Towards the Topographic Landscape Model of Switzerland

Stefan A. Voser
stefan.voser@lt.admin.ch
www.swisstopo.ch
The Audience Is Listening To

- Swiss specialities
- The Swiss TLM vision
- some conceptual views of the TLM
  - modelling
  - production line
  - feasibility studies
- final remarks
Swiss facts

• Strongly federalistic
  – 7 federal departements in national administration
    • COGIS: GI coordination at federal level (NSDI)
  – 26 cantons
  – ca. 3000 municipalities
• L+T since 1838

• Area: 41285 skm
• Forest: 30.8%
• Agriculture: 23.9%
• Alpine agriculture: 13%
• Urban area: 6.8%
• Hydrology: 4.2%
• Others (rock, etc) 21.3%

• Height:
  – max: 4633.9m (Dufourspitze)
  – mean: 1307m (based on DHM25)
  – min: 193m (Lago Maggiore)
**L+T: Swiss Federal Office of Topography**

**Bundesamt für Landestopographie**
Office fédéral de topographie

**Legende:**
- Kernprozess / Bereich
- Kompetenz-Zentrum
- Supportprozess
- Processus clef / Domaine
- Center de compétence
- Processus de soutien

**Kunden**
Clients

**Allgemeine Bundesverwaltung**

**Geschäftsstelle**
KOGIS / COSIG
Service de coordination des données de base SIG

**F+E / R+D**
Forschung + Entwicklung
Recherche + Développement

**Marketing**

**Geodäsie / Géodésie**

**Topografie / Topographie**

**Kartografie / Cartographie**

**Support / Soutien**

**Gl+T: Swiss Federal Office of Topography**

**GL**
Direction

**Führungsprozess**
Processus de conduite

**GL-Ausschuss**
Comité de direction

**L+T: Swiss Federal Office of Topography**
Topography and Landscape Model

- **Topography**
  The surface *shape of the earth* as well as its natural and artificial coverage, which characterises the earth's surface, and the *naming* of them. The Topography is subjected to temporal and content-wise modifications.

- **Landscape Model**
  Content-wise and semantically organised spatial modelling of the landscape (our geographical habitat, environment) or an extract of it. It has a *thematic and geometric representation* of it's setting, description and documentation. In a landscape model, visible or measurable phenomena of natural or artificial origin are represented and organised.
Topographic Landscape Model

• “The Topographic Landscape Model (TLM) contains Topographic Core Data in a cognitive and understandable order. They represent the natural and civilised reality in the sense of an inventory which provides an inference to reality.”
The General TLM Framework

- tradition and products of the L+T
- introduction of modern technology and work methods
- exploiting the new potential
- COGIS
- building up a new developing group
- look for new solutions
- new focus of L+T products
- higher financial requirements
- politics
Landscape Model

Map Based

2D/2,5D

Primary Geometry (directly restituted)
Stefan A. Voser

Photogrammetric direct restitution

3rd dimension

Accuracy 1m

Topographic base data

Blanket coverage

Seamless

Topographic Landscape Model

applications

Topography - Quo Vadis?
Reorganising the data flow

Future process:
- Topographic Data capture
- Geodata bank
- Map-production

Present process:
- Topographic Data capture
- Geodata bank
- Map-production
Tasks today and tomorrow

Current Production Line

Content of national maps
Capturing criteria
Photogrammetric restitution
Topographic field restitution
Editing and consistency checks
Map contents selection
Cartographic representation
Map production
Implementing geodatamodel
Vectorising
Specific theme extensions
Integration into Geodatenbase (GTDB)
Sales & distribution

Future Production Line

TLM content definition
Capturing criteria
Conceptual model
Implementing geodatamodel
Photogrammetric restitution
Topographic field restitution
Editing and consistency checks
Specific theme extensions
Integration into geodatabase
Sales
Map model
Value Adding

Stefan A. Voser
Technical Concept

• reorganisation of the production line
• managing the data stages
• separate tasks
  – digital photogrammetric restitution
  – digital field survey
  – integration in the 3-D GIS
  – interfaces for data delivery
• an integrated solution
Integrated Technical Solution

- Digital Photogrammetry
- TLM
- Geodatabase
- GI-Applications
- Cadastre
- Geodesy
- Cartography
- Data editing and data integration
- Field: pre- and post processing
- Field Survey: TopoPad and GPS
3-D Problems

Why 3-D?
• in principal data capture delivers 3-D data
• why leave information out?
• technology is reaching our expectations

! Attention !
• changing the way we look at objects!

Harmony of:
• compilation
  – by photogrammetry
  – in the field
• processing
• management
• queries
• visualisation
3-D Topography

Topological fusion:
• terrain model
• surface model
• object - "instances"

3-D Objects (selection)
• buildings
• bridges
• traffic routes
• dams
• high tension lines
• cable cars
• vegetation
• ...
3-D Objects
Content and Data model

• the TLM Spherical Model
  – minimum: updating the national map series (ca. 150 classes + Toponyms)
  – internal needs of the L+T
  – TOPO-enhancements
  – reference partners (coordination and harmonisation)

• conceptual design
• technical implementation
TLM-Reference Partner
Spherical Model

TLM: Spherical Model with Reference Partners

Federal Office Models

Other Models

Cadastre

L+T-Model

Topo-Model

Stefan A. Voser

sav, 13.9.00
The Dataflow

Topographic and Geodetic Field Survey
Photogrammetry
Remote Sensing
Object Recognition
VECTOR25, DHM
DOM, Toponyms
AV93, others

Geodata
Snapshots
Updates
Updating-elements
National maps
Reference data
Government inventory
AV, others
Reference partners:

- data suppliers (source of information, data integration)
- model harmonising for data expansion (reference key, restitution criteria...)
- restitution for reference partners
Model Harmonising

- consistency for GIS-analysis
- Map products
- Multirepresentation database
- Reference-partners
- Understanding of the user
- VECTOR25
- Toponyms
- Cadastre
- Hydrology (BWG)
- Road and communication network
  - NSDI coordination by COGIS
- others

Stefan A. Voser
**ATOMI: Building extraction**

Vegetation elimination with unsupervised classification (input data derived from RGB imagery)

Building detection from normalized digital surface model (vegetation removed)

Building reconstruction using 3-D edges, classification, VECTOR25, blob shapes and DSM information
Extract different features and cues about road existence, features and cues are:

1. **Subclass attribute derivation**
   - Road class
   - Horizontal & vertical curvature
   - Topology
   - Land cover

2. **2D**
   - Edges
   - Road regions
   - Shadows
   - Zebra crossing

3. **3D**
   - Straight edges
   - Road marks

**VEC25 and other input data**

- Use of existing knowledge, rules and models to reduce search space, and remove irrelevant features
- Use and fusion of multiple cues about object existence to remove irrelevant features, and resolve ambiguities
- Creation of redundancy to account for errors
- Early transition to object space, use of 2D and 3D interaction
- Object-oriented approach in multiple object layers
- Treat roads of different road classes and sub-classes accordingly
- Derive correct and reliable results by proper combination of features and cues, and deliver reliability measurement for each extraction result as well
Risks

• 3-D integration in GIS
  – 3-D preparation
  – 3-D consistency

• ATOMI + 3-D restitution
  – degree of automation
  – amount of re-editing needed

• Reference partners
  – co-operation spectrum is open

• Costs & financing model
Project Planning

- preliminary study (2000)
  - conceptual Modelling
  - reference partners
  - technical feasibility study
  - results from ATOMI
- system evaluation
- pilot production
- system implementation
- transfer of roads and houses
- production for map production

Stage 1

S.2

S.3
Summary

• TLM for the future
• Modern work methods
  – Reorganisation of restitution and management
• New Generation of Geodata
  – NSDI
  – Harmonisation
• Integrated Geodata processing
• Stronger co-operation
  – internally
  – externally
• Huge challenge
On the Web

• Swiss Federal Office of Topography
  www.swisstopo.ch

• The SWISS Government
  www.admin.ch

• COGIS - Coordination of GI & GIS
  www.kogis.ch

• ATOMI - Automated reconstruction of
  Topographic Objects by aerial images using
  vectorized Map Information
  http://www.photogrammetry.ethz.ch/
  research/atomi/