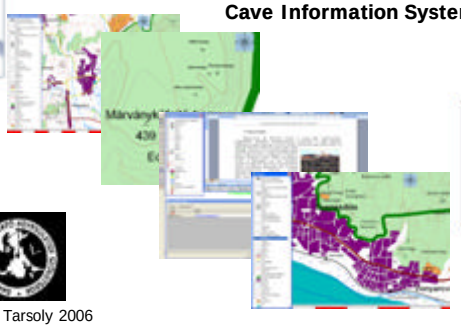
Cave Information System



Peter Tarsoly 2006

Introduction

- 1999-2002: BSc studies at the Faculty of Geoinformatics, University of West-Hungary.
- 2002-2005: cadastral surveying, DigiCart, Budapest.
- 2005-: Department of Geodesy, Faculty of Geoinformatics, University of West-Hungary.
- I am dealing with cave surveying and mapping from 2001, in the „Styx Cave Exploring Sport Club", in Balatonederics, in the Keszthely-Mountain.

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- Positioning of cave entrances
- Surveying the underground world
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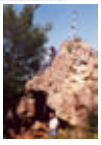
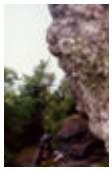
Determination of cave entrances

- Using GPS.
- Identification of entrances only with sub-meter accuracy.
- Measuring 300 cave entrances in the National Park of Balatonfelvidék with four GPS-receivers:
  - Leica-500
  - Trimble ProXr
  - Magellan Tracker
  - Garmin Etrex.

Determination of cave entrances

- The optimal measuring time: 10 minutes.
- Coordinate computation with code-method using broadcast ephemeris.
- Set up the receiver insofar high, as possible because of satellite visibility.
- Between the WGS-84 and the Hungarian EOV, it was relevant to use same general transformation parameter set for the whole area of the Balatonfelvidek.
- The accuracy of the navigation receivers was not sufficient to determine the positions of entrances.



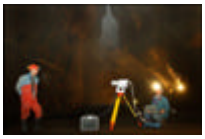


Surveying the underground world

- The wide-used instruments are the traditional instruments, like tape, compass and theodolite.
- Traversing, polar surveying.
- Adjustment and error calculation is needless.

Surveying the underground world-the future

- **Laser scanner:**
  - thousands of measurements per seconds
  - the accuracy of angle-measuring is +/- 60 micro-radian
  - the accuracy of the distance-measuring is in average +/- 6mm/50m
  - we can adopt the values in a three-dimensional studio
  - easy to make a digital terrain model
  - only their cost and size make limitations on their permeation.



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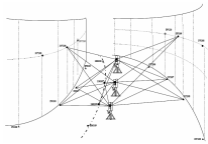
Surveying the underground world-the future



- **Smart Station-total station combined with a GPS-receiver :**
  - development of the GNSS-infrastructure
  - measure the representative points of the close range areas of the entrance
  - no need for control points, using RTK GPS we can carry out the procedure of the control-point densification
  - determining the coordinates of a single point takes only a few minutes
  - when the cave is not too narrow, total station may be used under the ground
  - own programs for the surveying.

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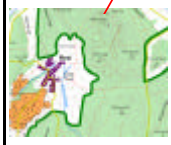
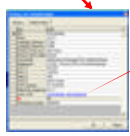
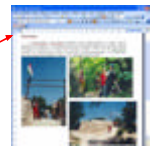
Map making

- **Planar visualisation of cave-map, like a cadastral map, shows the reality in scale.**
- **We favour the three dimensional mapping methods, or plan-maps with many attribute data's.**
- **The wide-used cave maps:**
  - cross-sections and different views
  - projection to one or more vertical plan
  - 3D visualisations
  - isometric and axonometric method:
    - replace the cave-arms with prism
    - by hydrotermical caves with ball-chambers.

Building the complex information system





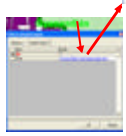


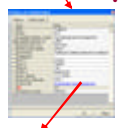
- **It comprises geometrical data and attributes.**
- **The systems are capable for publishing them in the Internet, so they can serve as a basis of user demands, from the scientific interest to the tourist claims.**
- **Two steps:**
  - shaping the map
  - compiling the descriptive data.

Building the complex information system

- **Shaping the map:**
  - choose a good basic map
  - the most capable for this exercise are the Hungarian topographical maps in the scale of 1:25 000
  - scan it with a professional scanner
  - digitalize the map elements
  - collecting all important attributes.

Building the complex information system





- Compiling the descriptive data:
  - The most important part of the information system
  - information not only about the caves, but about the towns, villages, hills and natural sights
  - All cave-table contain the following:
    - cadastral number of the cave
    - the name of the cave
    - length and deep
    - name of the researcher spelunker club and the year of the last research
    - type and age of the rock
    - other ethnographical name of the cave
    - Comments
    - Grid coordinates and height
    - Geodetic coordinates
    - description, photos, maps. ...

Acknowledgement

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