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**1. PRACTICAL APPLICATION
OF PHOTOGRAMMETRY**

Productive implementations of photogrammetric method in Poland are connected with production of topographic and large scale maps and with data bases for GIS/LIS. Demands for new maps may be still observed, however growing needs for updating of existing maps are also noticed. Such works are performed mostly by means of conventional methods, or with the use of analog stereo plotters equipped with numerical output interface.

After over ten years of rather low activity of practical implementation of photogrammetry, now again can be noticed some new projects.

Thanks to the efforts of Principal Surveyor of the Country at his office a laboratory supporting practical photogrammetric applications was organised. Equipped in very modern Kodak/Hostert line (thanks to the Japanese government financial support) for automatic processing of aerial black and white and colour films the laboratory can service all civil aerial photographic projects. From 1995 in the frame of Phare European program Poland has got financial means for covering all country territory with aerial photographs of the scale 1:26000 (colour diapositives) treated as a base for the new digital map and orthophotomap of the accuracy being equivalent of 1:5000 topographic map. At present over 20% of the country area has already been covered with the new aerial pictures. There is also another big photogrammetric project just started. It is 1:5000 aerial pictures for the 18 biggest cities, which will serve as a basic for the high accuracy municipal data bank. And the third big aerial project, that time paid by budget, it is 1:20000 aerial colour diapositives for the highway design. It is planned, that during coming 15 years (1995-2010) some 1.300 km of new highways will be build in Poland by private developers; in the 15% of the project price covered by the government there will be also costs of aerial photographs.

At the Centrum for Cartographic and Geodetic Documentation full line for orthophoto production was installed thanks to the Japanese financial support. That line Helava-Leica consist of DSW 2000 scanner DPW 770 photogrammetric workstation and photomap plotter Scitex. The first colour orthophotomap 1:5000 and smaller scale were successfully produced recently.

Except of those three main aerial photogrammetric projects there were some smaller local projects concerning large scale mapping for urban planning and cadastral needs.

Except of the older analog plotters modernised for the needs of digital map, in the civil laboratories two analytical Zeiss stereoplotters (P1 and P3), two high performance digital stereoplotters (Leica DSW 200 and Howtek 4000), one DVP of Leica, and several other PC based digital stereoplotters: Digital Video Plotters developed at the University of Mining and Metallurgy in Kraków, and used for training and map updating.

Close range photogrammetry covers mostly deformations measurement and recording of historic monuments, also with the use of digital stereoplotter VSD.

2. RESEARCH AND DEVELOPMENT

- a) At the University of Mining and Metallurgy in Kraków
- Geographic Information System for monitoring of environment of Krakow region being under heavy ecological hazard was developed covering ca 40x40 km area (IDRISI, GRASS, ERDAS),
 - The Video Stereo Digitizer as a LIS subsystem was analysed and technical & productional aspects of its use in vector and digital raster environment coexistence in the system were successfully defined,
 - The analytical and numerical methods of multistational photogrammetric terrestrial pictures were compared and classified (ORIENT),
 - The ground soil moisture study with the use of remotely sensed images and the thermal inertia model were performed,
 - The improvement was achieved in photogrammetric methods of determination of geometric parameters and deformations of constructions and industrial installations,
 - Methods of currant data updating for mining-geological digital model of an open pit based on remote sensing recording were further developed,
 - Improvement was made in photogrammetric recording of historic monuments by introducing non-metric cameras, ORIENT terratriangulation system and digital stereoplotter VSD,

- A study of effectiveness of classification of multispectral satellite images with the supporting use of parameters describing image texture was executed successfully,
 - A SCOP system applicability to the production of elevation thematic layers for GIS/LIS was confirmed in the research project, considering the 5x5m regular elevation points net and surface noncontinuity lines.
- b) at T.U. Warsaw
- The analytical plotter P3-Zeiss was purchased and is used for training of students and for research
 - The Intergraph Image Station was purchased and SPOT images were used for creation of digital map of soil for Poland
 - The technology for digital recording of historical monuments of architecture was elaborated
 - Successful experiments with the use of real-time GPS for projection centres recording for aerotriangulation were completed
- c) at Agricultural Technical Academy Olsztyn
- A PC program for DTM automatic generation using digital stereopares was elaborated
 - A PC program for digital orthophoto generation was produced
 - A PC digital visual system employing CCD camera and AGEMA 88 thermal camera was developed
 - A close-range digital off-line photogrammetric system was elaborated.
- d) At the Institute of Geodesy and Cartography in Warsaw, Photogrammetry Department were developed:
- A technology with use of GPS data recorded on a aeroplane during a flight. Block adjustment with PAT MR-GPS.
 - Videogrammetry technology for environmental studies.
 - DEM generation on the PS-1 Planicomp ZEISS and HIFI 88 software
 - DEM generation digitally using MATCH_T and ImageStation 6487 Intergraph /PRI²SM of I²S/DATRON.
 - Orthophoto generation digitally on ImageStation 6487 and PRI²SM I²S.
 - Technology for satellite image mapping up to the scale 1:10000 on the basis of merged KVR-1000 with SPOT XS, KFA-1000.
 - Technology of hard copy printing on IRIS
 - Technology for topographic map updating in the scales 1:50000 and 1:25000 digitally on the basis of satellite high resolution Russian photographs KFA-1000 and KVR-1000.
- e) At the Remote Sensing and Spatial Information Centre of the Institute of Geodesy and Cartography in Warsaw were developed:
- Remote sensing based system of dynamic grassland soil moisture determination and yield forecasting
 - The use of ERS-1 data for forest damage assessment
 - Soil moisture and evapotranspiration for crop yield assessment based on ERS-1 data
 - Large area operational experiment for forest damage monitoring in Europe with the use of Satellite Data (LAROE)
- The use of satellite remote sensing and GIS technology for forest monitoring
 - The use of the satellite imagery for the revision of topographic maps
 - Construction work on radiometers for ground truth measurements in the microwave frequency range serving to interpret ERS-1.SAR pictures
 - Stratification of the Polish Territory based on satellite photographs as a source of multi-purpose studies of environment.
- g) at Agricultural Academy Wroclaw
- An aerophotographic hydrologic documentation of Wisła river (from Oświęcim to Tczew) at the lowest in the last century water level (1992) was elaborated.
- h) at State Enterprise for Geodesy & Cartography Warsaw
- During last 10 years the photointerpretation technique is being successfully applied for creation of digital thematic maps for urban and agricultural planning, for environment protection needs and for special use by the great industrial plants and mines. Those thematic maps are produced with the scanned topographic maps in the background utilising Micro Station and I/RAS B. Hard-copies are produced with the use of HP Design Jet 650c. Usually aerial pictures 1:5000 to 1:18000 are used to produce thematic maps 1:1000, 1:2000, 1:5000, 1:10000, 1:25000.
- i) at Warsaw Geodetic Enterprise
- a LIS program DIGMAPA was elaborated to speed up the digital map production in the Micro-Station environment. The new packet makes digital map production more reliable, much faster than with the use of Micro-Station alone and makes possible automatic vectorisation of several very difficult map details (roads, stairs, escarp, etc.).
 - a LIS program InterSEG was elaborated for cadastral purposes. The packet works with the use of ORACLE data base and uses Micro Station environment for cartographic purposes. The solution allows for interactive use of both programs connected on-line, and for the utilisation of data stored in another cadastral systems.

3. EDUCATION

Photogrammetric education for geodesists and surveyors is given in Poland in the following three different levels:

- 1) high school or technical college - for Survey Technicians
- 2) post high school education of 4 years for Bachelor of Surveying (technology level)
- 3) university of 3.5 years for Engineer of Surveying and of 5 years for Master of Surveying.

The primary and middle level of photogrammetry is provided at 28 technical schools. The university education in the field of surveying and geodesy is provided at 2 technical universities and at 3 agricultural universities and at the military academy. There is one faculty devoted purely to geodesy and cartography, and

others combine geodesy with environmental protection, meteorology or drainage and other agricultural specializations. Yearly, about 500 students begin study in all above mentioned universities. But only about 30 students specialize in photogrammetry and remote sensing, and only 15 students is graduated yearly. The scope of photogrammetric education is carefully adjusted to fulfill the needs of passive and active photogrammetrists. Also foreigners are educated at the university level. We have students from some Asiatic and African countries.

The photogrammetric and remote sensing university and research staff is following: 5 professors, 4 associate professors, 35 doctors.

The university studies in geology, cartography and geography include photogrammetry and remote sensing courses also.

4. PROFESSIONAL SUBJECTS

Two main professional organizations for photogrammetry and remote sensing are active in Poland:

POLISH SOCIETY OF PHOTOGRAMMETRY AND REMOTE SENSING (PSPRS) - is the scientific section of POLISH GEODETIC ASSOCIATION (SGP). The activity of PSPRS began in 1930. In 1984 PSP took name PSPRS. The area of activity of PSPRS is Poland PSPRS continues the activity of PSP which was interrupted in 1939.

The aims of PSPRS are:

- a) activity in the field of photogrammetry and remote sensing together with various technical application,
- b) popularization and promotion of photogrammetric and remote sensing methods in different scientific and technical fields,
- c) exchange, publication and circulation of information within the country and abroad.

The supreme authority of the Society is the General Assembly. The General Assembly consists of all members of the Society, and every three years the President and, by the separate voting, the Council of the Society are elected.

The number of active specialists in the Society is about 150. PSPRS is a member of the Main Technical Organization in Poland (NOT- it is federation of scientific, and technical associations).

Legislative basis of the professional activities of PSPRS is statues law issued 27 October 1932 (Dz.U.R.P. Nr 94, poz.808) and amended 9 June 1982 (M.P. Nr 17, poz.144).

Main Technical Organization (NOT) and Polish Geodetic Association (SGP) have established the awards (monetary grant) to the author of outstanding merit also on photogrammetry, photointerpretation or remote sensing.

POLISH GEOGRAPHICAL SOCIETY (PTG) - THE CLUB FOR REMOTE SENSING SPECIALISTS is active in Poland on the basis of PTG Statutes.

The objective of the Club is the activity on photointerpretation field particularly for searching geographical environment. The number of members of the Club is about 30. They are members of PTG.

Polish Society of Photogrammetry and Remote Sensing and The Club for Remote Sensing Specialists of Polish Geographical Society established a common consulting body to improve the cooperation.

Actual changes in the professional activity of photogrammetry and remote sensing specialists as well as changes within the organization of associations, will possibly change the number of members as PSPRS as The Club for Remote Sensing Specialists of PTG.

5. BIBLIOGRAPHY

During period 1992-96 there were published some 200 scientific and technical papers.

In 1994 it was agreed among Polish Society for Photogrammetry & Remote Sensing, Polish Geographical Society - Club for Remote Sensing, cartographic and photogrammetric sections of the Committee for Geodesy of Polish Academy of Science and Cartographic Section of Polish Geodetic Association, that an editorial series „Archives of Photogrammetry, Cartography and Remote Sensing” is being established for the use by those organisation to publish various materials, also those papers which are presented during pertinent symposia and conferences in Poland.

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