APPLYING PHOTOGRAMMETRIC METHODS TO THE CREATION OF A STATE CADASTRE OF REAL PROPERTIES AND GEOGRAPHIC INFORMATION SYSTEM IN THE CZECH REPUBLIC

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PURPOSE: Automated Information System of Geodesy and Cartography of Czech Republic consist from three relatively self-sufficient information subsystems (SS). Digital cadastre is the main SS - it is formed by two interconnected information files (IF): IF digital cadastre map (DMK) and IF Evidence of Real Estates (ERE). IF of DMK is supplied by the data obtained from aerial photographs plotted by the use of numeric, analytic and digital photogrammetric methods.

KEY WORDS: GIS/LIS, Cadastre, Photogrammetry, Analytical, Accuracy

Return of legal rights after the 'velvet revolution' of '89 in Czechoslovakia has given a new not only technical but also political aspect to the project of Forming of an Automated Information System of Geodesy and Cartography (AISGK) [1]. Renewal of cadastre with its proprietary relations has its primary goal in forming a tool for a righteous restitution of real estates owned before the communist rule by citizens and to a legal taxation system of the state. It includes also informations about basic geodetic data, interconnection of East and West European nets and unification of European Datum. In the case of topographic maps it should solve data exchange in the boundary region of formerly divided zones of superpowers.

The new conception of the AISGK respects the prepared legal conceptions of the state [2], [3], [4] and reflects the future State Information System of the Czech Republic (SIS CR). This SIS CR is based on four source registers (information systems) of primary data (Fig.1). Uniform localization will be secured by the AISGK, especially in its function named "Register of Real Estates". This is specified by its main identifiers, namely space coordinates and lot numbers. Uniform identification of natural and juridical persons will be secured by the Register of Inhabitants and Register of Organisations. The Register of Territorial Identification divides in an uniform way the state territory division into territorial- administrative units. This register serves in regions simultaneously as Register of Buildings whose basic identifier is the uniform series of space unit numbers on the territory of the Czech Republic as well as uniform series of building numbers in separate regions.

From the point of view of SIS CR creation the goal of the AISGK forming is unified computerized 'source' geodetic and cartographic data base of primary informations as a source layer not only of the SIS CR, but of all localization information systems of other branches and state administration with aggregated data and of cartographic works in the Czech Republic. This means they will form a 'source' layer of step-wise created geographic and land information systems (GIS/LIS) on the territory of the Czech Republic [5] - [8].

The project of the AISGK supposes that the AISGK will consist of three relatively independent information subsystems. These will be mutually interconnected by a superimposed interfacing database file as well as by a software environment. (Fig.2)

1. Subsystem of geodetic coordinates consisting of spatial data (trigonometrical, levelling, and gravimetric) nets of fixed points covering the entire state territory by which an unified system of spatial coordinates and gravimetric data in an uniform projection is defined.

2. Subsystem of digital cadastre formed by two interconnected information files:
   - Information File of Localization (digital cadastral map DMK),
   - Informational File of Evidence of Real Estates (written cadastral documents).

3. Subsystem of topographic information which will realize a localizing basis to create a digital medium scale topographic map. Primary testing data acquisition and securing of necessary connections to above mentioned subsystems will play main part in this case.

Common matter of these subsystems is represented by identification and classification of individual objects. There is one very important task which is given by setting of binding data interface to secure information flow between information systems of interest as well as possibility to access public data network (PDN, or VDS in Czech). Simultaneous solution of relevant software for interactive graphical data acquisition and data base administration is demanded to forming of the AISGK as well as necessary technical means, i.e. applied geodetic, photogrammetric, and cartometric methods. A considerably substantial part is expected to be shared by remote sensing methods.

The work on the AISGK started due to its social importance by the solution of the subsystem of
REGISTER OF INHABITANTS
REGISTER OF ORGANIZATIONS
SIS ČR
STATE INFORMATION SYSTEM OF THE CZECH REPUBLIC
 Registrar of Territorial Identification

LEGEND:
 INFORMATION SOURCE SYSTEMS (PRIMARY DATA)
 INTEGRATED INFORMATION SYSTEMS (AGGREGATED DATA)

Fig.1. Outlines of the SIS ČR

AISGK
SUBSYSTEM OF GEODETCIC COORDINATES
SZBP
SUBSYSTEM OF DIGITAL CADA斯特
DIKAT
SUBSYSTEM OF TOPOGRAPHIC INFORMATION
STI

Fig.2. Outlines of the AISGK
The analog method is realized on stereophotogrammetric instruments as Stereometrograph and Topocart of C. Zeiss Jena. Plotted data are on-line registered on PC's (by an application program, e.g. FORS). Analytic block adjustment is realized on precise stereocomparator Stecometer of C. Zeiss Jena with direct output of a PC. The analytical method will be realized on the analytic evaluation system InterMap Analytic of Intergraph with possible direct data processing software MicroStation using I/SCAN program packet MGE (MicroStation 21) and 3.3 for PC and MS DOS operation system. To secure uniform technical solution of workstations by an application of the data base system DBase IV preceded by the integrating system MicroStation using IMAN subprogram.

Digital photogrammetry should be applied especially during proprietary relation renewal to real estates in connection with the renovation of cadastral cadaster.

The present written documentation of the Evidence of Real Estates includes informations about 12 millions of lots in 13 thousands of cadastral units and about approximately 2 millions of inhabited buildings. These data were in the past updated continuously by batch processing on mainframes. This documentation is oriented mostly to user's relations to real properties [13]. Proprietary relations, especially in such cases when lots were used during the past rule by so called socialist organisations, can be documented on the basis of original cadastral maps. These were successively devastated and at about 4 % of them completely destroyed after 1945. Nevertheless in some regions where for reasons of lack of time or economy the updating of cadastral maps by new survey is not possible, these old cadastral maps can be confronted with existing maps of the Evidence of Real Estates. Even if old cadastral maps are mostly in the 1:2 880 scale and each cadastral unit means an isolated coordinate system, transformation of their data into the maps of Evidence of Real Estates is possible, e.g. using identical cross sections of individual map sheets of cadastral data. There does not exist any possibility of direct transformation of their content to unified coordinate system and projection using identical points that can be determined on the spot.

This possibility was tested by digital photogrammetry. Raster image of an aerial photographs of a respective territory (its reality was proved at the 800 lines/inch) can with the software I/SCAN by Intergraph first transform by control points to the uniform coordinate system (on a graphical station this lasts nearly 50 second) and then with the help of tested identical points of situation of old original maps and the photograph of the terrain transform locally the whole information of these originally graphical maps into the photograph. This is the way how continuous work with the data base of original maps content can be processed. Even more other various thematic layers (e.g. results of land consolidation) can be connected to the content of original maps. And relatively quite exactly the original proprietary boundaries of lots can be identified on graphical workstations and digital cadastral map (coordinate cadastre).
We are well aware that a stepwise realization of the whole project of the Automated Integrated System of Geodesy and Cartography will be possible in the present conditions of the Czech Republic only with active cooperation with specialist of the most developed countries of the world. We are really very thankful for such helping hands, in these days especially to the American Intergraph Corporation. Our research facilities will try to transform all gained knowledges to technical help to practical use. We want to concentrate ourselves mostly to technical items (as software and hardware), technologies, organization, legislation, and economy [14]. Our main problem will be external and internal coordinations of systems. It is very essential to prevent in present stay of transition to free trade and rebirth of private property in our land to prevent any disturbance and secure optimal conditions to effective data exchange that plays an important economic role. The primary and also very urgent task is to define and agree to necessary standard, first of all exchange format of object oriented data.

**DIKAT**

Digital Cadastre of the Czech Republic

**Table 1**

<table>
<thead>
<tr>
<th>Accuracy Class</th>
<th>Control Points</th>
<th>Detailed Planimetry Points</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(X_Y)</td>
<td>(Y_Y)</td>
</tr>
<tr>
<td>3</td>
<td>0.06 m</td>
<td>0.14 m</td>
</tr>
<tr>
<td>4</td>
<td>0.12 m</td>
<td>0.26 m</td>
</tr>
<tr>
<td>5</td>
<td>0.20 m</td>
<td>0.5 m</td>
</tr>
</tbody>
</table>

Parameters of applied aerial photographs (of 23 by 23 cm format) are given in Tab.2.

**Table 2**

<table>
<thead>
<tr>
<th>Accuracy Class</th>
<th>Image scale</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(f = 88 \text{ mm or} 152 \text{ mm})</td>
</tr>
<tr>
<td>3</td>
<td>1:3400</td>
</tr>
<tr>
<td>4</td>
<td>1:6800</td>
</tr>
<tr>
<td>5</td>
<td>1:13600</td>
</tr>
</tbody>
</table>

Forward overlap is 80 %, side overlap is 30 %.

![Fig.3. Outlines of software configuration of DIKAT subsystem](image-url)
References:


[9] Intergraph: Prospects and Manuals


