemination of Information.  
Computer Programs

Chairman: *J. Badekas* (Greece)

After a brief introduction by the Chairman, mainly to report the changes of the programme of the session, the following papers were presented:

1. Author: *W. Faig* (CDN)

Title: Precision Photogrammetry for Industrial Purposes, presented together with the other scheduled paper by *Hakim* and *Faig* titled: The General Bundle Adjustment Triangulation (GEBAT) System. Theory and Applications, PP

2. Author: *H. Kager* (A)

Title: Das interaktive Programmsystem ORIENT im Einsatz, PP  
(this paper was presented in English)

3. Author: *Papu and A. Perelmutter (Isr)*  
 Title: Free Network Analysis of Storage Tank Calibration, PP  
 (paper presented by Perelmutter)
4. Author:  
 Title: Zehn Jahre Erfahrung mit UMK/1318, PP  
 (presented by G. Benthler)
5. Author: *C. Cundari (I)*  
 Title: La stéréophotogrammétrie pour la connaissance de l'environnement urbaines, PP

No time was left for discussion and the wish was expressed by the Chairman that an opportunity to do so would be presented sometime in the future.

Thursday, July 17, 1980, from 11.00 to 12.30

#### Session 6 of Commission V

- Topic: Analytcs of Close-Range Photogrammetric Systems  
 Chairman: *H.M. Karara (USA)*  
 Reports:  
 Author: *Dr. Karara (USA)*  
 Title: Report on the Activities of ISP WG V-I 1976-1980, WR

Dr. Karara gave a short summary of his report relating the members, areas of interest, symposium and achievements of the commission and the Working Groups.

- Author: *Dr. W. Faig (CDN)*  
 Title: An Exposé on Photographic Data Acquisition Systems in Close-Range Photogrammetry, IP

Following the presentation, there were a short discussion and a question to Dr. Faig.

- Author: *Dr. A. Grün (USA)*  
 Title: Precision and Reliability Aspects in Close-Range Photogrammetry, IP

Dr. Grün made a presentation of his paper.

The discussion that followed touched with suggestions for reliability evaluation, other control types like distancies and the number of control points.

- Author: *Dr. I. Hadem (N)*  
 Title: Bundle Adjustment in Industrial Photogrammetry, PP

- Author: *Mr. P. Hottier (F)*  
 Title: Couple Méthode des Residus Conjugués et Equation d'Observation 'Quasi-Déterminée', PP

Due to time shortage, no discussion followed these papers. The session was adjourned.

Thursday, July 17, 1980, from 14.00 to 15.30

#### Poster session

Main Topic: Calibration

*Adams (ZA)* – The use of non-metric cameras in short range photogrammetry.

Attendance – approx. 10.

*Murai et al. (J)* – Analytical orientation for non-metric cameras in the application to terrestrial photogrammetry

Attendance – 6 Set up in booth G4 instead of I2!

*Zolfaghari (IR)* – A direct method for measurement of coordinates of a three dimensional test field.

Did not turn up.

*Mustuoglu e Aytac (TR)* – Calibration of non-metric cameras from a single photograph – pair of photographs.

Did not turn up.

*Moniwa (CDN)* – The concept of 'photo variant' self calibration and its application in block adjustment with bundles.

Attendance – approx. 10

*Haggren e Vaatainen (SF)* – A comparature study concerning the accuracy of some measuring arrangements frequently need in close range photogrammetry.

Attendance – 5

*Bujakiewicz, Preuso e Wapinski (PL)* – Remarks on the imaging systems of calibration.

Attendance – 10.

Note title of paper, misleading and should read "Remarks on the calibration of imaging systems".

*Altan (TR)* – A comparison between 11 parameter solution and the bundles method at a photogrammetric control survey.

Did not turn up.

Thursday, July 17, 1980, from 16.00 to 17.30

#### Extra Session of Commission V.

- Topic: Analytcs of Close-Range and Terrestrial Photogrammetric Systems  
 Chairman: *H.M. Karara (USA)*

Dr. Karara, Chairman of Working Group V – I opened the session and introduced the author of the first paper.

- Author: *Dr. S.A. Veress (USA)*  
 Title: Contemporary Analytical Solutions in Terrestrial Photogrammetry, IP

*Dr. Veress* discussed a number of applications of terrestrial photogrammetry for deformation measurements. Two examples dealt with long period phenomena, namely the deformation of a retaining wall and a hill slide area both of which were monitored for several years. In both cases fixed camera station were coordinated and occupied with modified astronomic cameras (metric), especially since the object areas do not remain stable.

The third example dealt with the deformation of a steel tower under static and dynamic loads. In this case, a non-metric camera was used with coordinated control being in the object space. Space resection

determined the photo stations, and space intersection the target coordinates as for the other examples. The measurements were taken on an analytical plotter, while all computations were based on the collinearity approach. The required accuracies of a few centimetres were easily reached in all cases.

Discussion: The high accuracy requirements and the use of an analytical plotter were questioned. *Dr. Veress* replied, that the requirements were probably higher than needed. The analytical plotter was used for convenience and time saving, as the approximate target locations were preprogrammed and automatically covered.

Author: *V. Kratky* (CDN)  
Title: From On-Line to Real-Time Solutions in Close-Range Photogrammetry, IP

In this second invited paper of the session, *Dr. Kratky* first emphasized the common points of the two types of solutions, namely a computer connected with a measuring device to collect, process and use photogrammetric information. The typical on-line approach is the analytical plotter where the operator has the opportunity to interact, i.e. choose certain computational models etc.

Since close range applications do not usually follow standard conditions, calibration, constraints and auxiliary information have to be incorporated, possibly in a modular set-up.

Photogrammetry is not usually suited for real-time solutions because of the inherent time lag and the measuring speed. However, *Dr. Kratky* presented two examples, one from biomedicine where human movements were monitored via infrared diodes and photo diodes instead of cameras, and one from dynamic engineering where the movements of a space object were recorded with a video camera. The video images were constantly scanned, and x/y coordinates were instantly computed as was the case for the bio medical project. Thus motions could be plotted with virtually no time lag.

There were no questions after the paper.

Next were two presented papers, both concerned with close range camera calibration.

Author: *C.S. Fraser* (New Zealand)  
(presented by *R. Forrest*, AUS)  
Title: On the Self Calibration of Close-Range Cameras, PP

Author: *H. Salmenperä* (SF)  
Title: A Procedure for Close-Range Camera Calibration, PP

The first paper deals with convergent photography of one object distance with several focal settings, while the second one utilizes a more conventional test field (*Hallert's* approach). Both authors reported of excellent results, even for nonmetric cameras.

Since there was no discussion, the Chairman closed the session at 17.11.

Friday, July 18, 1980, from 9.00 to 10.30

Session 9 of Commission V

Topic: Industrial Photogrammetry  
Chairman: *Dr. K. Linkwitz* (FRG)

*Dr. Linkwitz*, the chairman of the Working group V-5, Industrial Photogrammetry, opened the session by reporting briefly on the activities of the group since its installation on the Inter-Congress Symposium of Commission V in Stockholm in 1978.

#### Invited Papers

Author: *Dr. K. Linkwitz* (FRG)  
Title: Working Group V-5 Report

Next were two invited papers focussing on the limitations and the possible applications of photogrammetry in different industrial branches.

Author: *Dr. M. Dutschke* (FRG)  
Title: Aufgaben und Verfahren der Fertigungsmeßtechnik, IP

Authors: *Dipl.-Math. H. Bopp*, *Dipl.-Ing. H. Krauß* (FRG)

Title: Potentials of Photogrammetry of Industry, IP

By means of a film *Dr. Dutschke* demonstrated impressively the modern high accurate methods of control techniques in mechanical engineering, an industrial branch in which he sees only little chances for a steady use of photogrammetry.

The same impression is withdrawn out of an investigation in different industrial branches by *Dipl.-Ing. H. Krauß* in his presentation. As results of these inquiries, carried out mainly in Germany and France, one can regard photogrammetry being a used or established measuring technique in the areas civil engineering, material behaviour studies, air and space technology. Inferior to other measuring techniques is photogrammetry in the branches mechanical and car industry. A small gap in the market for photogrammetry is seen in mechanical industry in such areas where large components are produced as single pieces or in small series and if these parts have to be controlled in their entire geometry. A new but fast growing market can be seen for under water photogrammetry in the area of off-shore technology in the North-Sea.

#### Presented Papers

Author: *Dr. T. Oshima* (J)  
Title: Recent Development of Industrial Photogrammetry in Japan

*Dr. Oshima* displays the projects using photogrammetric methods in several industrial branches, recently carried out in Japan.

Author: *Dr. B. Wrobel*, *Dipl.-Ing. W. Weise* (FRG)

Title: Deformation Measurement by High-Frequency Photography During Crash Tests of Steel Concrete Plates

In his presentation *Dipl.-Ing. Weise* explains the principles of the used film camera and he summarizes the obtained results.

Finally *Dr. Linkwitz* announces the discussion on the main topic for the session 14 of Commission V.

Friday, July 18, 1980, from 14.00 to 15.30

Session 10 of Commission V

Poster Session

Topic: Industrial Photogrammetry



The following papers were presented:

- Authors: *Mr. M.A.R. Cooper (GB)*  
*Mr. M.R. Shortis (GB)*  
Title: Analytical Photogrammetry Applied to the Measurement of Large Structures.
- Author: *Mr. B. Szczechowski (PL)*  
Title: The Photogrammetric Measurements of the Ship Deformations.
- Authors: *Mr. R. Bakken (N)*  
*Mr. H. Schöler (GDR)*  
Title: The Photogrammetric Measurements of Spherical Tanks.

Monday, July 21, 1980, from 11.00 to 12.30  
Session 12 of Commission V

Topic: Cost-Effectiveness  
Chairman: *J. Wapinski (PL)*

Reports

- Authors: *Prof. J. Wapinski, Dr. A. Bujakiewicz (PL)*  
Title: The Economical and Technical Aspects of Non-Topographical Photogrammetry, WR

The paper was presented by Dr. Bujakiewicz.

- Author: *Mr. W. Cheffins (GB)*  
Title: Non-Topographic Photogrammetry in a Commercial Mapping agency, IP

- Author: *Dr. Z. Sitek (PL)*  
Title: Control Principles of Architectural Documentation Prepared by Photogrammetrical Methods, PP

- Authors: *Mr. R. Ölsson, Mr. R. Larsson (S)*  
Title: Precision of Geodesy versus Photogrammetry in Building Control, PP

After presentation of the above mentioned papers, the discussion was opened.

*Prof. H. Hothmer (FRG)* pointed out that only one paper was dealing with the main topic of the session e.g. with economical problems of Non-Topographical Photogrammetry.

*Prof. Sitek (PL)* explained that not only economical but also technical problems belong to the topic of the session.

*Mr. K. Atkinson (GB)* remarked that it is very difficult to separate Non-Topographical and Topographical applications since both are performed in parallel in Photogrammetrical organisations.

*Dr. Y. I. Abdel-Aziz (Saudi Arabien)* said that in this case pseudoimage co-ordinates derived from horizontal and vertical readings on a theodolite could be used.

At 12.10 the Chairman, Dr. Wapinski, expressed his thanks to authors and all participants and closed the session.

Monday, July 21, 1980, from 14.00 to 15.30  
Session 13 of Commission V

Topic: Cost-Effectiveness.  
Chairman: *Prof. J. Wapinski (Poland)*

The following papers were presented.

- Author: *Prof. L. Homorodi (H)*  
Title: Photogrammetrische Arbeiten für Nicht-Topographische Zwecke in Ungarn, PP

- Author: *Mr. G. Hadjiev (BG)*  
Title: La Photogrammetrie Architecturale dans le domaine de la Preservation de Monuments Historiques en Republique Populaire de Bulgarie, PP

- Authors: *Mr. J. Gala, Mr. K. Rusiecki, Mr. K. Walocha (PL)*  
Title: Contribution of the Photogrammetry on the Restoration of Ancient Architectural Monuments and Sites of the old City, Krakow, PP

The paper was presented by *Dr. J. Jachimski (PL)*

- Author: *Mr. J. Risager-Christensen (DK)*  
Title: Observations of Displacements of a Bridge Loaded to Failure, using Analytical Photogrammetry, PP

The discussion was opened by *Dr. Torlegard (S)* who asked the authors and participants how often 3-dimensional deformations are determined by photogrammetrical methods.

The following participated in the discussion:

*Dr. S. Ghosh (CDN), Mr. Risager-Christensen (DK), Prof. L. Homorodi (H), Mr. O. Brande-Lavridsen (DK), Mr. R. Meyer (GDR), Mr. Otteman (NL).* The participants of the discussion expressed their opinion that mostly only 1- or 2-dimensional deformations are determined by photogrammetrical methods and only sometimes 3-dimensional.

At 15.10 the session was closed by the Chairman who expressed his thanks to the authors of papers and to all participants.

Monday, July 21, 1980, from 16.00 to 17.30  
Session 14 of Commission V

Topic: Industrial Photogrammetry  
Chairman: *Dr. K. Linkwitz (FRG)*

Dr. Linkwitz opens the session and announces the invited paper of Dr. Gates

*Invited Paper*

- Author: *Dr. J. Gates (GB)*  
Title: Non-conventional Measuring Techniques for Industry – Some Recently Developed Optical Measurement Techniques, IP

In his paper Dr. Gates outlines the recent development of optical means to control surfaces or deformations of objects with an accuracy far beyond the limitations of 3-D measuring machines. The obtainable accuracies reach the wavelength of light. In this area these techniques can hardly be replaced by any mechanical means and they can be regarded as either established tools in industry or in future to be applied intensively.

*Presented Papers*

- Author: *Dr. Trunin (SU)*  
Title: Choosing Optimal Variants of Photogrammetric Survey when Solving the

Problems of Rock Mechanics and Mine Surveying

Author: *Dr. S. Veress (USA)*  
Title: Photogrammetry for Dimensional Control of Bridges

After these presentations Dr. Linkwitz opens the discussions:

*Dr. Gates* indicates that up to now the moiré technique still leads to difficulties when used for dynamic control in connection with high speeds.

On the question where the non - conventional techniques are steadily used, *Dr. Gates* replies that the main applications are in the field of non - destructive testing in mechanical engineering and that these techniques are going to play an increasing role in air and space technology. It will obviously be the physicist to develop these techniques but the photogrammetrist should keep them in his eyes to promote them in industry together with the photogrammetric methods.

*Dr. Harley* (AUS) indicates that in Australia there are only few applications of photogrammetry in industry and that it is mainly the University institutes who try to promote this application.

*Dr. Torlegard* (S) remarks that for the close future one should realize a need for actions in two directions:

- one should continue an intensive inquiry in photogrammetric companies and institutes as well as with possible customers in industrial branches. The results should be summarized in such a way, that all sensible applications are listed and described briefly such that non - photogrammetrists could understand it and know when they should contact a specialist.
- The photogrammetrists should study the conventional metrological tools used in industry to get better informations concerning possible potentials of photogrammetry.

*Dr. Abdel-Aziz* (Saudi-Arabia) sees a great problem for intensive use for photogrammetry as long as the photogrammetrists tend to use overdimensioned methods to solve simple measuring problems.

In his closing remarks *Dr. Linkwitz* states that the non - conventional techniques and photogrammetry are useful tools in metrology as long as they cover the area of applications which cannot be filled out by 3-D measuring devices. A strong desire exists in direction to an on-line measuring method with high accuracy. Maybe that a way is already initialized by solid state cameras which might be further developed and thus lead to real-time photogrammetry. The photogrammetrists working in close-range applications should understand their tasks as a challenge and as a steady provocation to overcome the presently used conventional methods by possibly using the wide electronic possibilities of our days for their purpose and thus hopefully opening new applications for photogrammetry in the future.

Wednesday, July 23, 1980, from 9.00 to 10.30

Session 15 of Commission V  
(Working Group 3)

Topic: Non Conventional Techniques  
Chairman: *Dr. J.W.C. Gates* (Great Britain)

*Prof. K. Torlegard* introduced the Chairman, *Dr. Gates*, and congratulated him on his appointment as the new President of Commission V. *Prof. Torlegard* gave a brief description of *Dr. Gates'* career which had proceeded from photogrammetry to applied optics and investigations of non-photographic optical metrology.

*Working Group Papers*

Author: *Dr. J.W.C. Gates (GB)*  
Title: Report of Working Group V (Vol V P 228)

*Dr. Gates* stressed the healthy outward-looking attitude of the Group, and its connection with Groups from other commissions. He described important contacts with commission 6 of F.I.G. the lively symposium in Stockholm had been well attended. Its theme Photogrammetry for Industry had attracted several papers connected with WG 3. He also mentioned several other symposia at which the group had been represented.

Author: *Prof. R.J. Pryputniewicz (USA)*  
Title: State of the art in hologrammetry and related fields (Vol V. P 620), IP

The author gave an enthusiastic indication of the possibilities of evaluation in holographic measurement, as well as a brief description of the basic technique of forming the holograms. In answer to a question he said that he had only recorded objects of 15 cm in diameter, but he knew of a case where the object had been 1 m in diameter.

Author: *S.K. Ghosh (CDN)*  
Title: Future possibilities of precision mapping with electron microscopy (Vol V. P 244), IP

*Prof. Ghosh* summarized the methods he used on TEM and SEM to obtain measurements in three dimensions to the order of  $\pm 20$  nm. He then went on to describe further work done since his report in Stockholm, 1978.

Author: *Prof. O. Jacobi (DK)*  
Title: Photogrammetric tracking of a moving particle in running water (Vol V.P. 368), PP

The author described the tracking of a particle at discrete points using stroboscopic illumination. He said that the water/glass/air medium had presented the usual problems but claimed an absolute accuracy of  $\pm 0.2$  mm. The paper attracted some lively discussion as it appeared that several people had attempted similar measurement.

In the general discussion which followed, *Prof. Ghosh* described his method of calibration of a photographic SEM system. *Prof. Adams* described a technique of stereoscopic measurement of free water surfaces using emulsifying oil and a projected pattern.

*Dr. Gates* closed the session, reminding delegates that there was a paper being circulated entitled "Photogrammetric Deformation Measurement of Rubber tendes during a Ship Docking" from the Wuhan College of Geodesy.

Wednesday, July 23, 1980, from 14.00 to 15.30

### Session 16 of Commission V

#### Poster session

Main Topic: X-ray and SEM

The following papers were presented:

Authors: *Mr. Florek, Mr. Mierzra (PL)*  
Title: Stereomeasurement of SEM Micrography.

Authors: *Mr. M. Kureya, Mr. A. Oosaki (J)*  
Title: Trial to determine the coordinates in X-ray Stereophotography using several targets.

Authors: *Mr. P.J. Scott (GB)*  
*Mr. Y.I. Abdel-Aziz (Saudi Arabia)*  
Title: The Reflex Plotter: A Plotter without Photographs.

Wednesday, July 23, 1980, from 16.00 to 17.30

### Session 17 of Commission V (Working Group 3)

Topic: Non-Conventional Techniques  
Chairman: *J.W.C. Gates (Great Britain)*

This was a continuation of the session held at 9.00 of the same day.

Author: *R.J. Pryputniewicz (USA)*  
Title: Holographic numerical analysis in biostereometrics (Vol V, P 630), PP

The author described a project to measure load deformations of human teeth without touching the teeth themselves. He used a double-exposure hologram created by a pulsed laser.

Author: *Dr. B. Drerup (FRG)*  
Title: A procedure for the numerical analysis of moiré topograms (Vol V, P 165), PP

The author described an experiment on a plaster model whereby he had used moiré fringes to create a three dimensional mathematical model.

Author: *Mr. M. van Wijk (CDN)*  
Title: Moiré contourgraph — an accuracy analysis, PP

This paper covered the same field as the previous paper, but concerned itself with screening of live humans for evidence of scoliosis. The instrument was described and results were compared with stereophotogrammetric contours from simultaneous photographs.

The paper generated some discussion on accuracy and difficulty in judging the centre of the fringes.

Authors: *Layton, Smith + Cox (AUS)*  
Title: The application of photogrammetry to quantitative microscopy (Vol V, P 464), PP

The paper was presented by *Prof. J. Trinder*. A description was given of different techniques used to get stereoscopic photographs, and very high accuracy was claimed in the results (toward 1 µm). The main spheres of interest were in measurement of

surface texture of sand particles, and shape of diamond indentations.

Thursday, July 24, 1980, from 9.00 to 10.30

### Session 18 of Commission V

#### Working Group V-6

Main Topic: Biostereometrics  
Chairman: *Dr. R.E. Herron (USA)*

Dr. Herron opened the Session with a report of the Working Group (V-6) activities during the period 1976-1980. The major focus was on the successful meeting in Paris, on Applications of Human Biostereometrics which attracted 50 papers and 150 participants. He announced that the proceedings were recently published by the Society of Photo-optical Instrumentation Engineers. Other pertinent publications were mentioned along with the growing diversity of biostereometric research interests.

The papers were presented as originally planned and as indicated in the program:

Author: *Dr. F. Lippert (USA)*  
Title: A Comparison Between Convergent and Bi-Plane X-Ray Photogrammetry Systems used for Detect Joint Lossening. (Invited Paper)

Author: *Prof. J.P. Duncan (CDN)*  
Title: Pericentourgraphy (Invited Paper)

Authors: *Drs. T. Takamoto and B. Schwartz (USA)*

Title: Photogrammetric Measurement of the Optic Disc Cup in Glaucoma, PP

Authors: *Dr. E. Hierholzer and W. Frobin*  
Title: Methods of Evaluation and Analysis of Rasterstereographic Surface Measurements, PP

Following Dr. Lippert's paper, *Dr. Herman Woltring (NL)* asked the question: "Can you clarify why the Cleveland System is easier to calibrate than the Seattle System?" Dr. Lippert replied that: "The Cleveland System takes advantages of stronger geometry of orthogonal system, therefore fewer points need to be measured. The axes are located on the calibration plates and are thus alignable visually on the x-y light table. The Seattle System requires measurement of more points because of a need to overmeasure.

*Dr. Herron* asked *Dr. Hierholzer* if the new instrument which he recently developed is available commercially. Dr. Hierholzer explained that the complete system is not available commercially but the major components may be acquired "off-the-shelf". There being no further questions, the session was adjourned.

*Report of Working Group V/6 — Prof. R.E. Herron (USA)*

A working group on biostereometrics was formed according to Resolution 6 of Commission V at the Helsinki ISP Congress, 1976. The purpose of this working group, as expressed in the terms of the resolution, was:

" . . . to encompass the application of photogrammetry to the study of living structures and

processes in biomedical and non-biomedical fields such as botany, entomology, etc."

In addition to the successful symposium which was held in Paris in July 1978, growing interest in biostereometrics was demonstrated through a wide variety of publications in such fields as orthopedics, ophthalmology, orthodontics, pediatrics, dentistry, biomechanics, psycholinguistics, aerospace medicine and transportation safety.

Two recent books on close-range photogrammetry contain chapters which embrace the field of biostereometrics. The first, edited by *Dr. Sam Karara* for the American Society of Photogrammetry, includes a chapter written by myself; the second, edited by *K.B. Atkinson* and published by Applied Science Publications, England, includes a chapter by *Ian Newton* on medical photogrammetry.

A meeting on the subject of Teratological research and rehabilitation held at the Westfälische Wilhelms-Universität Münster in March 1979 also addressed several topics in biostereometrics.

The main activity of Working Group V-6 focussed on the Symposium entitled "Applications of Human Biostereometrics" which was sponsored by the Scientific Affairs Division of NATO in co-operation with several other organizations. The meeting was hosted by the René Descartes University of Paris in July, 1978. *Professor Alex Coblenz* and I had the privilege of serving as co-chairmen and co-editors of the proceedings.

The symposium was attended by approximately 150 individuals from 20 countries. Over 50 papers were presented at 12 sessions which covered: developments in materials and techniques; art; biomathematics; biomechanics; stereometric radiography; the brain; ophthalmology; trunk and whole body form; cranio-facial growth and physical anthropology.

The proceedings which contain a complete text of 50 papers have just been published by the Society of Photo-Optical Instrumentation Engineers, Bellingham, Washington. If you are interested in obtaining a copy, please write to SPIE directly or let me know and I will pass your order along to them.

During the last four years, biostereometrics has reached a level of activity which has outgrown the need for a Commission V Working Group. As a more appropriate vehicle for communication, we propose the formation of an International Biostereometrics Society which will operate initially as a corresponding group. We are especially interested in obtaining the services of national representatives. All those who are interested in assuming this responsibility please let me know at this meeting or write to me at:

Institute for Biomedical Engineering Research,  
226 Auburn Science and Engineering Center, University of Akron, Akron, Ohio 44325.

Let me conclude by saying that I have greatly enjoyed my role as chairman of this working group and I wish to thank the many individuals who helped make our activities both interesting and productive. I hope you will continue your efforts to further develop the exciting field of biostereometrics in the future.

Thursday, July 24, 1980, from 11.00 to 12.30

### Session 19 of Commission V

Main Topic: Biostereometrics  
Chairman: *Dr. R.E. Herron* (USA)

*Professor P. Burke* (GB) presented the invited paper on the topic "Serial Biostereometric Analysis of Growth Changes in the Face from Birth to Ten Years of Age".

*Dr. Herron* noted that the work described by *Prof. Burke* represents a landmark contribution to the field of human biology.

The remaining papers were presented as listed in the program (with the exception noted below):

Author: *Mr. J. Jaakkola* (SF)  
Title: Measurement of the Human Face Using a Projected Grind, PP

Author: *Mr. A. Östman* (S)  
Title: Treatment of Anthropometric Data for the Design of Children's Glasses, PP

Author: *Dr. B. Savara u. G. Gross* (USA)  
Title: Craniofacial Syndromes by Use of Biostereometrics, PP

Author: *Dr. H. Woltring* (NL)  
Title: Biostereometrics in Optoelectronic Gait Measurement, PP

Author: *Mr. H.J. Hellmeier* (FRG)  
Title: Photogrammetrische Bewegungsanalyse mittels Bandabsorptionstechnik, PP

All the papers were presented by their first or sole authors, except that *Mr. Gross* read the paper on behalf of *Dr. Savara* and himself. Questions were limited due to the lack of time.

*Dr. Herron* concluded the session by thanking the authors for their contributions and for their cooperations in trying to fit the available time constraints. He also urged the participants to work with Commission V in their combining efforts to unprove communications between all those interested in the growing and exciting field of biostereometrics. He thanked the audience for their kind attention and the meeting was adjourned.

Thursday, 24 July, 1980, from 14.00 to 15.30

### Session 20 of Commission V

Topic: Business meeting  
Chairman: *Dr. K. Torlegard* (Sweden)

*Dr. Torlegard* related discussions on the name of the Commission. He said that it was agreed in the resolutions committee that the name should be "Non-Topographical Photogrammetry and Close-Range Sensing." He then proceeded to relate the different resolutions that had been prepared by the resolutions committee.

Resolution: Photogrammetry and related disciplines.

*Dr. Badekas* asked if the work of CIPA was to be duplicated.

*Dr. Torlegard* said that this was not the intention.  
*Dr. Oshima* stressed the importance of the resolution.  
Decision: The resolution was approved.  
Resolution: Off-Shore and Industrial Photogrammetry

*Dr. Oshima* asked how this resolution was related to the Underwater WG in Commission I.  
*Dr. Torlegard* said that Underwater Photogrammetry is already a part of Commission V and that future interference with Commission I can be avoided.  
Decision: The resolution was approved.

Resolution: Optical metrology and general sensing.  
There followed a longer discussion regarding the terms used in the resolution.

Decisions: The title of the resolution was approved. The resolution was approved.

Resolution: Analytics of Non-Topographic Photogrammetry

There were questions regarding what parameters that should be optimised, and if also technical and economical aspects should be included.

Decision: The resolution was approved.

Resolution: Low Altitude Aerial Photography.

There was no discussion.

Decision: The Resolution was approved.

*Dr. Torlegard* informed that the papers that had arrived under the Congress were to be printed as Volume 11 of the Archives 1980.

The Bibliography of Close-Range Photogrammetry printed in Volume B6 should possibly be available to a reduced price. No decision thereof had been taken yet, though.

Those interested in Commission V work for 1984–1988 were USSR, Greece and Australia.

*Dr. Herron* asked if there were to be any organisation of SEM and TEM work during the next period.

*Dr. Gates* answered that it was his intention to have a session on this topic in the coming Symposium.

*Dr. Torlegard* finally directed a thank you to all those who had taken part in the Commission V work during the period 1976 – 1980. He also directed greetings and thanks to the secretary of the Commission, *Mr. E. Dauphin*, who unfortunately could not be present at the Congress 1980.

*Dr. Torlegard* congratulated the new commission chairman and secretary, *Dr. J. Gates* and *Mr. K. Atkinson*.

*Dr. Gates* directed a thanks to *Dr. Torlegard* for the chairmanship during the last four years.

## COMMISSION VI

ECONOMIC, PROFESSIONAL AND EDUCATIONAL ASPECTS OF PHOTOGRAMMETRY

ASPECTS ECONOMIQUES, PROFESSIONNELS ET PEDAGOGIQUES DE LA PHOTOGRAMMETRIE

WIRTSCHAFTLICHE, BERUFLICHE UND LEHR-TECHNISCHE GESICHTSPUNKTE DER PHOTOGRAMMETRIE

President: *Dr. H.Z. Sitek* (Poland)  
Secretary: *Dr. J. Jachimski* (Poland)

Wednesday, July 16, 1980, from 9.00 to 10.30

### Session 1 of Commission VI

Topic: Information Dissemination  
Chairman: *A. Linsenbarth* (Poland)

Chairman *Linsenbarth* opened the session by giving the agenda for the meeting, and requesting the invited speakers to join him at the head table. *Dr. P. Wolf* (USA) was also requested to join the speakers at the head table and to act as secretary for the session.

*Dr. Z. Sitek* (PL), President of Commission VI was the first speaker. He summarized the activities of Commission VI at the 1976 Helsinki ISP Congress, and discussed the work of the seven working groups of the Commission during the period 1976–1980. In his paper, published on pages 185 through 195 of Book B6 of the Congress Proceedings, *Dr. Sitek*

explained that the principal areas of concentration of Commission VI during the period 1976–1980 have been in a) Photogrammetric Education and Research in Developing Countries; b) The History of Photogrammetry; c) The Development of a trilingual Glossary of Photogrammetry Terms; d) Bibliographies in Photogrammetry and the Dissemination of Information; e) Planning, Economy and Professional Aspects; and f) Photogrammetric and Remote Sensing Periodicals.

*Dr. Sitek* also discussed the very successful Commission VI Symposium held in Krakow, Poland in 1978. He showed a series of slides of the symposium location, participants, and activities being conducted during the Symposium.

The second speaker on the program was *Mr. J. Ten Haken* (NL) who discussed Automated Storage and Retrieval Systems for Photogrammetry and Remote Sensing. This was followed by a presentation by *Mr. K. Clayton* (GB) who discussed Geo Abstracts for Remote Sensing, Photogrammetry and Cartography.

Following these presentations a Panel discussion was held during which questions were asked of the speakers concerning their topics. Questions concerned mechanisms and costs connected with the Automated Storage and Retrieval Systems, and with the Geo Abstracts. *Professor A. Brandenberger* (CDN) suggested that the United Nations might be a source of funding for these mechanisms.

*Professor J. Hothmer* (FRG) expressed some concern about the magnitude of materials to be read in the proposed systems for Information Dissemination and suggested ways of reducing the amount. *Professor P. Wolf* (USA) discussed the importance of these

Information Dissemination programs as a means of assisting Photogrammetry and Remote Sensing Researchers worldwide. Dr. Wolf also recommended that Commission VI develop a set of International Photogrammetry and Remote Sensing symbols and notations to foster more concise communication among the people of the many nations engaged in Photogrammetry and Remote Sensing Research. *Professor A. Brandenberger* (CDN) suggested authors prepare abstracts for their research papers to be published in the Geo Abstracts. *Professor K. Atkinson* (GB) suggested that the already established Geo Abstracts Publication at the University of East Anglia in Norwich, England continue as the official publishers of Photogrammetry and Remote Sensing Abstracts.

*Professor A. Linsenbarth* (PL) gave some summarizing remarks for the session. Then *Dr. Z. Sitek* made some closing remarks and called for a meeting of the Commission VI Resolutions Committee to follow the Monday, July 21 session. *Dr. A. Linsenbarth* (PL) declared the session closed at 10:30, and thanked all speakers and participants in the meeting.

Monday, July 21, 1980, from 16.00 to 17.30

#### Session 2 of Commission VI

Chairman: *Dr. S.K. Ghosh* (Canada)

Topic: Terminology, Economic Aspects and History of Photogrammetry and Remote Sensing.

Prof. S.K. Ghosh (CDN), chairman of Working Group VI/2, opened the session and introduced all speakers.

*P.W. Wolf* (Professor, University of Wisconsin, USA) reported on "Tri-lingual glossary of Photogrammetry Terms". He presented the report concerning information about activities of Working Group 3 of Commission VI during the period from 1976-1980. A draft version of definitions of common photogrammetry terms which have been the result of this work has been attached to his invited paper. This draft was intended to serve as the basis for developing the final version of the Photogrammetry part of the ISP Tri-Lingual Glossary of Terms.

With reference to this report *J. Hothmer* (next President of Commission VI) invited colleagues to participate in this work which Prof. Wolf has started.

*S.K. Ghosh* (Professor of Laval University, Quebec, Canada) gave in his invited paper (Report of Working Group 5) a "General Report on the planning, economy and professional aspects of photogrammetry in the world". He submitted that in most countries, the topographic mapping is done by public organizations, in which planning, economy and professional aspects are controlled under the framework of their general economic plans. Performance/accuracy seems to be considered as the most important factor of effectiveness.

*A.J. Brandenberger* (Professor of Laval University, Quebec, Canada) discussed on the costs spent for preparation of the thematic maps in Canada by using of remote sensing methods.

*G.C. Agarwal* (Director, Survey of India, Dehradun, India) reported on "Concepts of Planning for Mapping in a Developing Country". He discussed information concerning the perspective-constraints and possible solutions with particular relevance to a developing country. He confirmed that a planning for national mapping needs is a complex exercise particularly for developing countries and mapping needs can be met with the use of appropriate modern technology if they are properly planned.

The report of activities of Working Group 2 Commission VI on "Photogrammetry - historical review of methods and instruments" have been prepared by *Dr. T. Blachut*, the chairman of this group. Because of the author's absence Prof. Z. Sitek - President of Commission VI - summarized this report. He informed that the publication of the historical review of photogrammetry is being prepared. It is being prepared by 11 authors and concerns different applications of photogrammetry. With reference to this report *Prof. Badekas* (Greece) mentioned that in XIII Congress in Helsinki was told that the history of Photogrammetry should not be concerned with the current times but consider only first one hundred years of photogrammetry.

*K.B. Atkinson* (Senior Lecturer of University of London, U.K.) introduced a publication on "F.V. Thompson 1880-1917, a pioneer of Photogrammetry".

The session was closed at 17.30 hours.

Wednesday, July 23, 1980, from 16.00 to 17.30

#### Session 3 of Commission VI

Topic: Research and Education in Remote Sensing and Photogrammetry

Chairman: *Z. Sitek* (Poiand)

Chairman Sitek opened the session by giving the agenda for the meeting.

*Prof. A. J. Brandenberger* (Laval University) delivered the Invited Paper "Activity report of ISP WG VI-1, period 1976-1980".

Then Prof. Sitek introduced to the audience the new Commission VI President - *Prof. Dr. J. Hothmer* (FRG) who announced a possible creation of four working groups connected with education and research. The new President invited all interested in the commission VI activities to cooperate as members with the chairmen of working groups.

The following presented papers were delivered:

*A. Adamec, G. Ellis* (AUS): "Remote Sensing: The Problems involved in Designing Suitable Courses."

Speaker - Mr. A. Adamec, head of the Division of Photogrammetry at the Royal Melbourne Institute of Technology

*O. Brande-Lavridsen* (Photogram. Lab. Alborg University Centre, DK) "Problems? The Alborg University Centre Model of Problem Oriented, Project Organized Studies"

*J.A.R. Blais, E.J. Krakivsky* (CDN) "A New University Centre of Surveying in Canada", presented by D.R. Blais, Professor of The University of Calgary, Canada.

*D.K. Rokos* (Senior Lecturer, Photogr. Lab. National Techn. University of Athens, Greece) "Photogrammetry and Remote Sensing Education and Research in Greece and Cyprus" summarized by Prof. Brandenberger (CDN)

*Prof. H. Bonneval* (F) "Education and Research in France, French speaking Switzerland and African Francophone Countries"

In the discussion which followed the presentations *Dr. Ihemadu* (Nigeria) asked *Mr. Brande-Lavridsen* how they can judge the quality of students when they do not use marks. The answer was, that they still know the students as they have to pass the examination, "most of us do not believe in marks at any rate", he stated. Then *Mrs. J. Drummond* (GB) asked if the Diplomas of Alborg University are recognized. The answer was yes, after three years of practice they have full rights.

Then *Prof. Hothmer* asked *Prof. Blais* why the presented slides vary from the tables printed in the proceedings. The answer was, that they presented the newest data, which have not been available half a year ago, when he wrote the paper. Then *Prof. Wolf* (USA) asked *Prof. Blais* if they have official guidelines for teaching programs and if their programs follow such guidelines. The answer was that Eng. Faculty Council at the University has approved programs and that the National Association of Engineers always agree with the decisions of University Council; they follow the guidelines, but they are free to change the details. Then *Dr. Ihemadu* (Nigeria) asked *Mr. Bonneval* (F) if he is aware of existence of bilingual Regional Centre for Training in Aerial Surveys in ILE-IFE, Nigeria and of cooperation among African Countries. At the end of this session Prof. Sitek, the chairman announced, that two presented papers which were to be delivered on this session are transferred to the next session due to the lack of time. On this the session was closed.

Thursday, July 24, 1980, from 11.00 to 12.30

#### Session 4 of Commission VI

Topic: Photogrammetric Education for Non-Photogrammetrists

Chairman: *A.J. Brandenberger* (Canada)

The chairman of the session opened the meeting and gave detailed accounts of the program of the session.

There were three invited papers and three presented papers.

1. Author: *H. Ferschke* (FRG)

Title: Minimum and Maximum Program of Photogrammetric Education for Cartographers

2. Authors: *Z. Sitek, J. Jachimski, W. Mierzwa* (PL)

Title: Minimum and Maximum Program of Photogrammetric Education for Surveyors

In the following discussion *Prof. Badekas* from Greece asked *J. Jachimski* about purpose teaching of photogrammetry for mining students at University of Mining and Metallurgy in Cracow. He got the

reply from *Dr. Jachimski*. Next *Prof. Visser* (NL) asked about program of teaching in the Polish Technical University.

*Dr. Jachimski* answered to the questions.

With regard to *Prof. Ferschke's* paper *Prof. Brandenberger* suggested that photogrammetry teaching for cartographers should be increased.

*Prof. Wolf* (USA) presented some comments to *J. Jachimski's* paper.

3. Author: *T.M. Erez* (ISR)

Title: Photogrammetric Course Curriculae – Developed Countries

*Dr. Ihemadu* (Nigeria), *Prof. Wolf* (USA) and *Mr. Adebekun* (Nigeria) commented on *Dr. Erez's* paper. *Prof. Hothmer* recommended better use of bibliography.

4. Author: *Dr. Ghosh* (CDN)

Title: Status of Activities in Photogrammetry at Academic Institutions in the USA (presented paper)

5. Author: *Hoschtitzky* (NL)

Title: A Survey of Education and Research in Photogrammetry

6. Author: *Dr. S.O. Ihemadu* (Nigeria)

Title: The Regional Centre for Training in Aerial Surveys.

*Prof. Cundari* (I) suggested that emphasis should begin on teaching geometry principles for architectural photogrammetry.

The chairman, *Prof. Brandenberger* expressed his thanks to all participants.

Friday, July 25, 1980, 11.00, Hall 4

#### Session 5 of Commission VI

Topic: Photogrammetric Education in Developing Countries and Photogrammetric Periodicals

Chairman: *J. Jachimski* (Poland)

#### Program

1. *P.O. Fagerholm* (S): "Optimum Photogrammetric Education in Developing Nations".

2. *M.M. Datta* (IND): "Photogrammetric Education in Curriculae in Developing Countries", IP. Presented by *Col. Agarwal* (IND).

3. *H. Hothmer* (FRG): "Regional International Periodical (RIP) on Photogrammetry and Remote Sensing".

#### Discussion

Concerning paper 1:

*Brandenberger* (CAN) recommends that higher level institutions in developed countries should include in their surveying and mapping programs at least one course which deals with surveying and mapping problems in developing countries so that those who will later become experts (UN, FAO, etc.) in developing countries will be sufficiently qualified.

*Fagerholm* (S): There is such a course in the Stockholm University program.

Concerning paper 2:

*S.O. Ihemadu* (Nigeria): A broad base is wanted for the personnel. In photogrammetric courses also subjects such as photointerpretation, aerial photography, should be introduced.

*Agarwal*: The broad base is present in the program.

Concerning paper 3:

*Hothmer* (FRG): Why read the papers during the session instead of using the time for discussion?

*Ackermann*: Sessions are also for slides and projector use.

*Prof. H. Hothmer*, President of Commission VI for the period 1980–84, gives some ideas about the work to be done.

There are several tasks, for instance:

Education: An extra working group seems necessary to study and use the collected information.

A multilingual dictionary is wanted in several languages. Standards for professional levels have to be made.

The Federal Republic of Germany has hosted as yet many symposia and this congress. The incoming President considers the possibility of holding the midterm symposium (1982) in another country, preferably in a developing country.

*J. Jachimsky* thanks *Prof. Sitek* for his activities as President of Commission VI and congratulates the new Commission President *Prof. Hothmer* and wishes him and all the colleagues who are active in Commission VI success in preparing material for the next congress.

### Business Meeting

*Prof. Z. Sitek*, the outgoing President of Commission VI, opened the meeting and presented the following agenda:

- Presentation of proposals for ISP Commission VI resolutions,
- Considerations for the term 1980–84 activities.

Secretary of Commission VI, *Dr. Jachimski*, read the text of the resolutions prepared by the resolution committee.

Remarks on resolutions were given by:

*Prof. Brandenberger* (CDN):

He makes some complementary remarks on the surveying and mapping data bank located in the Department of Photogrammetry, Laval University, Quebec, Canada. This data bank also includes extensive information on photogrammetric and remote sensing education and research programs; and also economic data on photogrammetric work.

*Mr. v.d. Veer*:

I understood that the writing of "History of Photogrammetry" was progressing under the chairmanship of Mr. Blachut. How far in fact is the work done?

*Prof. Sitek* answered that most chapters are written, but translations have to be made. The main problem is the financial part.

*Prof. C. Cundari* (I):

On propose, pour parvenir en manière plus simple à la diffusion de la méthode photogrammétrique et de sa technique, de favoriser le développement de ses relations interdisciplinaires et la diffusion de

l'apprentissage des problèmes fondamentaux aussi dans l'espace des matières géométriques. Dans cette matière il serait possible de parvenir à une diffuse connaissance (à niveau élémentaire) des caractéristiques géométriques du stéréogramme et des procédiments d'utilisation géométrique et graphique de même; depuis, il serait plus simple de parvenir à la formation de spécialistes en quelconque secteur d'application de la photogrammétrie avec des enseignants spécifiques.

*C.D. Burnside* (UK):

He asked the following question:

"Have any definite plans been made to introduce international periodicals for any areas? Would it perhaps be a good idea to commence with the introduction of just one journal, in an area of the world where it was most needed?"

Then *Prof. Hothmer*, the incoming Commission VI President, presented his considerations about Commission VI activities in the period 1980–84.

### O. Basic considerations

"The Technical Commissions are responsible for the scientific work of the Society" (Statute ISP, paragraph 10). Scientific work may be considered to comprise all activities leading to well founded knowledge based on research, education and literature. Whereas other ISP-Commissions concentrate on research, Commission VI covers the educational portion of the definition. In addition, it is felt Commission VI has quite a strong servicing component and, thereby, assists other Commissions regarding literature. The economic and professional portion within the tasks of Commission VI can be considered as belonging to research and/or servicing ISP.

#### 1. Educational and research facilities

Education and research are an investment into the future, and the well being of any scientific field depends on appropriate facilities. An earth-wide inventory of educational and research facilities for photogrammetry and remote sensing can be considered as a barometer to forecast one aspect in the behaviour of our Society. ISP owes gratitude to *Prof. Brandenberger* for having compiled this inventory. He should be asked to continuously update the inventory.

#### 2. Stimulation of education

A working group should concentrate on drawing conclusions from the inventory, and should stimulate education and research on photogrammetry and/or remote sensing wheresoever feasible. Monetary and personnel resources should be listed for advising institutions. Requirements for guest professorships should be explored. Partnerships between universities should be made available.

#### 3. Curricula for developing nations

Professors are individualists and educational conditions vary from country to country. As a consequence, a standard curriculum can not be established. Instead, a working group should compile a collection of curricula on photogrammetry and remote sensing as published or available so far. This collection should be made available to anybody so requesting.



#### 4. History of photogrammetry

The most valuable undertaking of publishing the history, as edited by *Dr. Blachut*, should obviously have fullest support of Commission VI.

#### 5. Terminology

Terminology has a considerable effect within ISP. Some multilingual glossaries are being compiled, whereas others do exist as yet. ISP should concentrate on combining these multiple efforts by preparing a multilingual glossary with terms in about ten languages and definition of terms in at least three languages. This undertaking should be done in co-operation with Sister Societies, and according to relevant recommendations of the International Organisation for Standardisation.

#### 6. Bibliography

Our era demands for at least three requirements for a successful bibliography:

- a) Availability of a reliable, comprehensive and updated bibliography somewhere;
- b) Easy access to this bibliography for anybody;
- c) The text of bibliographies must be available in more than one language.

A computerized system, supplying translations automatically, could be the answer. Users send requests on a postcard and get outprints.

#### 7. Economic considerations for planning

A working group, chaired by a colleague having long years of practical experience with economic aspects and planning, should collect and combine all available material, both practical and academic, with the intention to assist decision makers in member countries of ISP.

#### 8. Professional aspects

In several countries, our profession is not adequately recognized according to its capabilities for contri-

buting towards the welfare of people. A working group should counteract this evolution by elaborating an appropriate strategy, and by collecting data for backing colleagues in these countries.

#### 9. Technical assistance for developing nations

Colleagues in some countries engage themselves for years for achieving a project from United Nations Development Program, however, sometimes all these efforts are in vain as they are not sufficiently familiar with pertaining policies and procedures. A working group should prepare relevant information on this subject to the benefit of colleagues in developing nations.

#### 10. Regional International Periodicals

A working group should stimulate implementation of Regional International Periodicals on Photogrammetry and Remote Sensing in some geographic regions with the objectives to

- facilitate access to progress through reducing the number of existing periodicals in industrialized countries;
- provide developing nations with their own forum to actively participate and contribute towards progress.

#### 11. Co-operation between ISP and ICA regarding topography and automation

The subject should be covered by Commission IV, ISP.

#### 12. Symposium 1982

Whenever the General Assembly ISP should entrust the Federal Republic of Germany with the responsibility for Commission VI for the term 1980–84, consideration should be given to hold the mid-term symposium in a country not having hosted as yet any symposium or ISP-Congress.

## Commission VII

### INTERPRETATION OF DATA

### INTERPRETATION DES INFORMATIONS

### INTERPRETATION DER INFORMATIONEN

President: *Prof. Dr. G. Hildebrandt* (Fed. Rep. Germany)

Secretary: *Dipl.-Phys. H.J. Boehnel* (Fed. Rep. Germany)

Monday, July 14, 1980, from 15.00 to 17.00

Session 1 of Commission VII  
(Working Group VII/1)

Topic: Natural Land Resources

Chairman: *J.J. Ulliman* (USA)

#### Presented Papers:

Five papers were presented, mainly on the use of satellite remote sensing and specifically LANDSAT imagery, for natural resources in Australia, Argentina, Poland, Brazil and Sweden.

*J.A. Szorenyi* (AUS) of the Western Australian Institute of Technology Perth presented: Remote Sensing Research in Western Australia.

*A.B. Viola, C.M. Viola Binaghi* (RA): Satellite LANDSAT-Skylab. Evaluation of Selected Natural Resources of the Argentine Republic.

*J. Konieczny, A. Linsenbarth* (PL): Development and Application of Remote Sensing in Poland.

*C.M.R. Carneiro* (BR): Planimetric and Thematic Mapping Potential of LANDSAT MSS Imagery for Integrated Survey of South Brazilian Natural Resources.

*S. Zenker* (S): Operational Use of Satellite Imagery — are we there yet?

The Papers presented practical application of the use of remote sensing imagery, including the last paper which asked the significant question whether spacecraft imagery is really operational yet. The question was answered in the positive.

### Discussion.

There was one and a half hour discussion period after all the papers were given. Interesting questions were asked about many subjects; e.g.

a. The quality and resolution of salute imagery — a paper will be presented on this subject later in the Congress.

b. Whether there was any difference between combined LANDSAT-MSS bands 4,5,6 and 4,5,7; *Mr. Viola* stated there is a difference for his purposes.

c. How good is LANDSAT for sea depth determination; one comment was that 11 meter depth difference could be determined.

d. How was interpretation accuracy determined; *Mr. Viola* said he used the system developed by *Dr. R. Colwell's* group at the University of California. The accuracy gained from LANDSAT was better than anything they had before.

This last question should be asked of every project and a statement made on the finished product of what accuracy can be expected. One other comment was made about an image analyse system which would soon be available for DM 80.000.

Monday, July 14, 1980, from 15.00 to 16.30

Session 2 of Commission VIII (Working Group VII/2)

Topic: Vegetation Damage  
Chairmen: *Dr. C.M. Girard* (France)  
*Prof. Dr. P.A. Murtha* (Canada)

The contributions of this session reported on a joint research project by Italian and German scientists as well as the Joint Research Center (JCR) of the European Community. The spectral signatures of healthy and diseased sugar-beet fields were examined using laboratory methods, in-situ measurements with Eg+G spectro-radiometer and spectralradiometrical measurements with an 11-channel scanner from an aeroplane. Included were fields from different appearance of diseased forms.

The report series came under the title: "Differences in the Spectral Characteristics of Healthy and Diseased Crops for Sugar Beets" and was presented by

*A. Berg* (I): Remote Sensing techniques applied to sugar beet diseases in Germany and Italy; Introduction to the results of a European project.

*E. Sanwald* (FRG): Spectrophotometry measurements in the Laboratory and ground truth data collection.

The contribution on the same subject by *C. de Carolis* et al. was read only by title in the authors' absence (Proceedings B10 pp.486).

The following discussion dealt with questions on the measuring methods and gave extra information on the causes of damage or disease of the measured fields.

Tuesday, July 15, 1980, from 9.00 to 10.30

Session 3 of Commission VII (Working Group VII/2)

Chairmen: *Dr. C. Girard* (France)  
*Dr. P.A. Murtha* (Canada)

During the session contributions on questions of detection and identification of damages in agricultural cultivations and pastures were presented and discussed.

*H.E. Nilson* (S): Application of remote sensing methods at macroscopic and mircroscoping levels in plant pathology

A review was given on different methods and techniques for detection, identification and assessment of disease and damage symptoms as well as for studies of plant parasites explaining the possibilities of remote sensing in this field.

*Kannegieter* (NL), presented by *R. Graham*: The use of various film/filter combination in aerial photography for the detection and assessment of disease attack in winter wheat

*H. Helbig* (FRG): Erkennung von Pflanzenschutzmaßnahmen, Düngeeffekten und Ertragsmessungen hoher Genauigkeit aus Luftbildern

Colour aerial photographs (MS 2448, IR 2443 — Kodak) were digitized and corrected radiometrically. Thereafter a linear correlation between the class coefficient determined from aerial photography data and the fertilizing and plant protection in the field could be shown by digital image processing.

The paper by *B.V. Vinogradov* (USSR), Télédétection et cartographie des pâturages was read by title (Proceedings Vol. B10, p.738).

Tuesday, July 15, 1980, from 11.00 to 12.30

Session 4 of Commission VII (Working Group VII/9)

Topic: Spectral Signatures of Objects  
Chairman: *Dr. J. Sievers* (Fed. Rep. Germany)

### Invited Papers:

*J. Sievers, K.T. Kriebel* (FRG): Report of ISP Working Group VII/9, "Spectral Signatures of Objects"

For describing the reflection properties of objects the (Spectral) Reflectance Factor  $R(\eta)$  seems to be the most suitable quantity in remote sensing (see also resolution T VII/4). In a later meeting it was not possible to reach a general agreement for the suggested definition of the term "Spectral Signature". In the future it is proposed that studies be made of factors affecting the spectral signature.

*M.E. Bauer, W.C. Vanderbilt, B.F. Robinson, C.S.T. Daughtry* (USA): "Spectral Properties of Agricultural Crops and Soils Measured from Space, Aerial, Field and Laboratory Sensors".

The paper is organized in four parts: (1) spectral properties of leaves, (2) reflectance properties of soils, (3) reflectance characteristics of crop canopies, and (4) large area applications of spectral measurements. Only the reflective region of the spectrum (0.4-2.4  $\mu\text{m}$ ) will be considered. The paper concludes with a brief discussion of future research needs.

*S. Jaakkola, P. Saukkola* (SF): Spectral Signatures of Field Layers and Canopies of Pine Forest Stands in Northern Finland.

Samples from ground and field layers of mature Scots pine stands were measured both in laboratory and outdoors. The results showed good agreement. Secondly the spectral Signatures of pine forests representing one site type but variable development classes were measured from a helicopter. The objective was to classify timber types numerically.

*G. Guyot* (F): Analysis of Factors Acting on the Variability of Spectral Signatures of Natural Surfaces.

Paper deals with the variability of spectral signatures due to the method of measurement (measuring height, zenith view angle, simultaneous measurement of radiance and irradiance) and due to the experimental conditions (elevation of sun, atmospheric conditions, wind, crop rows orientation, soil properties, canopy geometry, phenological evolution of vegetative canopies).

Tuesday, July 15, 1980, from 14.00 to 15.30

Session 5 of Commission VII (Working Group VII/9)

Topic: Spectral Signatures of Objects  
Chairmen: *H.J. Boehnel* (Fed. Rep. Germany)  
*S. Jaakkola* (Finland)

*Presented Papers:*

*F.H. Goetz* (USA): „Geological Spectroscopy and its practical Application to Lithologic Identification“.

Landsat MSS data has provided the first extensive test for rock and soil identification. Although some success has been obtained in discriminating different rock units, no direct identification of materials based on spectral reflectance has been possible except for limonite.

Thousands of spectra (0.4 – 2.5  $\mu\text{m}$ ) have been obtained using field equipment and analyzed by statistical means to determine which wavelength bands will prove most useful for future imaging systems. Wavelengths greater than 1  $\mu\text{m}$  invariably result in better discrimination. A Shuttle Multi-spectral Infrared Radiometer (SMIRR) has been built to fly on the second flight of Shuttle to test the value of ten spectral channels in the reflective IR.

Discussion confirmed that the spectral range 2 to 2.6  $\mu\text{m}$  is the most useful for the discrimination of different rock types. The influence of the water content of clay, of the coverage by vegetation, and of the shadowing by clouds on the behavior of rocks was also discussed.

*A. Kadro, G. Hildebrandt* (FRG): Beobachtungen über das spektrale Reflexionsverhalten von Keifern- und Fichtenbeständen. Observations on the spectral reflection behavior of pine and spruce stands)

It was found from spectroradiometrical in-situ measurements on stands of *pinus silvestris*, *pinus nigra*, *pinus pini* and *picea abies* that the trees of this nature show different spectral reflection behavior in the spectral range  $\lambda = 400\text{-}1100\mu\text{m}$ . Considerable differences are, however, also shown by trees of the same species in respect of the reflection in the direc-

tion of light and opposite light. Apparently there further exist relationships at a given ratio of irradiation- and observation azimuth angle between the irradiation zenith angle and the amounts of the reflection of different reflection zenith angles which are typical for the species.

*F.H. Goetz* asks during the discussion how the established direction dependencies of the reflection affect the Landsat photogrammetric records. Due to the narrow angular aperture  $\Omega$  of the scanner these effects should be minimal. Further questions on the variance of the reflection factor and its dependence on the illumination ratios were discussed.

*W. Schneider, A. Lautschner* (A): "Object dependent spatial variations of spectral signatures on Infrared Colour Aerial Photographs".

The authors describe methods for determining object specific spatial distributions of colour density on aerial photographs. The distributions are obtained by adjustment calculations from density measurements on sample areas imaged of least twice on neighbouring photographs. Examples of data on space-dependent colour densities of certain objects have been shown. Improvements in classification accuracy after preprocessing steps compensating these spatial variations were demonstrated. Finally a classification method making deliberate use of the object-specific spatial distribution of colour density was described.

Tuesday, July 15, 1980, from 14.00 to 15.30

Session 6 of Commission VII (Working Group VII/3)

Topic: Urban areas  
Chairman: *Dr. M. Juppenlatz* (Netherlands)

*J. Wilmet, H. Beguin, H. Dotu* (B): Comparison of Classification Methods for Urban Image Interpretation.

The speaker compared different classification methods for the interpretation of small urban areas from Landsat images. He demonstrated how improved techniques of textural analysis prevented small local textural parameters from being "smoothed out". He went on to demonstrate a technique for improving the interpretation of Landsat images for small towns in developing countries.

Discussion points: The principal component analysis method was used in the first example, and for the improved technique, local texture parameter histograms were used to identify the less representative classes.

*Dr. F. Hendersen* (USA): Influence of Radar Azimuth angle on small settlement detection. Examples of nine experimental flights over settlements in USA ranging from 1000 to over 100.000 were demonstrated. The results show that settlements with a linear form gave excellent return when radar scan was orientated  $\leq 10^\circ$  to the perpendicular and parallel with the direction of flight. The images for large cities were equally good, and indicated that it may also be useful for estimating population numbers and densities.

*Dr. P. Carter* (UK): Monitoring Urban Growth in U.K. from Landsat Data.

The speaker discussed the progress being made for a Dept. of Environment project for monitoring changes in urban spread from Landsat data, and demonstrated the extent to which omissions and errors in both rural and urban area detection which precludes interpretation of a very high degree of reliability; i.e. results show 70% reliability in urban areas, and 90% reliability in rural areas.

*Dr. K. Naiko, J. Yamamoto, S. Hanaki, K. Akiziki* (J): Correlation studies between Landsat MSS Data and Population Density in Japan

Studies from two test areas in Japan showed that it was possible to find some correlation between Landsat MSS data and population density, but, as such data do not depict population, as such, it is necessary to investigate the relationship between the population density and land use types with the MSS data on each occasion.

*Dr. P. Stock* (FRG): Die Klimadaten von Hagen erstellt auf der Basis von Thermalbildern.

The speaker demonstrated the making of temperature measurement maps to 1°C isotherms, using the town of Hagen and its environs.

Tuesday, July 15, 1980, from 16.00 to 17.30

Session 7 of Commission VII (Working Group VII/3)

Topic: Urban areas  
Chairman: *Dr. Juppenlatz* (Netherlands)

*Dr. J. Nichol, Dr. W. Collins* (UK): The Remote Sensing evaluation of Habitat Resources in a New Town Site.

The speaker demonstrated the use of air photo interpretation for identifying travel paths for wild life, and how these areas can be plotted on maps, that the lines and areas can be afforded protection in any new planning proposals, the new town of Milton Keynes was used to demonstrate the method.

*Dr. V. F. Pollé* (NL): The size of the net residential area on air photos as for population and housing estimates as applied to cities in developing countries

The speaker described some experiments which had been carried out at ITC by course participants into the consistency of housing interpretation from air photos, using the dot-grid method. The quality of results depends greatly on the quality of the interpreters, but on the whole, reliability of accuracy is, on average, only approximately 70%.

*Dr. S. Sekliziotis* (GR): Measurement of open space and socio-economic status from air photos

The speaker used the results of a study carried out for Liverpool in U.K. with Dr. W. Collins to demonstrate the complexity and problems encountered in defining and recognizing "open space" from air photos. He also showed a method used to correlate the decline in the urban environment with the various uses of open space in two sample areas of the city.

*Dr. W. Winter, M. Casimir* (FRG): Remote Sensing and Nomadism in Afghanistan

The speaker showed the method used to interpret biodata from air photos, measuring regenerating vegetation and consumption demands by nomads and their animals in a selected area in the hills in northern Afghanistan.

Tuesday, July 15, 1980, from 16.00 to 17.30

Session 8 of Commission VII (Working Group VII/9)

Topic: Spectral Signatures of objects  
Chairmen: *C.M. Girard* (France)  
*M.E. Bauer* (USA)

The dependence of the spectral signature of sugar beets on the level of observation and the reflection geometry:

Part A: *E. Sanwald* (FRG): Laboratory spectrophotometric measurements and biological parameters

The biological and spectral reflectance (0.5 – 2.5 µm) characteristics of healthy and nematode infested sugar beets were compared. Differences in the reflectance of leaves of healthy and stressed plants, their canopy reflectance was different from the healthy canopies.

Part B: *H.J. Boehnel, W. Fischer, G. Knoll* (FRG): Measurements in situ with spectroradiometers.

Spectral measurements (0.5 – 1.1 and 1.5 – 2.5 µm) of healthy and stressed sugar beet canopies were compared for different solar and view angles. Two types of curves corresponding to the difference between the directions of illumination and viewing. There were clear differences in the spectral reflectance factor of healthy and stressed plants attributed to changes in canopy morphology and reduced soil coverage by the stressed plants. The highest sensitivity was at 0.675 and 2.120 µm.

Part C: *P. Reichert* (FRG): Measurements with an airborne multispectral scanner

A Bendix M<sup>2</sup>S scanner operated from 300 and 2000 m was used to acquire measurements over sugar beet fields. Spectral measurements compared very well with the in situ spectroradiometer measurements. Adjustment for scanner angle effects significantly improved the identifiability of the crop.

*A. Perrier, Ch. Goillot, P. Boissard, P. Valéry, P. Belluomo* (F): Signification du concept d'inertie thermique pour diverses surfaces naturelles; sol ou couvertes végétales

Thermal measurements were acquired at noon and midnight over maize, sugarbeets, bare soil and other cover types. It was found that the thermal inertia of bare soil was low and high for the crops. The difference between day and night temperature gave better separability with about 10° differences between night and noon for maize and beets and about 20° for bare soil.

Wednesday, July 16, 1980, from 9.00 to 10.30

Session 9 of Commission VII (Working Group VII/6)

Topic: Methodology of Photointerpretation  
Chairman: *Dr. G. Hildebrandt* (Fed. Rep. Germany)

*Dr. M. Antrop, Dr. L. Daels* (B): A Method for Temporal Image Analysis of Conventional Archives - Photographs in Relation to the Study of Soil Marks

Soil marks on aerial photographs 1/10.000 to 1/40.000 proved to be valuable indicators for detailed soil studies. Some of the soil marks are temporary others have a more permanent character. Their detection is determined by ecological as well as phototechnical factors. The methodological problem is to combine the information contained in a large number of existing photographic coverages for which no specific ground truth is available. Five series, ranging from 1957 to 1973 have been used to combine the information concerning soil marks. A temporal analysis allowed to increase the amount of information successfully. The amount of information, expressed as pattern density of the soil marks, ranged from 62 m/ha to 278 m/ha on the individual photo-series. After the temporal analysis a value of 625 m/ha could be obtained.

The paper of *Dr. G.M. Lechi, G. Zani, E. Zilioni* (I): Image Interpretation as a Cultural Factor

was read by title only. The paper is published in the Proceedings Part B 10 p. 550

*E. Amadesi, G. Vinaello* (I): Connection between remote sensing and data-bank for the land thematic mapping.

The photointerpretation of satellite imagery or aerial photographs, represents a necessary integration of the territorial data, collected in a data-bank. This methodology permits the systematic revision of the data-bank and, in the same time, the detailed investigation at larger scale of territory relevant problems. As an example the methodology for the carrying out of slope stability and eroding maps was explained and discussed.

*D.J. Bernhard, Dr. Schmidt-Falkenberg* (FRG): Die Arbeiten der Kommission E der OEEPE

Commission E is concerned with the perception of objects on aerial photographs reproduction and processed images. The work is done by two groups. The group under the direction of *Prof. Schmidt-Falkenberg* examines the possibilities of the establishment of a mathematical model of the optical-photographic chain of transfer: object - aerial negative. The group "Influences of reproduction processes on the perception for orthophotodetails" (directed by *Dr. Bernhard*) competes a comparative experimental study on orthophotographic reproduction methods commonly used in Central Europe (11 participating centres; investigated scales 1:5000, 1:10.000, 1:25.000).

The discussion of the papers presented by *M. Antrop, E. Amadesi* and *J. Bernhard* took up many problems of the conventional photo interpretation including such questions as the role of available auxiliary

information and the interpreter's specific expert-knowledge.

*Dr. S.O. Ihemadu* (Nigeria): The Regional Centre for Training in Aerial Surveys, Ile-Ife, Nigeria

The paper traced the history of the Regional Centre for Training in Aerial Surveys, Ile-Ife, Nigeria, highlighting the Centre's objectives with respect to training, research and provision of consultancy services in aerial surveying, and indicating the administrative set-up, the continental geographical spread of admission of students, the bilingual status of the Centre, sources of financial support, and the present and prospective courses.

Wednesday, July 16, 1980, from 11.00 to 12.30

Session 10 of Commission VII (Working Group VII/9)

Topic: Spectral Signatures of Objects  
Chairman: *Dr. E. Sanwald* (Fed. Rep. Germany)  
*Dr. G. Guyot* (France)

*Presented Papers.*

*B.F. Robinson, M.E. Bauer, D. P. Dewitt, L.F. Silva, V.C. Vanderbilt* (USA): Multiband Radiometer and Data Acquisition System for Remote Sensing Field Research

The characteristics of the radiometers presently available were described with respect to observation level, calibration problems, and spectral sensitivity. As a consequence of this overview it became evident that, as radiometric in situ investigations are of indisputable importance, and the given sensors do not fulfil the requirements in the view of availability, technical characteristics, and economics, the development of a radiometer corresponding to the needs is of primary importance. Such a radiometer which meets all necessary requirements was constructed and introduced by the paper.

*V.C. Vanderbilt, B.F. Robinson, L.L. Biehl, M.E. Bauer, A.S. Vanderbilt* (USA): Simulated Response of a multispectral Line Scanner Over Wheat as a Function of Wavelength and View/Illumination Directions

The aim of this study was to establish a model of a sun angle/view angle concept for the spectral response of wheat canopies as measured by a truck-mounted radiometer. More than 1.200 measurements were carried out over four different wheat canopies and evaluated with respect to different solar zenith angles, azimuth angles, and view angles. Ancillary data of the agro-biological crop characteristics were recorded along with the measurements. The results of the measurements were displayed as contour lines in two- and three-dimensional figures. They corresponded to the results given by other authors during previous sessions (*Boehnel* et al., *Guyot* et al.); i.e., it was found that the changes of the spectral reflectance factor are different for different spectral bands and different view angles. Conclusively, the establishment of models for the spectral reflectance behaviour of plant canopies at off-nadir-view angles must include physical para-

meters of the canopy as well as agro-biological data.

*G. Guyot, P. Malet, F. Baret (F):* Analyse des Indicateurs de Réflexion de L'Orge et du Blé: Possibilités de la Stéréoradiométrie

It described joint measurements by two radiometers of barley and wheat canopies in the four Landsat spectral bands at conditions of clear sky and cloudiness. The results of Vanderbilt and others were confirmed with respect to the %R changes. This applies, however, not for uncovered soil: here, no differences could be observed for varying angular conditions neither between different channels nor between measurements with a time lapse of exactly one year. In channel 7, no separation between wheat and barley was possible throughout the vegetation period, whereas the channel 8 measurements gave discrimination possibilities at the same view angle of 45°. The studies on these problems are still going on.

The discussion on the last two papers clarified questions with regard to the correlation of the results to airborne missions.

Wednesday, July 16, 1980, from 11.00 to 12.30

Session 11 of Commission VII (Working Group VII/3)

Topic: Environmental Monitoring

Chairman: *Dr. S. Schneider* (Fed. Rep. Germany)

*Dr. Maria Domonkos (H):* Untersuchung von durch Industrien verursachter Umweltschäden mit Hilfe photogrammetrischer und Fernerkundungsmethoden

After the discussion of general questions on combined investigations of industrial plants, the interdisciplinary work of experts from different fields, e.g. geologists, hydrologists, chemists was emphasized. As an example the analysis and the cartographic presentation of the environmental pollution by an aluminiumoxide factory was presented.

*Dr. J. Nichol, Dr. W.G. Collins (UK):* Ecological Monitoring of Balancing Lakes by Multi-spectral Remote Sensing

An evaluation of film types for monitoring the vegetation of balancing lakes. Colour infra-red film was found to be the most useful film type for identifying emergent vegetation. The slight overexposure of this film-type is thought to allow better depth penetration for the mapping of submerged vegetation and for viewing the lake bed.

*M. Sartori (A):* Technische Verbesserung der Fernerkundung-Interpretation bei Gewässeruntersuchungen

A number of important methodological suggestions for the development or the interpretation of remote sensing data were given. For the interpretation of an area a representation in form of a mathematical model is required.

Such models are supplied with remote sensing data and data from supplementary measurements.

Photogrammetric technique, geometrical image rectification, correct physical handling during the acquirement of the model input variables as well

as the data presentation will be demonstrated by practical examples of hydrologic studies.

*Dr. W. Hassenpflug (FRG):* Die Luftbilddokumentation der Auswirkungen extremer Witterungsverhältnisse — dargestellt an Schnee- und Sandverwehungen in der nordwestdeutschen Heckenlandschaft

The effect of the wind guard of the Northwest German coastal lattice fences (breaks) and those fences, which have been built with much costs after the II World-War can be seen during strong winds with drifts of snow and/or sand, particularly in the spreading specimen of the deposited snow/sand. Aerial photographs as well as hand camera and oblique photographs are, in view of the shortliving nature of the shapes, the conclusive documental evidence, which can also be quantitatively analysed. To show that, examples were given.

*Th. H. Lackie, Ch. P. Hwang, W.B. McCoy (CDN):* Water Pollution Surveillance

This paper dealt with a low cost unsophisticated method of relating film densities of pollution plumes to ground truth data at selected transects across a river.

Wednesday, July 16, 1980, from 14.00 to 15.30

Postersession of Commission VII

Chairmen: *H.J. Boehnel* (Fed. Rep. Germany)

*G. Hildebrand* (Fed. Rep. Germany)

This session included the following five presentations:

— *F. Jaskolla, R. Mössmer (FRG):* Anwendung von Fernerkundungsmethoden für ökologische Kartierungen auf europäischer Ebene (Application of Remote Sensing for Ecological mapping within the Area of the European Community)  
Paper published in Vol. XXIII, Part B8, pp. 639–647 of the Archives.

— *I. Hadem, G. Skrämo (N):* Fixed-Base Photogrammetry with Wingtip Mounted Cameras. Calibration Procedure and Forestry Application  
Paper published in Vol. XXIII, Part B10, pp. 520–527 of the Archives.

— *M. Cagirci (Turkey/FRG):* Untersuchungen zur Klassifizierung von Baumschäden mit Farbmeßgeräten  
(Observations on the classification of tree damages by colour-densitometry)  
Paper published in Vol. XXIII, Part B7, pp. 112–121 of the Archives.

— *K. Herda, K.H. John, V. Kroitzsch (GDR):* Comment on the Visual Interpretation of Colour Synthesis Maps  
Paper published in Vol. XXIII, Part B7, pp. 421–429 of the Archives.

— *W. Tzschoppe* — presented by *Mr. Müller (GDR):* MSP-YC Multispectral Projector — A colour Synthesis instrument for the

Interpretation of Multispectral Photographs.

Paper published in Vol. XXIII, Part B8, pp. 924-931 of the Archives.

Wednesday, July 16, 1980, from 16.00 to 17.30

Session 12 of Commission VII (Working Group VII/2)

Topic: Vegetation Damage

Chairmen: *Dr. C.M. Girard* (France)

*Dr. P.A. Murtha* (Canada)

#### *Invited Papers.*

*C.M. Girard* (F): Télédétection des dommages causés à la végétation: Rapport sur les recherches en agriculture

The author gives an idea of the importance of agricultural losses due to crop damages in Europe as well as in France. She gives a review of the actual aims of plant protection which is to assure the lower losses of yields as well as reducing the chemical applications.

In conclusion recommendations are presented to orient the forthcoming work by searchers as well as practitioners in this field of interest.

*P.A. Murtha* (CDN): Report of the Forestry Section: Working Group on Vegetation Damage

This report of the forestry section of the vegetation damage working group informed about activities since the last Congress. Current activities were discussed. Problem areas requiring further work have been defined, and recommendations for delegate consideration were presented.

*E. Sanwald, P. Reichert* (FRG): State of the Art in Crop Stress Detection by the Use of Remote Sensing Techniques - a Critical Review

The use of remote sensing techniques for detecting stress situations in different agricultural crops on a world-wide level were critically reviewed. Aerial photography and/or MSS systems have been used in grains, corn, potatoes, sugar beets, soybeans, citrus, cotton, and others. Stress situations concerned are of biotic as well as abiotic origin. In several cases methods ready for practical application could be developed. The larger part of the work done, however, was confined to the experimental stage. This is mainly due to the fact that the establishment of links between scientific research and final use is not sufficiently taken into consideration.

*W.A. Ciesla* (USA): Putting Remote Sensing Technology to work in Forest Damage Evaluation

Photographic sensors have been proven as valuable aids for data acquisition on status of certain destructive forest pests. One of the greatest challenges facing forest pest management specialists is the transfer of this technology into operational use for pest management decision making.

In order for sensor-based data acquisition systems to be adopted as operational tools, they must provide data responsive to user-defined needs. A cadre of trained professionals and technicians committed

to operational use of remote sensing technology is required to ensure system implementation.

Use of high-resolution panoramic color IR photography for forest damage evaluation WRS described as an example of how new sensor technology is transferred to users.

*J. Riom* (F): Réponse spectrale de forêts de pins défoliés. Importance de l'environnement de l'arbre

The author shows through spectral measurements in the field at low height above healthy and defoliated pines how the spectral reflectance may be highly affected by the tree environment, for example heathers, *Molinia coerulea*. It seems that through only spectral values it is quite impossible to distinguish between the different healthy and diseased pines, in such way that it has to be considered again if remote sensing detection of defoliated trees is possible.

It shows that remote sensing is not a whole over solution but must always thought of being integrated in biological throughout studies.

Thursday, July 17, 1980, from 9.00 to 10.30

Session 13 of Commission VII (Working Group VII/3)

Topic: Environmental Monitoring

Chairman: *Dr. S. Schneider* (Fed. Rep. Germany)

*S. Schneider* opened the session with a report on the investigations of the usage of Landsat data for regional planning in the Federal Republic of Germany.

#### *Invited Papers:*

*O. Kölbl, H. Trachslor* (CH): Regional Land Use Survey Based on Point Sampling on Aerial Photographs

To renew the official statistic of the land usage of Switzerland a random sampling process was envisaged, which is based entirely on visual interpretation of aerial photography. The position of the random sample point in the photograph has to be analytically determined, a process which considers the elements of orientation of the photographs as well as the ground relief. The random sample scanning (100 m mesh width) is automatically drawn on a foil and serves as a reference for the visual interpretation.

The process was tested on a large scale experiment and is expected to be operational before long.

#### *Discussion:*

Questions from *Dr. Schneider* concerning the scope of terrestrial controls and from *J. Weingart* about the optimum time for the photographic flight calculator and on the picture scale. *Dr. Z. Tomasegovic* asked about increasing the scope of the random sample of a point to include the interpretation of an area.

Answers: Altogether about 7 % of the random sample points within the large scale experiment were terrestrially investigated, with the necessary work being almost as much as for the evaluation of the whole of the aerial photography.

The aerial photographs have to be compiled during the vegetational period for the updating of maps; a special image flight for landuse survey would not be entertained due to costs.

*Dr. Hildebrandt* informed that the method of transferring orthogonal grid of points in aerial photographs developed by *Kölbl* has already been successfully applied in a large area woodland stock in Southwest Germany by *Schade* (see the contribution by *Schade*, Proc.Part B9, pp.794).

*J.R. Schott* (USA): Remote Sensing of Thermal Loadings on Aquatic Systems. The Paper was presented by *H. Rib* (USA)

The presentation described two remote sensing techniques for determining water quality parameters: The first described thermal infrared sensing technique which enabled the mapping of water surface temperature to within 0.5°C without requiring surface data; the second the densitometric analysis of aerial color photography correlated to limited field sampling data to determine water quality parameters such as levels of chlorophyll, total suspended solids and organic carbons with reasonable degrees of accuracy. The successful application of these techniques in an actual field study was discussed.

*S.A. Ljungberg, Dr. R. Norberg* (S): Use of Aerial Thermography in Urban Areas. Development of a Method for Collection of Data for Energy, Climate and Building Planning

A report was given of mainly the research performed in the National Swedish Institute for Building Research 1975–1978 and in the last two years. The speakers also informed about the work for the future going on right now. The main purpose of their research is to develop an aid useful for physical planning and a tool for efficient fulfilment of local energy conservation programs.

Discussion: *Dr. Laudam* and *Dr. Schneider* (A) had some questions and comments on the appearance of the facades of the shown apartment buildings. The background of the pictures was explained.

Thursday, July 17, 1980, from 11.00 to 12.30

Session 14 of Commission VII (Working Group VII/3)

Topic: Environmental Monitoring  
Chairman: *Dr. H. Trachsler* (Switzerland)

*C. Emmott, W.G. Collins* (UK): Air Photo Interpretation for the Measurement of Changes in Urban Land Use

The paper reported the use of orthogonal dot grids of 1 hectare unit cell for the recording and measurement of land use area on 1:10.000 aerial photography.

This method of recording when combined with standard computer facilities provides much useful data. Such a system should be of interest to town and country planners as well as researchers.

In the discussion *Mr. Tyagi* (NL ITC, Enschede) asked a question concerning the land use classification employed. *Dr. Emmott* replied that it was specially designed for the project and contained only those

categories which it had been shown possible to identify on the photographs.

*Dr. Pollé* (ITC, NL) noted that the considered the method of recording on a dot grid to be very useful as a technique in the training of air photo interpreters. He stated also, that in considering the accuracy of area measurement by this method account should be taken of the size, shape and distribution over the photos of the actual parcels which comprise any particular category.

*Dr. Trachsler* (CH) noted that his institute had undertaken a project concerning the measurement by dot grids on air photos of land use on a regional basis.

*P. Collier, W.G. Collins* (UK): The Classification and Interpretation of Land Use in the humid Tropics: An Air Photo Study

The authors discussed problems encountered when attempting a study of the relationship between land use and soil erosion in Jamaica. They show how existing classifications, being based on cover, crop type or usage on the date of photography are unsuited for the purpose of this project. They used this example as an opportunity to discuss the "classification" as a general problem and stated that a classification should be the order by arrangement of information for a specific purpose, and this purpose must be clearly defined.

*P. Triglia, V. Romano* (I): Méthode Analogique-Digitale pour la détermination du contenu agricole d'une zone d'étude en Province de Ravenne (I) à travers des Données MSS Landsat

*H. Lappänen* (SF): Aerial Data in Forecasting of Urban Development and Traffic in Tripoli

Based on Population census 1973 and former employment statistics as well as aerial photos 1973 and 1977 the population and employment in 1977 were defined. Using monitored urban development potentials the population and employment in 2005 were forecasted.

The paper by *J. Sima*: Interpretation of color Aerial Photographs for Updating the Maps of Land Register in Czechoslovakia was read by title (Proc.Part B8 p.858).

Thursday, July 17, 1980, from 14.00 to 15.30

Postersession of Commission VII

Chairman: *H.J. Boehnel* (Fed. Rep. Germany)

This session included the following five presentations.

– *G. Kritikos, P. Reichert, P.S. Roy, V. Parthasarathi* (FRG/IND): Separability of spectral signatures and the feasibility of forest type classification using multivariate M<sup>2</sup>S data – A case study (Abstract in Vol. XXIII, Part B10, p.771 of the Archives)

– *D. Bannert, Pöhlmann, R.W. Scholz* (FRG): Ein schneller Weg von der Analyse multispektraler Satellitendaten zum Druck thematischer Karten (Quick Ana-



lysis of Multispectral Satellite Images for Map Production)  
Paper published in Vol.XXIII, Part B7, pp.24–29 of the Archives.

- *W. Fink, K. Niemz* (FRG): Eine Strategie der rechnergestützten Landnutzungsklassifizierung (A Strategy for the Computer-Aided Land Use Classification). Paper published in Vol.XXIII, Part B7, pp. 291–301 of the Archives.
- *R. Hoffmann, W. Kantov, W. Kruck*, presented by *P. Hoppe* (FRG): Auswertung der Landsat-Abbildungen für Untersuchungen im Bereich Bodenkunde/Landnutzung an ausgewählten Beispielen in Afrika (Evaluation of Landsat images for Land-use and soil studies in selected areas of Africa) (Paper published in Vol.XXIII, Part B7, pp.447–456 of the Archives).
- *S. Ljungberg, R. Norberg* (S): Use of Aerial Thermography in Urban Areas (Paper published in Vol.XXIII, Part B8, pp.558–563 of the Archives)

Thursday, July 17, 1980, from 16.00 to 17.30

Session 16 of Commission VII (Working Group VII/2)

Topic: Vegetation Damage  
Chairmen: *Dr. P.A. Murtha* (Canada)  
*C.M. Girard* (France)

Four papers were delivered and one paper was read by abstract.

*P. Boissard, R. Perrin, B. Andrieu, P. Valéry* (F):  
Exploitation numérique du film infrarouge couleur pour l'étude de la maladie de l'écorce du Hêtre

The speaker delivered a paper on remote sensing of beech bark disease. The principle method used an Optronics scanner to digitize color-infrared air photos coupled with principle component analysis to assess damages.

*H.U. Scherrer, H. Flübler, F. Mahrer* (CH):  
A Sampling technique to Assess Site, Stand and Site Characteristics of Pine Forests on CIR Aerial Photographs

It was reported on an investigation of Site characteristics relative to levels of tree damages in an air pollution zone. No report was given relative to cause and effect, but a means to evaluate present stand conditions was suggested.

*G. Guyot, J. Riom* (F): Détection de pins malades dans l'infrarouge thermique (Bande 8 – 14  $\mu$ ).

An AGA thermal vision scanner was being used to detect incipient roots rots. It was hypothesized that if the root rot affected the water translocation then a thermal difference should be recorded in the tree canopy. The report concentrated on the preliminary results and problems encountered in the study.

*S. Takahata, M. Miyama* (J): Studies on the Plant Damage Caused by the Mt. Usu Eruption Using Remote Sensing.

The speaker provided a vivid description of the damage caused by ash-fallout after the Mt. Usu volcanic eruption in 1977. Crop damages were estimated by airborne MSS data. The buried fields could be identified using supervised most likelihood classification (channel 7,9,11).

Compared with the two years MSS data, it was able to indicate the degree of vegetation regrowth.

It was concluded that a digital analysis of the aircraft MSS data is effective for plant damage surveying.

The paper by *R. Dillman, Ph. Weber, B. White* (USA): Capabilities of high altitude panoramic photography for mountain pine beetle damage Surveys was read by abstract.

Thursday, July 17, 1980, from 16.00 to 17.30

Session 17 of Commission VII (Working Group VII/3)

Topic: Environmental Monitoring  
Chairman: *Dr. H. Hoefner* (Switzerland)

*Dr. W. Hassenpflug* (FRG): Erprobung von Fernerkundungsverfahren (Satellitenbilder) bei der Umweltüberwachung sowie zur Unterstützung von Biotopkartierungen

The contribution presented a project which was started in Schleswig-Holstein (Federal Republic of Germany) in spring 1980. It is to investigate which specific information on landscape elements, which are significant in the scope of environmental control (swamps, floods, gravel pits etc.) may be obtained from Landsat images. This is done by comparison with conventional landscape information sources and by continual recourse on the conventional visual interpretation of the processed imagery by competent officers who have a good knowledge about the region.

*W. Kirchhof, G. Lützwow* (FRG): The potential Use of Remotely Sensed Data for Regional and Zonal Planning.

It was the authors' intention, after many years of experience in the field of evaluating MSS-data, LANDSAT and aeroplane imagery for regional and zonal planning, to point out the potentials and limitations of this remote sensing system. They were able to show that useful information for regional and zonal planning would be obtained also for small and intensively used areas through computer-aided methods and analyses.

*R. Bachhuber, C. Franke, W. Kirchhof* (FRG): Landnutzungskartierung mit Hilfe digital verarbeiteter Luftbilder

For 6 test areas, which were mapped of about 70 % of overflying time an interpretation code for land usage mapping has been worked out for digitally processed photogrammetric material. Dependent on the instance of overflying it is regionally applicable.

The results of the interpretation of the image examples were discussed and the expenditure on costs and

energy of this landuse mapping were compared with those of conventional mapping.

*L.E. Pla* (Venezuela): Desertification: Generating Hypotheses from Aerial Photographs

The paper represents an example of the use of aerial photointerpretation for the study of perennial plant cover changes occurred in a period of 20 years. The comparison of the results of photointerpretation through a classification system based on structural features of vegetation allowed problem identification and delimitation of critical areas, to select priorities for further research.

Friday, July 18, 1980, from 9.00 to 10.30

Session 18 of Commission VII (Working Group VII/2)

Topic: Vegetation Damage  
Chairmen: *P.A. Murtha* (Canada)  
*C.M. Girard* (France)

In the second session on vegetation damage to trees three papers were delivered, one paper was read by title. Two papers dealt with the impact of SO<sub>2</sub> on vegetation and the other dealt with the assessment of urban trees.

*P.A. Murtha* (CDN): Modelling tree Damage-Type Patterns for Photo Interpretation of SO<sub>2</sub> Injury

The speaker presented a model for interpreting SO<sub>2</sub> caused damages to trees and photographically illustrated the SO<sub>2</sub> caused damage. Finally he showed an application of the technique.

*K. Zirm* (A): Erfahrungen bei der Klassifikation geschädigter Vegetation mit Hilfe von multispektralen Scannerbildern

The use of computer-aided classification and interpretation of airborne multispectral scannerdata to assess low levels of SO<sub>2</sub> damages were discussed. The successful assessment was based on an improved "Quader-Classification".

*H. Kenneweg* (FRG): Luftbildinterpretation von Straßenbäumen in westdeutschen Städten

The author described the assessment of damages to trees in German cities. He gave examples of costs involved in such studies and the results of an inquiry of municipalities on the demand and interest for such inventories.

The paper of *T.M. Lillesand* (USA) "Photographic Detection and quantification of Urban Tree Stress" was read by title (Proc. Part B7, pp.548).

The discussion of the three papers centered around types of ground truth, how and when it is obtained. There was also a suggestion that air photos taken for engineering purposes in cities could be obtained in color-infrared instead of B+W, thus making the photos more useful. Furthermore the discussion dealt with the question of the identification of the damage cause and the discrimination of different causes.

In summary, all of the Working group VII-2 meetings brought together a large number of experts working with vegetation damage around the world. Problems are similar, there is a need for standardized techniques for ground truth data collection, statements

of error estimates and reliability statements as well as a continuing need for basic studies in spectral reflectance and changes in spectral reflectance at the onset and during continuing damage.

Friday, July 18, 1980, from 11.00 to 12.30

Session 19 of Commission VII (Working Group VII/1)

Topic: National Land Resources  
Chairman: *H. Kenneweg* (Fed. Rep. Germany)

This session mainly concerned itself with remote sensing of vegetation, specially forests. Four presented papers were given.

*I. Nakajima, Y. Mukai, S. Takenchi, S. Tanaka* (J): Application of Landsat Data for the Management of Forest Resources

General aspects, basic methodology and specific examples of the application of Landsat data for forestry purposes were discussed.

*C.M.R. Carneiro* (BR): Planimetric and Thematic Mapping Potential of Landsat MSS Imagery for Integrated Surveys of South Brazilian Natural Resources

The planimetric and thematic potential of visually interpreted Landsat MSS bulk images for application to integrated surveys of Brazilian natural resources have been analysed.

From the results of many operational applications, it was observed that the maps made from the images meet the planimetric and thematic requirements of United States Geological Survey class B maps, or of third order maps in accordance with the norms of the Brazilian Geographic Service - DSG.

*J.J. Talts* (S): Landsat Data and Topographic Maps for a Forest Inventory

The methodology and present results of an experimental forest inventory where Landsat data and digitized topographic maps are used simultaneously have been discussed in detail. The purpose of the investigation is to see if data from present Landsat can be applied to a national forest inventory in Sweden.

*H. Odegaard* (N): Mapping Polar Vegetation at Spitsbergen by Use of Landsat

The speaker described the specific requirements of mapping the vegetation of Spitsbergen and the applied methodology using Landsat data. Some points brought up by him are especially worth mentioning: He uses cluster analysis for so called "Salt and pepper" areas, otherwise he uses unsupervised classification. Furthermore, he uses digital analysis for the most detail rather than manual analysis.

There was much discussion of all presentations.

Friday, July 18, 1980, from 14.00 to 15.30

Session 20 of Commission VII (Working Group VII/1)

Topic: Natural Land Resources  
Chairman: *J.J. Ulliman* (USA)

The Session concerned itself with remote sensing for forestry purposes. Three papers were presented, another paper was read by title.

*S. Sicco Smit* (NL): Use of Landsat Imagery for Forest Management Mapping

In a case study of the Kobenhauer Wald in Austria (10000 ha forest land) landsat imagery (August 1979) in form of colour enhancement prints and CCT printouts of individual bands and principal component calculations were compared with data from orthophotomaps (1974) and recent aerial photography (1979).

The comparisons indicated that from Landsat imagery important forest data might be obtained, but in this case study area these data are not accurate enough for the requirements of a forest management map.

*F. Mohrer* (CH): Application of Aerial Photography for the Swiss National Forest Inventory

The author described the proposed methodology of a National Forest Inventory in Switzerland. Conventional black- and- white aerial photography should be used. The photo-interpretation should be done at sample points of a geometrically corrected dot grid, produced by the photogrammetric procedure developed by Kölbl. A sample of the photoplots will be selected for ground measurements.

*A.A. Akca* (FRG/Turkey): Holzvorratsermittlung durch digitale Luftbildauswertung

Basic considerations and methodological details of a new approach of digital evaluation of aerial photographs for timber volume measurements have been discussed. It was shown that the timber volume of pine stands in a german test site could be ascertained with sufficient accuracy.

The paper of *J. Schade* (FRG): Mehrphasige Stichproben für großräumige Weltinventuren in Mitteleuropa (Multistage Sampling for Large Area Forest Inventory in Central Europe) was read by title. It is published in the Proceedings (Part B8, pp. 794)

There was much discussion after the presentations, especially of Dr. Akca's paper. One point worth mentioning as brought out by *Mr. Mahrer* is, that it is proposed for the Swiss Forest Inventory to use 10 photo plots for every one ground plot.

Friday, July 18, 1980, from 16.00 to 17.30  
Session 21 of Commission VII (Working Group VII/1)

Chairman: *J.J. Ulliman* (USA)

*Invited Papers:*

*E.E. Derenyi* (CDN): Role of Remote Sensing in Regional Farm Land Inventory Programs

Procedures followed in establishing, monitoring and updating a Farm Land Inventory in the Province of New Brunswick, Canada were described. Initially the inventory data are recorded graphically on photo maps and then stored digitally. Monitoring and updating of the data are performed by digital image analysis techniques using geometrically corrected Landsat MSS images, which are registered on

the UTM grid. As a back-up source of information, visual observation and small-format camera photography are employed. The updating operation is facilitated by the positional and dimensional data available for each farm field in the inventory file.

*J. Cihlar, C. Goodfellow, A. Alfoldi* (CDN): Remote Sensing Technology Transfer to Operational Use in Canadian Forestry

Forest management requires information at several levels of detail and frequencies of revision. Remotely sensed data from airborne and spaceborne sensors have been shown capable of providing certain kinds of forest information in a timely and effective manner.

The purpose of the paper was to review the approach to remote sensing technology transfer to forestry agencies in Canada. Technology developers and adopters were identified and their roles in the transfer process were outlined.

*G. Fraysse, P. Montellanico* (I): A Methodology for a large Scale Olive Trees Inventory

In order to establish a methodology for the determination of olive trees area and number in cadaster parcels in southern Europe (Italy, France), several methods were compared: black-and-white aerophotography, color infrared aerophotography, multispectral Scanner imagery. Human photointerpretation, automatic processing were applied to the main categories of olive trees fields. The results of these experiments were presented and the sources of errors have been analyzed.

*V.I. Sukhikh* (USSR): Forest Remote Sensing System

The role of spaceborne and airborne remote sensing in the USSR for forestry purposes were discussed. Special emphasis was given to the information supplied by multispectral photographic imagery taken by Sojus-Missions. It could be shown that remote sensing techniques esp.with analoge interpretation methods are an integrated part of the forest information system in the USSR.

*Discussion:*

There was limited questions and answers because of time. Most questions were asked of *Mr. Fraysse* who noted that there were problems, e.g. that it is difficult to differentiate olive cultivation especially from orange trees, and it is even more difficult to determine production levels.

Also the members of the German working group "Forstliches Luftbild- und Kartenwesen" took part in the working group meetings of Commission VII, held on July 18, 1980. This day's sessions were held at the same time as informal meetings of the team of specialists "Remote Sensing" of the IUFRO (International Union of Forestry Research Organizations).

Monday, July 21, 1980, from 9.00 to 10.30  
Session 22 of Commission VII (Working Group VII/5)

Topic: Remote Sensing in Engineering Projects and Industrial Processes

Chairman: *Dr. Harold T. Rib* (USA)

*William T. Baker* (USA): Photologging: A Close Range Photogrammetry Tool for Highway Engineers, presented by: *Harold T. Rib* (USA)

Paper jointly sponsored by Commission V/5 and VII/5. The presentation described the equipment and techniques used for obtaining photographs of the road and its environment at fixed intervals from a moving vehicle. Analysis techniques and areas of application were also discussed. Some of the common applications of photologging data mentioned were: review of hazardous intersections, traffic control devices and sign inventories; uses in public hearings and court litigations; and minimizing the need for field trips.

*Peter K. Pleitner* (USA): Applications of Airborne Thermal Infrared Scanners to Engineering Problems

Mr. Pleitner illustrated by slides the applications of thermal infrared surveys to a variety of engineering problems. Some of the areas of applications described were heat loss surveys, seepage through dams and dikes, buried pipe detection, and geotechnical land siting surveys. The discussions following the paper were largely on the characteristics of the new infrared scanner described by Mr. Pleitner (0.6mr, ofv; 0.4  $\mu\text{m}$  resolution) and the geometric corrections applied.

*Taichi Oshima* (J): Environmental Studies by Pattern Classification for Evaluating the Effect of Civil Engineering Projects under Construction

Dr. Oshima described the data reduction procedures and computer analysis techniques applied to evaluating environmental factors for the construction of forest roads. The techniques discussed included an example of consideration of multiple factors such as land productivity, vegetation protection, and landslide probability on evaluating alternate corridors.

Monday, July 21, 1980, from 11.00 to 12.30  
Session 23 of Commission VII (Working Group VII/7)

Topic: Interpretation of Radar Imagery  
Chairmen: *Dr. P. Fagundes*  
*Dr. C.M.R. Carneiro* (Brazil)

**Presented Papers:**

*F. Voss* (FRG): Natural Resources Inventory of East Kalimantan/Indonesia by Side Looking Airborne Radar Surveys

Report on a natural resources inventory for a proposed transmigration project, esp. on the experiences with the interpretation of SLAR imagery for geological, geomorphological and agricultural (soils, vegetation) purposes.

*C. King* (F): Contribution à l'Etude des Sols Nus par Microondes; the paper was presented by *Madame C. Girard*:

The study comprises the observation of the behavior of the ultrashort wave signals (frequency: 1.5, 3, 4.5, 9 GHz and 4 combinations of polarization) under precise observation conditions on bare ground

for very low height (15 m) and a good knowledge of the study zones in question.

The whole of the compiled information allowed the determination of the monofactoral relationships between the reflected signals and the parameters of the terrain.

The comparison from March - May 1978 - depending on the different unevenness of the ground - shows that the signal increases with the increase in unevenness for a given degree of humidity, apart from 4.5 GHz, where the signal is insensitive to changes in unevenness.

The influence of the humidity area could be studied from March till May 1978 and 1979 in the range from 3 to 30 % (humidity by weight), increases with the increase in moisture content. The increase was calculated, independent of the used frequencies, using the method of linear correlation for 0.3 dB each for every percentage humidity.

*J. Nithack* (FRG): Auswertung von Radarbildern mit visuellen Methoden

Visual interpretation of x-band radar images shows good geologic-pedologic results if soil and rock differences are expressed by Morphology. Extraction of land use classes was difficult.

Grassland detection becomes only successful when multiseasonal imagery was combined. Mapping of soil moisture differences depended very much on the kind of vegetation cover.

The paper from *F.M. Henderson* (USA): Extracting Urban Data from Seasat SAR imagery: The merit of image Enhancements and Density Slicing was read by title (Proc. Part B7, pp.411).

Discussion: Questions from the floor were addressed to the three speakers.

In addition to the discussion, *Dr. P. Fagundes* (BR) gave some information about the RADAMBRASIL-Project and *Dr. Rivera* (Columbia) made a few comments about the PRORADAM-Project developed in Columbia.

Monday, July 21, 1980, from 14.00 to 15.30  
Session 24 of Commission VII (Working Group VII/7)

Topic: Interpretation of Radar Imagery  
Chairman: *Dr. P. Fagundes* (Brazil)

This main session of WG VII-7 was the attempt to discuss the state-of-the-art in analog Interpretation of Radar imagery. Three experienced speakers summarized possibilities and limitations of such interpretation for geomorphologic, hydrologic, forestry, and geological purposes. *Dr. Martin Faye* and *Dr. S. Pala* illustrated their presentations with many slides. *Mr. Sicco Smit* presented a case study to explain the problems and the methodology.

The speakers and the titles of the invited papers were:

*Dr. P.H.A. Martin-Kaya* (UK): Regional Interpretation of Radar Imagery

*G. Sicco Smit* (NL): SLAR Mosaic Interpretation for Forestry purposes, a Case Study of the Interpretation of a SLAR Mosaic of Nigeria without Additional Information.

*S. Pala, R. Mussakowski, E. Wedler (CDN): Seasat SLAR Data Evaluation for Structural and Surficial Geology*

Monday, July 21, 1980, from 16.00 to 17.30  
Session 25 of Commission VII (Working Group VII/1)

Topic: Natural Land Resources  
Chairman: *H.J. Boehnel* (Fed. Rep. Germany)

Presentations:

*A.F.H. Goetz* (USA): Stereosat: A Global Digital Stereo Imaging Mission

Stereosat, a satellite to obtain stereoscopic images of the earth's land masses in a consistent scale, has been proposed as a joint venture between the Government and private sector industrial corporations.

For any organizational structure, ranging from the government exercising minimum control over an all private venture to the government undertaking Stereosat and creating a mechanism for the private sector to eventually purchase the system, a number of legal, economic, political and institutional issues must be addressed. For example, the Outer Space Treaty requirement of "authorization and continuing supervision" must be resolved consistent with national and international policy.

The paper discussed both the range of potential organizational models and issues which will influence the eventual structure created.

*G. Saint, P. Hebert, C. Leprieur* (F): Cartographie de l'Evolution du Manteau Neigeux du Massif Central à l'aide des images du Satellite "TIROS N", presented by *R. Jeansoulin*

The presence of the middle infrared channel in the information of the Satellite TIROS N makes a good differentiation of the snow from the cloud possible. The regular observation of the blanket of snow as well as the study of the periods of rapid variation and its spreading gives much information on the density of the snow conditions of the concerned regions as well as on the volumes of water, which are useful for the electrical production.

*Dr. F.B. Henderson* (USA): International Geological and Geophysical Remote Sensing from Space

This paper of the President of the Geosat Committee, Inc, reported on the work of the Geosat Committee which was organized to recommend satellite systems optimizing geological remote sensing from space.

The recommendations include rock/soil sensitive spectral bands, high resolution film, Landsat-compatible stereoscopic digital imaging data (STEREOSAT), and synthetic aperture radar.

Potential space remote sensing systems are being evaluated under the joint JPL/NASA-Geosat Test Case Program. The recommendations are influenced by recent national and international developments; the 1979 Space Policy; OSTP studies on military/civilian remote sensing systems integration and private sector involvement; Presidential Directive 54; Senate and House action in 1978, 1979 and 1980 on space policy and the development of an opera-

tional earth remote sensing system; the activities of Comsat on STEREOSAT development. Some Geosat recommended data may become available through non-US earth remote sensing satellites. Geosat hopes these systems will be Landsat-compatible.

*K.S. Dueholm* (DK): Computer supported geological photointerpretation

A desk-top computer is connected to a photogrammetric plotting instrument and programs have been developed to calculate geological structural parameters. The plotting instrument is equipped with a stepping motor on the z-column which is guided by the computer. Hereby the measuring can be kept in a precalculated geological horizon during interpretation and plotting. Based on point observations and geological models and using the feedback from the computer to the plotting instrument the geological structure of the study area in greenland could well be approximated by a interactive procedure.

*J.P. Delpont* (F): Spot et le Service aux Utilisateurs  
The paper was presented by *Dr. Fontanel* (F).

It was reported on the considerations and intentions of CNES, which should lead to the building of a flexible SPOT-data distribution system for the users in the international community. It is intended to set up an organization with the highest possible autonomy, which will be responsible for the distribution of the collected SPOT-data and the promotion of its use as well as the necessary services.

Wednesday, July 23, 1980, from 9.00 to 10.30

Session 26 of Commission VII (Working Group VII/1)

Chairmen: *J.J. Ulliman* (USA)  
*Dr. M.C. Girard* (France)

This session was on the use of remote sensing for soils.

Presentations:

*M.H. Boubaker* (TN): Application de la télédétection à l'Etude de l'Occupation du Sol Requis par les Aménagements Hydrauliques en Tunisie

The results of these investigations from aerial photographs, photographic plans and orthophoto plans have contributed on a regional basis to a preliminary land analysis and the portrayal of conveyance activities as well as the agricultural use and settlement of the country side. These experiments make up the results of these applications in land utilization which is to be seen as being equal in value to the elimination of the hydraulic influences in conjunction with a quantitative approximation to vegetation.

*M.C. Girard, J.P. Rogala* (F): Analyse de l'Humidité des Sols comme Paramètres de l'Environnement

The authors describe the potentials and the limitations of interpreting soil humidity from satellite photography. They point to the necessity of interpretation by a soil scientist, so as to be able to draw analogical conclusions and to recognize relationships.

Through the teamwork between soil and computer scientists it will be possible to develop general models for digital classification.

*A.E. Thies, R. Winter (FRG): Classification of Salt Affected Soils and Detection of their Changes by Digital Analysis of Multi-temporal Landsat Data*

The digital classification of salt affected soils on LANDSAT-images required pre-informations of the investigated area (central Turkey). Visual LANDSAT-images interpretation and fieldwork were the best prerequisite. Thereby, the relevant feature combinations and appropriate seasons were obtained. This "interpretation key" was applied to previous LANDSAT-scenes of the same area. A supervised classification of different degrees of salinisation and the change in the result, which could be used for prognosis and planning purposes.

#### Discussion

There was much discussion at this session. Some of the important points of this discussion were:

- Both Photogrammetric and photointerpretation technique were used in Dr. Girard's soils/crop study.
- Classification of drainage units was made by both computer and visual analysis of Landsat data.

Wednesday, July 23, 1980, from 9.00 to 10.30

Session 27 of Commission VII (Working Group VII/5)

Topic: Remote Sensing in Engineering Projects and Industrial Processes

Chairman: *Dr. Harold T. Rib (USA)*

#### Papers:

*L. Homorodi (H): Using Photographs for Traffic Control*

Paper jointly sponsored by Commissions V/5 and VII/5

Dr. Homorodi described the technique of obtaining photographs from the ground and the accuracies achieved for traffic studies by this technique.

*Harold T. Rib, R. Woodman (USA): Application of Remote Sensing for Highway Maintenance and Inventory Surveys*

Dr. Rib described the various types of maintenance Survey techniques developed and examples of their use. Some of the aerial techniques described included the use of continuous strip camera for road inventory; mapping of cracks and surface deformations from large scale photography as a method for rating pavements for maintenance; mapping of color staining on concrete pavements from large scale color photographs for evaluating the condition of the concrete pavement and rate of deterioration; and mapping of patches on the deck of bridges for evaluating the life of the patch and the condition of the pavement. Some ground technique mentioned included the use of photologging; some research on the evaluation of bridge decks by the use of thermal infrared scanners; and the Schonfeld technique for using ground stereophotographs of the pavement surface to determine the skid resistance properties of the pavement surface.

*Harold T. Rib (USA): Report of Activities of Working Group VII-5*

Dr. Rib presented a report on the activities of Working Group VII-5 during the 1976-1980 period. This was followed by an open discussion on possible future activities of this Working Group. Recommendations included continuing the activities in remote sensing applications of new sensors, expanding to include the applications in engineering geology, and continuing cooperative work with working group V/5.

Wednesday, July 23, 1980, from 11.00 to 12.30

Session 28 of Commission VII (Working Group 6/10)

Topic: Analog Interpretation Methods

Chairman: *Dr. G. Hildebrandt (Fed.Rep.Germany)*

#### Invited Paper:

*H. Schmidt-Falkenberg (FRG): Über Analogieschlüsse in der Photointerpretation*

The lecturer dealt with basic questions on the methodology of classical interpretation of aerial and satellite photography. The identification of objects in the photograph allows its characterizing with the terms "imageshape" (shapely sight), "syntactical identification" (identification according to the class) and "semantic identification" (identification according to the significance). The inferences by analogy are of particular importance, in particular when the shape of the image cannot be directly identified or when the shape of the image is of a higher order (structures).

The second part of the report was on the state of an experimental investigation on visual, integral photointerpretation, which is being analysed by WG VII/10 for quite some time now.

*L. Fox III, K.E. Meyer (USA): Computer Classified Landsat Data Used as a Forest Stratifier*

The majority of the Landsat classifications performed prior to 1976 contained limited information on the forest environment. General categories such as forest/non forest or conifer/non conifer did not provide the detailed information needed for intensive forest stratification and associated ground plot inventory. Development in guided clustering techniques have increased the potential for more useful classifications. Conifer species groupings, vegetation cover classes and tree site classes can be discriminated with accuracies ranging from 83 to 91 percent. Classifications oriented to timber volume determination show the potential for providing the stratification necessary to carry out a stratified random sampling design on the ground.

*B. Rhody (FRG): 70 mm-Stereoluftbildaufnahmen für eine streifenweise Waldinventur*

Report on a system of stereoscopic camera with 70 mm-cameras which could easily be mounted on small airplanes and are suitable for large scale stereophotos of random sample areas or strips. By means of stereo projections the effectivity of such photographs was demonstrated. The author suggested that, if necessary, such photographs should be employed in the scope of a federal German forest inventory.

The paper of *S. Vetrella, A. Moccia and L. De Fusco* (I): Spectral morphological and textural data integration for remote sensing applications was read by title (Proceedings Part B10, pp.726)

Wednesday, July 23, 1980, from 14.00 to 15.30

#### Postersession of Commission VII

Chairman: *H.J. Boehnel* (Fed.Rep.Germany)

#### Presentations:

*H. Gienapp* (FRG): Submikroskopische Trübung des Meerwassers und deren Einfluß auf Eigenschaften seines Streulichts (Submicroscopic Turbidity of Sea Water and its Influence on the Scattering of Light). Paper published in Vol.XXIII, Part B7, pp.326-334 of the Archives.

*P. Lohmann, W. Reil, R. Stätter* (FRG): Die Berechnung von Reflexionsfaktoren aus multispektralen Bilddaten (The calculation of Reflectance Factors from Multi-spectral Image Data). Paper published in Vol.XXIII, Part B8, pp.564-573 of the Archives.

*H. Rivera* (Colombia): The Radar Project for the Colombian Amazon

*P. Frin, J. Prulain* (F): Applications de la thermographie à certains problèmes relatifs à l'énergie (Application of the thermography for certain problems related to the energy). Paper published in Vol. XXIII, Part B7, pp. 302-307 of the Archives.

Wednesday, July 23, 1980, from 16.00 to 17.30

#### Joint session of Working Group VII/4 and VII/7

Topic: Sea Ice and Oceanography

Chairman: *Dr. K.A. Ulbricht* (Fed.Rep.Germany)

#### Presentations:

*K. Strübing* (FRG): Sea Ice conditions in the Weddell Sea (Antarctica) during the German "Polarcircle" Expedition (1979/80) as documented by TYROS N AVHRR Images

The German Antarctic research programme includes the establishment of a scientific station on the Filchner-Ronne Ice Shelf in 1981. During the navigation season 1979/80 an expedition entered the Weddell Sea Polynya to survey the front of the ice shelf for a suitable discharging 'port'. The success of the expedition depended very much on the sea ice conditions. By TYROS-N AVHRR images the unusual favourable development of the sea ice conditions in the season 1979/80 was demonstrated.

*A. M. Cowan* (UK): Sea Ice Morphology in the Context of Wave Ice Interaction studies

A report on the long term studies on wave-ice interaction by the Scott Polar Research Institute Cambridge was given. Field work has been carried out in the Arctic Ocean, the Labrador and the Bering Sea and near Greenland. SLAR, IRSL, laser and photographic sensors have been used as well as sonar on nuclear submarines. Pressure-ridge spacing and the ratio of ridge sail height to keel draft have been investigated. Information on wave decay in the Marginal Ice Zone has been linked to changes in such two-dimensional morphological parameters of the ice cover as floc-size distribution. Modes of analyses were described.

*F.T. Barath* (USA): Synthetic Aperture Radar for Imaging Sea Ice

The preliminary design of a synthetic aperture radar (SAR) for imaging sea ice has been completed in response to functional requirements established by the ice and climate experiment (ICEX) science and applications working group. The radar is required to produce high quality imagery in near-real time of both polar regions above 60 degrees altitude, with a two-day repeat cycle. Ice type, extent, morphology, and dynamics are the primary geophysical parameters to be derived from the images. The SAR operates at x-band and provides a 360 km-wide continuous image swath from a 700 km orbit. The imagery has a 23 db dynamic range, pixels of 100 x 100 m, and good geometric and radiometric accuracy. A high resolution mode provides imagery with 25 x 25 m pixels over a 90 km swath.

The functional performance of the system, and the design details of the dual planar array antenna and the sensor on the spacecraft, as well as the near real-time digital ground processor were described.

*P. De Leonibus, J. Ernst* (USA): A Summary of Wind and Wave Conditions for 28. Sept. 1978 Extracted from Conventional Data Sources

This paper presented a summary of weather and ocean surface wave system at the U.S. East Coast during SEA-SAT Pass number 1339. Wind and wave conditions described by the author are intended to support the analyses of Ross and Beal (see the following abstracts).

*D.B. Ross* (USA): Seasat Surface Wind Measurements Compared to Aircraft Underflight Measurements

The essential facts of this paper have been presented by *Mr. De Leonibus* (USA).

The potential of SAR for monitoring both macroscopic and microscopic wind fields can be demonstrated in Seasat if the L-band (30 cm interaction wavelength) SAR backscattered power can be shown to have high correlation with measured surface wind fields. As a first step in this correlation search, the SAR relative backscattered power has been compared to the Seasat Scatterometer (2 cm interaction wavelength) and aircraft wind magnitudes for Pass 1339. As the surface wind increased from 2 m/s to 11 m/s, the SAR received power increased by approximately 10 dB. This increase, however, does not appear to follow a simple power law, and may consist of several distinct regions. Such behaviour would not be inconsistent with a modified form of the Pierson-Stacy spectral model in the 1 to 30 cm wavelength region. Qualitatively, the wind speed

sensibility exhibited by SAR was also found to be in good agreement with wind measurements derived from the Seasat Scatterometer and Scanning Multifrequency Microwave Radiometer.

*R.C. Beal (USA):* Detection and Tracking of a Low Energy System off the U.S. East Coast with the Seasat SAR.

The speaker discussed one of the results of a Seasat research project of the Applied Physics Laboratory of the John Hopkins University.

On the morning of 28 September 1978, seasat approached the U.S. East Coast with the SAT 100 km swath. A well organized, very low energy swell system was tracked on that morning with the Seasat SAR from deep water, across the continental shelf, and into shallow water. The results of the analysis indicate that (1) the SAR can successfully detect low energy swell systems of significant wave height,  $H \frac{1}{3}$  well under 1 m (actually 0.65 m + 0.25 m) (2) refraction of low energy but  $\frac{1}{3}$  well organized swell due to local ocean depth changes is clearly detectable in both wavelength and direction, and (3) the complexity of the ocean spectrum seems to have little bearing on the threshold detection limits.

During the session the President of Commission VII *Prof. Dr. G. Hildebrandt* congratulated *Captain Ragnar Thorèn* on his 85. birthday. On behalf of ISP Commission VII the President expressed the gratitude for Mr. Thorèn's important contributions to the work of Commission VII since its beginning.

Thursday, July 24, 1980, from 9.00 to 10.30  
Session 29 of Commission VII (Working Group VII/8)

Topic: Methods of digital data interpretation  
Chairman: *H.J. Boehnel* (Fed.Rep.Germany)

Presented Papers:

*B. Bargel (FRG):* Klassifikation von Fernerkundungsdaten durch Spektral-, Textur- und Formmerkmale (Computer-aided classification of remotely sensed data by spectral, textural and form elements)

Methods of multispectral, textural and form analysis and their range of applications in the automatic separation of different classes of objects in agriculture and forestry as well as in housing affairs were described. Examples were used to explain the adaptation of a classifier using a regression analysis, the methods of automatic classification of larger image ranges as well as possible steps of subsequent processing.

Dr. Bargel stressed during the discussion the necessity and the importance of expertise choice of suitable fields for classification training.

*J. Larsson (S):* Use of a Digital Terrain Model in Digital Multispectral Analysis

Multispectral scanner data must be geometrically rectified including corrections for terrain relief displacements. The speaker discussed an attempt to include topographic information, obtained from a DTM, in the multispectral analysis. With this technique a more accurate object classification can

be obtained in some cases where the information extracted from the spectral signature is insufficient.

In the discussion the author clarified that multi-spectral and topographic properties (and other sources of information) of the scene are combined in maximum likelihood classification.

*U. Bausch, W.D. Groch, W. Kestner, M. Sties (FRG):* Objektgesteuerte Segmentierung von Luftbildern (Object-guided segmentation of aerial photographs)

A concept of segmenting aerial photographs in units of semantic importance was presented. Many well known methods of photograph segmentation lead to inaccurate results, if the picture contents, which are fundamentally visible to the interpreter do not stand out clearly against the other contents. The concept considers the integration of the interpreter in a system of photograph interpretation. The expense of interaction could be high (low cost system) or negligibly low (interaction for the control and guidance of automatic modules). The concept was realized as a flexible, partly automatic system and was tested on numerous examples.

*T. Yoshida, H. Kurioka, Y. Matsuo, S. Kasahara (J):* Post Processing for Classified Land Use

Airborne MSS data from low flights used for land use classification must be generally corrected because housing areas, fields, roads a.s.o. are so intermingled. In the paper a qualitative smoothing method for the classified results was discussed. The method uses a probability based majority rule. The aims are:

- 1) Clear specification of zone boundary from the available point area;
- 2) Improvement of the accuracy in the data by using the Surrounding element information;
- 3) Removal of noise contained in the data.

*V. Cappellini, M. Fondelli, F. Muntoni, G. Kanni (I):* Some High Efficiency Digital Techniques for Remote Sensing Data Processing

It was described how by means of two-dimensional digital filters it is possible to perform enhancement and noise reduction on the remote sensing images, improving their quality. Further it was shown how by means of some local space operators it is possible to extract boundaries and edges to perform with pattern recognition algorithms a clear identification and classification of different image parts. Two techniques, one based in digital filtering and decimation the other on data compression algorithm, were presented for comparison and correlation of earth maps obtained from sensors at different heights.

Thursday, July 24, 1980, from 11.00 to 12.30

Session 30 of Commission VII (Working Group VII/1)

Topic: Natural Land Resources  
Chairmen: *J.J. Ulliman (USA)*  
*C.M. Girard (France)*

This session covered subject areas of land use, crops and digital image processing.



Presented papers:

*M.C. Girard, C.M. Girard (F):* Analyse, description et classement des paysages ruraux à partir de données LANDSAT

The authors have worked out a method of describing landscapes on the basis of Landsat data. The standardized description allows a quick portrayal of the landscape units depending on the types of the visible hydrographic grids, on the types of land occupation, on the size of the form of the structuring of the plots, if they are distinguishable.

The use of the photographs from Landsat makes the solution of this problem possible, although some inaccuracy in unit spacing remains.

The validity of the method used here is completely independent of the scale of the satellite data and it is hoped that in this way the use of the data of larger scales like those of the Landsat D and SPOT can be prepared for.

*J.A. Jakobs (FRG):* Land Use and Parcelling Pattern on Landsat Images – the Key to Physiography and Soils of North German Landscape

The author showed that the distribution of grassland and farmland in the North-German lowland distinguishable from Landsat images and from the pattern of the lots conclusions can be drawn on the qualities of the land and natural areas can be demarcated for the use in land regionalization.

*D. Marchetti, G.J. Garcia (BR):* Yield Estimatives for Corn Crop through the colored Infrared Film. The paper was presented by *Mr. Antulli (BR)*.

In an experiment several corn-fields were photographed with color and color infrared film. Then the optical density of the imaged fields was measured with a transmission microdensitometer, with an aperture of 0,8 mm.

The interaction between Yield and Optical Density was analysed through correlation and linear regression. The analysis of the results led to the conclusions: a) alter calibrations, the color infrared film, can be used in the yield forecasting of corn; b) the quantitative interpretation of the results, through transmission density, suggests application of this method in other types of cultures.

*E.A. Krauth (FRG):* Abschätzung des Ertrages von Feldfrüchten aus Luftaufnahmen

Dr. Krauth reported on the results of an experiment to estimate the crop yield of wheat, rye and barley fields according to the measurement of the color density in IRC aerial photography. The density values were correlated with the crop yields and correlation coefficients of  $r = 0.86$  were obtained for rye and winter wheat.

Thursday, July 24, 1980, from 14.00 to 15.30

Business-meeting Commission VII

Chairman: *Dr. G. Hildebrandt (Fed.Rep.Germany)*

Invited Paper:

*G. Hildebrandt (FRG):* Bericht über die Arbeit der Kommission VII 1978–1980 (Report

on Commission VII activities 1978–1980)

The report is published in Part B7, pp. 430-436 of Vol.XXIII of the Archives.

The outgoing President of Commission VII, *Prof. Dr. G. Hildebrandt* introduced the President of Commission VII for the period 1980–1984, *Dr. Louis Laidet (France)*.

Following up the participants of the business meeting discussed proposals of resolutions.

As a results of the discussion resolutions have been adopted.

Thursday, July 24, 1980, from 16.00 to 17.30

Film-Presentation

*R. Barion, D. Lecamus (F)* presented the film: De la Photographie Aérienne à la Carte, une Méthode Simple d'Elaboration de Cartes d'Utilisation du Sol

Thursday, July 24, 1980, from 16.00 to 17.30

Session 31 of Commission VII (Working Group VII/4)

Topic: Oceanography, Sea Ice

Chairmen: *Dr. K.A. Ulbricht*

*Dr. H.G. Gierloff-Emden (Fed.Rep. Germany)*

Presented Paper:

*R. Thorén (S):* Application of Remote Sensing to Oceanography an Sea Ice

The speaker gave a summary of his comprehensive paper (63 pages) and report on remote sensing for sea ice exploration, esp. on the Swedish activities in this field such as the Activ Interdisciplinary Expedition with the "YMER" the oil and gas exploration in the Canadian Arctic Archipelage, the remote sensing experiments in the Bay of Bothnia (1975), under-ice piloting by sonar a.s.o.

Invited Papers:

*R. Frassetto (I):* Remote Sensing for Oceanography

The first generation of experimental marine satellites have demonstrated the potentials of R.S. to furnish oceanographers with the missing synoptic information over the large scales of the world ocean.

A new era may begin in the 90's with an application and use of R.S. as a tool, together with mathematical models, to observe, monitor and simulate ocean phenomena and improve forecasts of weather or climate effects on human properties, exploitations and activities.

The products of scientific interest of each presently experimented sensor, the promising developments, and some drawbacks in data acquisition, preprocessing and processing and the goals which oceanographers should reach have been reviewed.

*R.O. Ramseier, H. Hengeveld, C. Livingstone, R. Lowry* (CDN): Results of the Canadian Surveillance Satellite Sea Ice Experiment

During the SURSAT sea ice experiment dedicated profiling sensor flight lines were flown in both the Beaufort Sea and the Davies Strait sorties to collect spatially and temporally coherent 19.35 GHz horizontally polarized radiometer data, 13.3 GHz dual polarized fan beam scatterometer data and mapping camera photography of sea ice. These data have been analyzed to determine the quantitative microwave signatures for WMO sea ice classes found under winter, early spring and spring marginal ice zone conditions. Results show that 11 sea ice types may be uniquely identified from their active and passive microwave signatures for the sea ice conditions found in this experiment. The effect of changing incidence angles on the characteristics of radar imagery of sea ice with SLAR, SAR and SEASAT-1 SAR are examined. Based on the SURSAT experiment an integrated ice reconnaissance system is proposed which makes use of surface, airborne and spaceborne deployed active and passive microwave sensors.

*H.G. Gierloff-Emden* (FRG): Time scale as Interface of Satellite Data Acquisition Systems against Coastal Water and Tidal Region Processes

Some natural processes are of such time scale that a change of the phenomena is going on meanwhile a sensor system works on data acquisition. The time-space problem of tidal coverage of wadden areas is very important for R.S. methods of coastal areas. Methodological aspects of relationship of time scale of processes of coastal water versus time scale of data acquisition have been introduced.

Friday, July 25, 1980, from 9.00 to 10.30  
Session 32 of Commission VII (Working Group VII/4)

Topic: Oceanography, Sea Ice  
Chairman: *Dr. K.A. Ulbricht* (Fed.Rep.Germany)

Presented papers:

*P. Lohmann* (FRG): Digitale Korrektur von Thermalaufnahmen von küstennahen Wasserflächen

Two methods of correction were discussed: 1) a method which uses a polynomial statement to transform the equivalent radiation temperatures obtained in the air to those which have been measured in-situ on the ground; 2) a method by which atmospheric corrections were carried out on the original data and then verified using independent control measurements on the ground.

*K. Strübing* (FRG): Application of Remote Sensing Techniques for Sea Ice Reconnaissance in the Western Baltic

The paper reported on the results of both Landsat-image interpretation and SLAR-image evaluation for sea-ice observations in the Western Baltic Sea during the severe Winter 1978/79. The SLAR was deployed by the DFVLR (Germany).

*A.P. Cracknell, S.M. Singh* (UK): The Determination of Chlorophyll-a and Suspended Sediment Concentrations for EURASEP Test Site, during North Sea Ocean Colour Scanner Experiment, from an analysis of a Landsat Scene of 27th June 1977

A detailed comparison between airborne data of the 10 channel Ocean Colour Scanner (OCS) and the "sea truth" data has been made at the IRC in Ispra to produce maps of suspended sediment and chlorophyll-a. The speaker described results of an analysis of Landsat data obtained from a pass over the same area of the North Sea. A detailed comparison between the results of the OCS work and the Landsat work were given.

*K.A. Ulbricht, U. Horstmann* (FRG): Landsat imagery of Phytoplankton Development in the Baltic Sea

The paper showed applicability of Landsat imagery for phytoplankton ecological investigations, especially for the variability of horizontal distribution of near surface plankton. Results of the interpretation of Landsat scenes of the Baltic Sea taken in various dates resp. phytoplankton development stages.

*W. Mücksch* (FRG): A verification trial of the coast morphology of sand embankment by surf waves from Landsat-imagery

A morphology of submarine sand embankment in mangrove deltas and estuaries was carried out by coordinate measurements from LANDSAT-imagery of band 5. The theory of waves and its characteristic surf formulas are applied to the morphological data to verify the influence of surf waves on the forms of sand embankments. By adjustment computation the best fitted model was found from which the surf period of waves can be derived.

Friday, July 25, 1980, from 11.00 to 12.30  
Session 33 of Commission VII (Working Group VII/4)

Topic: Oceanography, Coastal Zones  
Chairman: *Dr. K.A. Ulbricht* (Fed.Rep.Germany)

Presented Papers:

*U. Wieczorek* (FRG): Charakterisierung von Watttypen durch Bildstrukturparameter

The relief structures of the tidal land was investigated through digital filtering and digital analysis of the obtained pattern. The expected parameters of the structure of the images allow a simulation of morphometrical ground measurements and the characterization of the tidal land types. The basic material of the investigation were the aerial photographs 1:500 - 1:20 000.

*H.P. Bähr, E. Dennert-Möller* (FRG): Multispectral Classification of Tidal Lands from Landsat-scenes

The authors reported on methods and results of an experiment to map and classify tidal lands on the German North Sea coast. The methodical process in digital geometrical correction and in the classification (Maximum-Likelihood) was described and in the process the importance of the right choice of

suitable training fields and the support by experts who know the region well was pointed out. The obtained results were critically appraised.

*P. Lohmann, H.v.d. Piepen* (FRG): Evaluation of Ocean Bottom Features from Ocean Colour Scanner Imagery

An attempt has been made to obtain bottom features in a coastal area from airborne multispectral imagery. For this purpose OCS data taken of high tide above the Jake Estuary was compared with a hydrographic map as well as a Landsat image taken at low tide.

WG VII/4, which until now has been jointly and provisionally attended to by *Prof. Dr. Frassetto, Prof. Dr. Gierloff-Emden, Dr. K.A. Ulbricht* and *Dr. Romeo-Nedwed* should in future be led by *Dr. K.A. Ulbricht* as chairman.

*Dr. Frassetto* and *Dr. Gierloff-Emden* are kindly willing to continue to give *Dr. Ulbricht* advisory support as co-chairmen. This was announced by *Prof. Dr. Hildebrandt*, President of Commission VII, being the result of an exchange of views during the meeting.

Friday, July 25, 1980, from 11.00 to 12.30  
Session 34 of Commission VII (Working Group VII/8 and VII/6)

Topic: Interpretation Methods  
Chairman: *Prof. Dr. J. Talts* (Sweden)

Presented Papers:

*S. Ekenobi* (FRG): Multispectral Image Classification in Remote Sensing — The Class Boundaries Approach

The classifications were made on the basis of a simulated scene with assumed reflectance properties. Various classification algorithms are tested by data sampled in various ways. These findings are compared with those of a real Landsat scene.

The discussion concerned mainly the amount of computer time for the classification on the basis of simulated scene reflectances.

*J.L. Labradero, F. Palon* (E): Application of Principal Component Analysis to Soil Survey in Central Spain

This work analyzed the results of applying a principal component transformation to a subimage of a LANDSAT-scene which corresponds to an area in the geologic basin of Madrid, which is formed by a variety of tertiary and quaternary sedimentary deposits. The identification and discrimination of soil features, was done with the help of pattern recognition techniques provided by the interactive system ERMANN II.

*R. Streit* (FRG): Stand der Fernerkundung am Bayerischen geologischen Landesamt und Erfahrungen mit der Luftbildauswertung

The report informed about the present use of the stereoscopic evaluation of aerial photographs on routine basis and simple practices in photographic map plotting of the Bavarian geological office. In favorable conditions there is the possibility of carrying out a geological aerophotogrammetric mapping of geologically simple built areas. Structures

with sectional faults are particularly easy to identify.

*N. Opreacu, E. Mandescu* (R): On the Hardware and Software of the System of Processing and Converting Videoinformation

To achieve an analysis system of input, conversion and processing of remote sensing data available in Rumania some conditions such as versatility modulation, convenient changes of hardware, utilisation of existing components, economic aspects have been considered. These considerations result from the previous experiences, representing the viewpoint of users for the case of developing countries. The authors discussed a system which meet present requirements and possibilities.

*V. Calistru, N. Opreacu* (R): Regarding the Experience with Drawing up by Remote Sensing of Thematic Maps in Supervised Regime esp. in Deltaic Areas

The paper presented some observations and recommendations as a result of using LANDSAT data processing in supervised regime, utilization of the main components (Karthunen-Loève transformation) and other types of data compression and thematic classifications. Many examples are given regarding results obtained in areas with natural-deltaic zones, including interpretations of crops, excess of humidity, hydrology and pollution.

Discussion concerned the accuracy of the thematic mapping depending on the number of pixels forming the reference areas.

*M.F. Oudin, D. Chaume* (F): Une aide à la photo-interpretation des images LANDSAT

The A.C.P., resulting from the code of Karthunen-Loève, contains the essential information of the Landsat image and can ensure the required link between the work, the person working on the topic and the automatic classification. The study of the stability of the code allows the measurement of the extent of the validity of the interpretation key and the classification whose origin it shows.

Friday, July 25, 1980, from 14.00 to 17.30  
Joint Session of all Commissions  
prepared by Commission VII

Topic: Remote Sensing from Space in the 1980's

Chairman: *Prof. Dr. G. Hildebrandt* (Fed. Rep. Germany)

Moderator of the Panel Discussion:

*Prof. Dr. G. Konecny* (Fed. Rep. Germany)

Invited Papers were given to describe the importance and the prospects of remote sensing from space in the 1980's.

Four papers dealt with aspects of future space technology (sensors and platforms), three papers summarized the present status of evaluation and interpretation of spaceborne remote sensing data and imagery.

*J.V. Taranik and P.G. Thome* (USA): Development of Space Technology for Resource Application in the 1980's

The resource observation program within NASA's Office of Space and Terrestrial Applications conducts research and develops technology for space related observations of the Earth. The program has three interrelated elements which address national and global needs. The Renewable Resources program is largely aimed at improving agricultural assessments through a program called Agristars. The Non-Renewable Resources program is directed towards improving the effectiveness of global assessment and exploration for mineral and energy resources. The Geodynamics program is focussing on global observations of crustal plate stability or deformation, earth rotation, and polar motion. A detailed review of NASA's platform and sensor projects and developments were discussed as well as experimentally developed space systems which are tested in space using the Shuttle or free-flying satellites.

*N.L. Makarenko and Y.P. Kienko (USSR): Remote Sensing of Natural Resources in the USSR*

A vast program of natural resources exploration by space and aerial remote sensors is carried out in the Soviet Union. The territory of the USSR is surveyed from "Salut" manned space stations, "Sojuz" space ships, "Meteor" and "Cosmos" automatic space apparatuses, as well as from AN-30 airborne laboratories. Technological details or specific plans for the forthcoming decade were not mentioned.

The utilization of remote sensing data provides in the USSR important scientific and practical results in the field of mineral resources exploration, forestry shelf exploration etc.

*M.L. Reynolds (F): Optical Imaging Instruments for ESA Remote Sensing Programs*

European efforts are directed

a) to the further development of the Earthnet, which comprises data reception and preprocessing facilities in Europe that acquire, distribute and archive satellite remote sensing data;

b) to the participation in Spacelab missions with special emphasis to the tests of a metric camera system and a microwave remote sensing experiments (MRSE);

c) to the development of European operational Satellite systems (COMS, LASS) with optical imaging instruments as well as SAR and Scatterometers as sensor candidates.

Special French and German developments were introduced by Fontanel and Schlude during the panel-discussion (see below).

*F.J. Doyle (USA): Earth Orbiting Remote Sensing systems for the 1980's*

A systematic critical and realistic judgement of the sensor systems assigned or under development for future Shuttle or Satellite missions was given. Doyle considered the probabilities of their realization, discussed and compared economic and technical aspects as well as the parameters of expected data and images. Examined were Landsat D and the thematic Mapper, Stereosat and Mapsat, Metric Camera Systems, Microwave Sensors, the expected European (ESA, France, Germany) and the Japanese Sensor systems.

*J.A. Howard (I): Towards a World Index of Space Imagery*

The need for a quick reference data base on the source of worldwide available aerial and outer space imagery has become increasingly apparent in recent years, particularly for those concerned with natural resources surveys and management. With this in mind, FAO has held two expert consultations (1977, 1979). The paper reported on the findings of the consultations and outlines the measures needed to provide a world index of space imagery (WISI). Reference was made to the final report of the expert consultations.

*R.M. Hoffer and P.H. Swain (USA): Computer Processing of Satellite Data for Assessing Agricultural, Forest, and Rangeland Resources*

The quantity of data produced by multispectral scanner systems from satellite (or even aircraft) altitudes clearly indicates the need for effective computer-aided analysis techniques. Significant progress has been made in developing and refining a variety of techniques for processing and analyzing such data.

Basic aspects of computer processing of MSS data including preprocessing, enhancement, and in the main classification have been discussed. A systematic overview of classification methods and recent developments in this field were given. Special consideration was given to the use of ancillary data as part of the classification process. The ECHO algorithm and the layered classification technique, which appear to be particularly important for effective analysis of earth resource features, were described. The paper concludes with a look to the future of remote sensing data collection systems and analysis techniques.

*R. Mühlfeld (FRG): Bilanz über den Einsatz der Satellitenfernerkundung in den Bereichen Geologie/Lagerstättenuche, Hydrogeologie, Bodenkunde/Landnutzung im Rahmen von Projekten der Bundesanstalt für Geowissenschaften und Rohstoffe Hannover (B.G.R.)*

Since the advent of satellite remote sensing data the BGR has successfully used such data in a lot of research as well as development-aid-projects in various African, Asian and South-American countries. Both analogue and digital interpretation methods have been applied. The paper illustrated with a set of examples the importance of satellite information in deposit and groundwater reconnaissance, geology, hydrogeology, soil mapping as well as vegetation and land use inventory.

Multispectral (including IR) data have been proven as important and multitemporal data very often as indispensable especially for multidisciplinary reconnaissance, inventory and monitoring of natural land resources.

#### *Paneldiscussion on Remote Sensing from Space*

Moderator: *G. Konecny (Fed.Rep.Germany)*

Panelists: *J.V. Taranik, NASA Headquarters, USA*

*R. Hoffer, Purdue University, USA*

*F.J. Doyle, U.S. Geological Survey, USA*

*I.T. Antipov, USSR*

*M.L. Reynolds, ESA*

*J. Howard, FAO*

A. Fontanel, I.F.P. France  
 S. Murai, University of Tokyo, Japan  
 F. Schlude, DFVLR, Fed. Rep. of  
 Germany  
 R. Mühlfeld, Federal Agency for Geo-  
 Sciences and Resources,  
 Fed. Rep. of Germany

The discussion was introduced by three short presentations of national programs which were not especially mentioned in the presentations:

*Dr. Schlude* mentioned the German participation on the Space Shuttle experiments. ATLAS as a metric camera experiment for cartographic applications, MOMS (modular optoelectric multispectral Scanner) and a SAR microwave sensor are planned and under development for the first Space Shuttle mission.

A free flyer with a MOMS or a Camera-system to be launched with further Space Shuttle missions is under preparation.

*Dr. Fontanel* reported that in the national program of France main efforts are concentrated on "the development" of the SPOT system with contactual participation of Belgium and Sweden. The satellite will be equipped with high resolution sensors in the visible and near infrared (spatial resolution of 10 m in the panchromatic mode and 20 m in the multispectral mode, resp.). High rates of repetitive ground cover and acquisition of stereo information will be possible. Two launches with ARIANE rockets are already approved (first for 1984), two further satellites are planned. For preparation and training purposes a SPOT simulation program on the basis of airborne MSS data will be carried out. Costs of data acquisition and pre-processing will be shared with the users.

As *Dr. Murai* explained, Japan plans the launch of 3 Main Observation Satellites MOS in 1984, 1985 and 1989 which will be equipped with a four-band scanner (vis. and NIR), a multiband radiometer (vis. and TIR), and a scanning microwave radiometer. MOS-3 will probably be complemented by a SAR system.

In addition to this program 2 Land Observation Satellites LOS are scheduled for 1987 and 1991 equipped with multiband radiometers and stereo-cameras. LOS-2 will have an improved ground resolution and an air pollution detector.

The panel discussion was then followed by five questions:

*First question:* Which are appropriated platforms for future space missions?

Schlude: Federal Republic of Germany has decided to take part in the Space Shuttle Program. Development of new sensors (Metric Camera, Microwave Experiment, MOMS) bases on applications in SPACELAB missions three flyers are required for related operational applications. At this time no decision is possible whether the Shuttle or the Ariane will be used as platform.

Taranik: Experimental studies can be carried out at relatively low costs with aircrafts, and tests in the space environ-

ment with the Shuttle. In operational projects if repetitive cover up is required free flyers must be used.

Antipov: Depending on the special purpose different kinds of platforms are used in the Soviet Union including unmanned and manned satellites. No standard platform which covers all requirements. The Shuttle experiment is watched with high interest.

Reynolds: As a general answer: the best platform is the cheapest one, more money remains for instruments and experiments. The shuttle brings restrictions in life-time — 2 years life-time expected — and area coverage. Five-synchronous free flying platforms are necessary for operational programs.

Doyle: Preference for free flyers. Cost reduction by using renewable or multission spacecrafts. Continuity and repetitive coverage are the main advantages of the free flyer (but not approved by NASA?) as platform for vis. I.R. Radar, CCD's.

*Second Question:* Which sensors are the most important or most appropriate?

Taranik: The reflective portion of the spectrum is the most informative, especially for topographic mapping and multispectral analysis. Thermal infrared and radar can provide complementary information but will not replace the other data. Improvements expected in solid state imagery technology and microwave technology.

Schlude: In the case of Germany a boundary condition exists: existing systems as multispectral scanners must be used. Efforts in the development of new instruments are focused on the metric camera in the visible range and of the microwave experiment which will be used in addition to MSS.

Doyle: In the spectral portion covered by the human eye the maximum of information is transmitted. Radar if only used as all-weather substituted for photography would be too expensive.

More efforts are required in order to develop other applications of this technology. In spite of the all weather capacity of Radar sensors, they cannot replace sensors in the visible and IR-Range of the spectrum.

Fontanel: Decision was made in France for systems operating in the visible and near infrared in order to achieve as soon as possible operational instruments. Radar technology is not yet in this stage.

*Third Question:* What does the user expect from Remote Sensing systems?

Mühlfeld: Problems will arise if the USA shares the total costs of future programs with the users of the data because developing countries where resources are to be explored and environmental damages are to prevent have not enough money. Further problems will arise if the sensor data will only be transmitted via data relay satellites to receiving stations in the United States and cannot be directly received in other countries by e.g. mobile stations. With a clear atmosphere Landsat images are in many cases sufficient. Radar should provide additional data if the sky is covered by clouds. With improved spatial resolution some kinds of mineral deposits could directly be detected and differentiation between soil types which are more or less suitable for agriculture could easier be prepared.

Hoffer: The problem is not the principal availability of data but the accessibility of data of good quality for special purposes, e.g. crop yield estimation. Concerning the type of sensor we are not in an either/or situation. Different types of sensors will provide useful complementary information. For the future the development of appropriate data bases as resources information system seems to be necessary.

Howard: For the detection of crop conditions, yield estimation, etc. in agriculture a resolution of 10 m is derived.

Konecny: For standard cartographic products mapping with 5 m photographic resolution is required. This would suppose pixel sizes of 2 m and an evaluation accuracy of 20 m. Presently not only the sensors but also the data processing units do not allow this accuracy because of the limitations in the the data transmission rate.

Fontanel: The French SPOT system was a spatial resolution of 10 m in the panchromatic mode and of 20 m in the multispectral mode and disposes of the stereoscopic capability so that photogrammetric methods can be applied for the data evaluation. Moreover a potential index repetition rate of 2.5 days is given through a movable mirror. For an optimal use of the data not only the satellite system must be operational but also the data dissemination system.

Doyle: Standard cartography products should be of a high quality. Short

time period between data acquisition and availability is not so important for high developed countries where all things are already well mapped but for developing countries where actual informations often are missed.

Antipov: The Soviet Union is involved in the preparation of international programs e.g. for mapping purposes and resources detection. Co-operation with scientists of their countries, participation in manned space flights in which photographs of areas of those countries are taken with a ground resolution of 50 m and better.

*Fourth question:* Should space efforts in Remote Sensing be national regional or worldwide by international cooperation?

Howard: All kinds of efforts are required. FAO/United Nations are involved in multinational projects.

Reynolds: ESA agrees with international cooperation. There exist some practical problems, one of them is the time which is necessary for the preparation and the conduction of international program.

Fontanel: International cooperation is necessary in order to share the costs and to include the technical experience and capability of other countries. Also the data should be made available to other countries to have an optimum utilization of the system.

Taranik: NASA agrees with the international level of cooperation. It is important to realize one of the efforts concerning the availability of the data and to avoid if reasonable redundant projects connected programs. Competition is healthy.

Konecny: International cooperation is necessary, national programs cannot cover all requirements.

*Fifth question:* How can the application of Remote Sensing be introduced? Is training needed?

Murai: Training courses are organized since three years for people of the Eastern Asia Countries. The problem is to unify the education background. The program started with courses of three weeks, but they are now extended up to two months. An easier understandable text book is necessary.

Hoffer: Several levels are needed for educational programs. Workshops must be organized to define the true state of the art and the capabilities of the system.

*Open discussion:*

R. Frassetto (I):

The application of microwave systems is necessary to overcome the difficulties produced by the high degree of cloud coverage in Europe. The thermal infrared spectral range is very important in connection with investigations of climatological problems. More attention should be given to oceanography.

O. Hofmann (FRG):

A spatial resolution of 2m as required in the panel discussion for standard cartographic products can presently not be realized and is probably not really necessary. The demand to have 3 pixels per line pair is based on the requirements for grid resolution. But the main elements in cartography are lines etc. Further discussions are necessary. The experience with Landsat images shows that phenomena could be identified which are below the theoretical resolution limits.

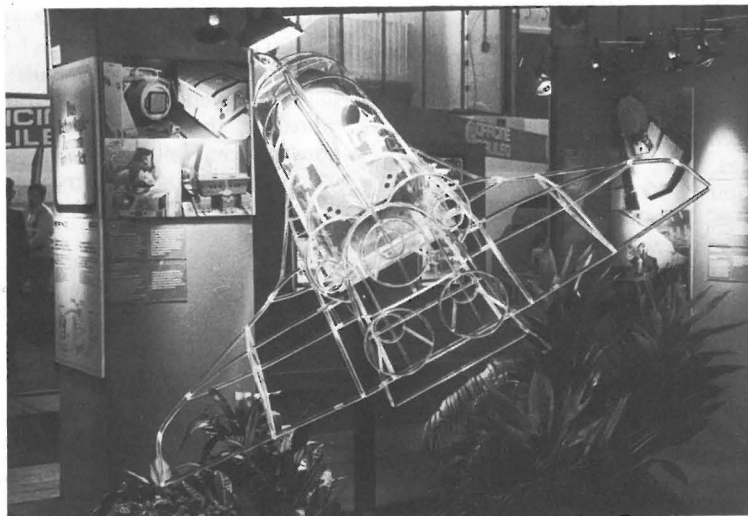
J. Hothmer (FRG):

The congress should propose a certain number of space missions for cartographic purposes in order to trigger the various organizations which are responsible for future programs.

G. Agarwal (India):

The congress should unify the Indian space program which includes a large number of activities as well in development of system as in the application of remote sensing. Developing countries cannot pay the cost for mapping and resources exploration. They must be supported by the industrial countries and international organizations.

At the end of the session *Captain R. Thorén* (S), the senior of the participants who celebrated his 85th birthday during the congress expressed his thanks to the commission and the congress organizers for the condition of this successful conference.



The Spacelab model in the Technical Exhibition



Aircraft Exhibition