

OEEPE-Workshop
From 2D to 3D
08-10.10.01
Hanover

***Towards the
Topographic Landscape
Model
of Switzerland***

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Topographic Landscape Model - TLM

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The Audience Is Listening To

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

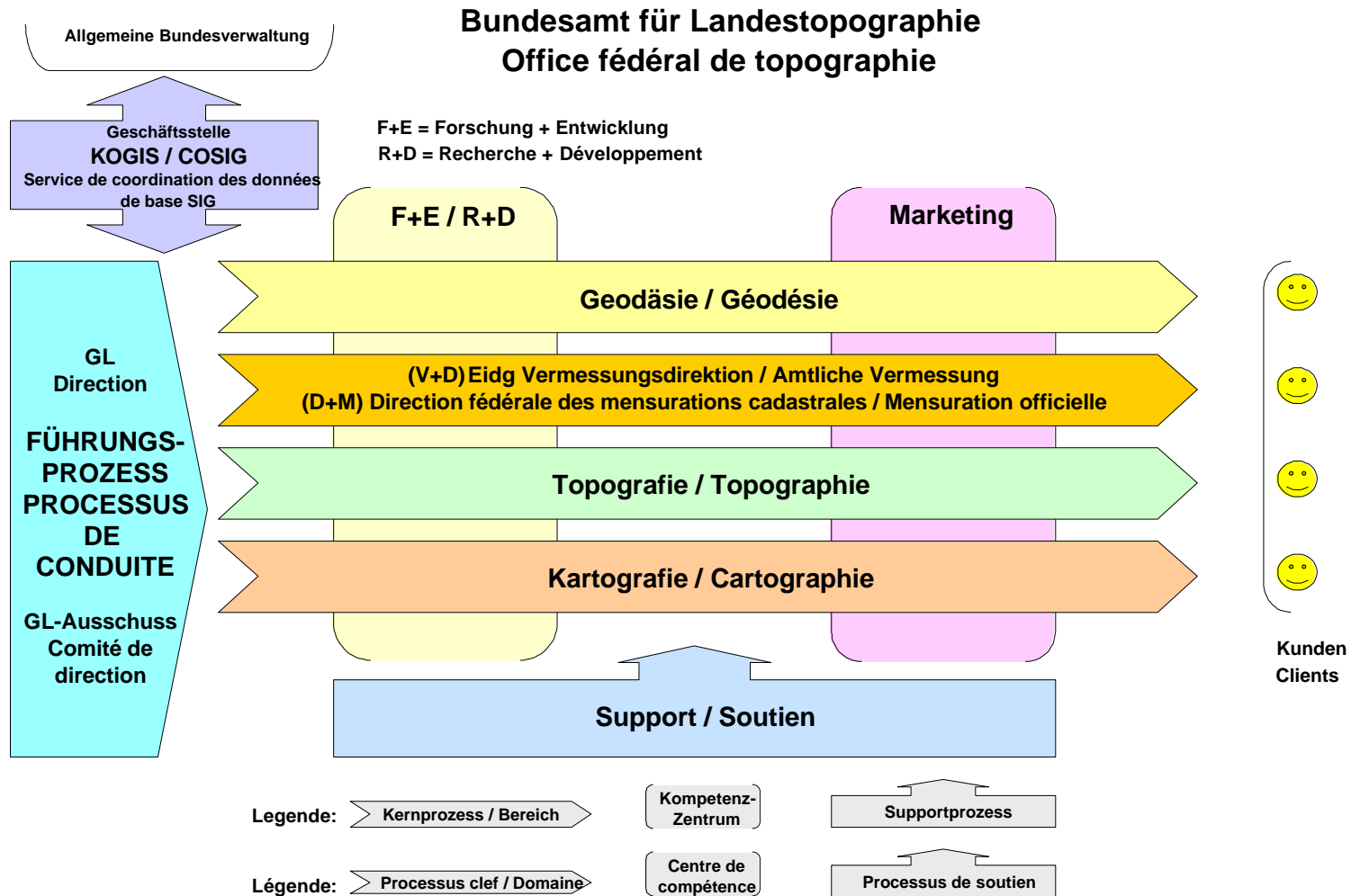


Swiss facts

- **Strongly federalistic**
 - 7 federal departements in national administration
 - **COGIS: GI coodination at federal level (NSDI)**
 - 26 cantons
 - ca. 3000 municipalities
- **L+T since 1838**
- **Area: 41285 skm**
- **Forest: 30.8%**
- **Acriculture: 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



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**

3-D

2D/2.5D

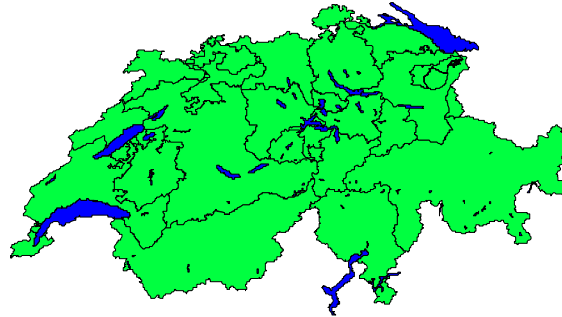
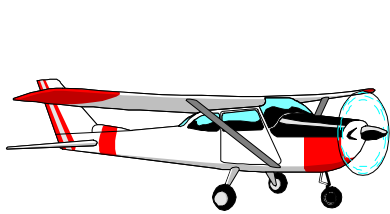


**Primary Geometry
(directly restituted)**



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Topography - Quo Vadis?



***Photogrammetric
direct restitution***

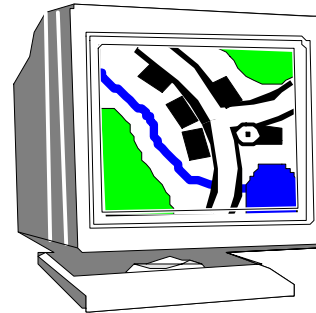
***Topographic
base data***

3rd dimension

Blanket coverage

Accuracy 1m

Seamless

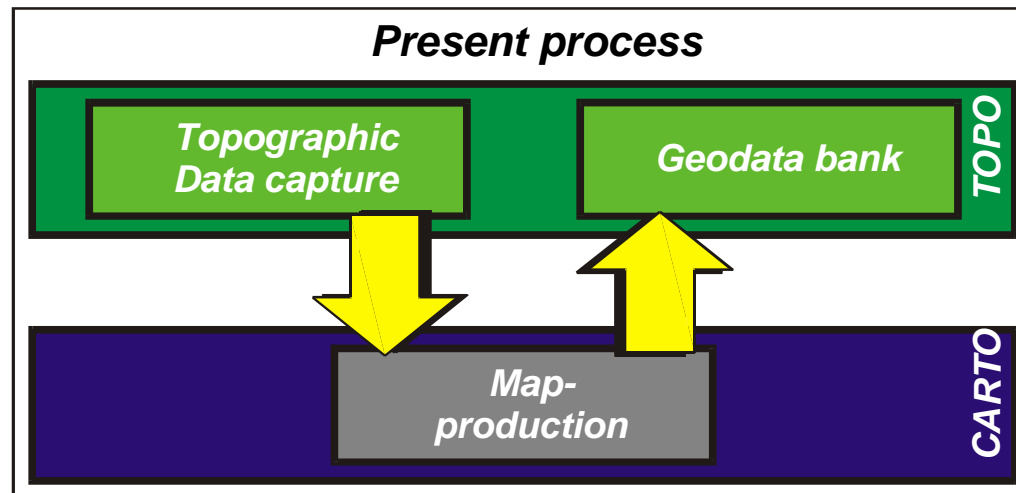
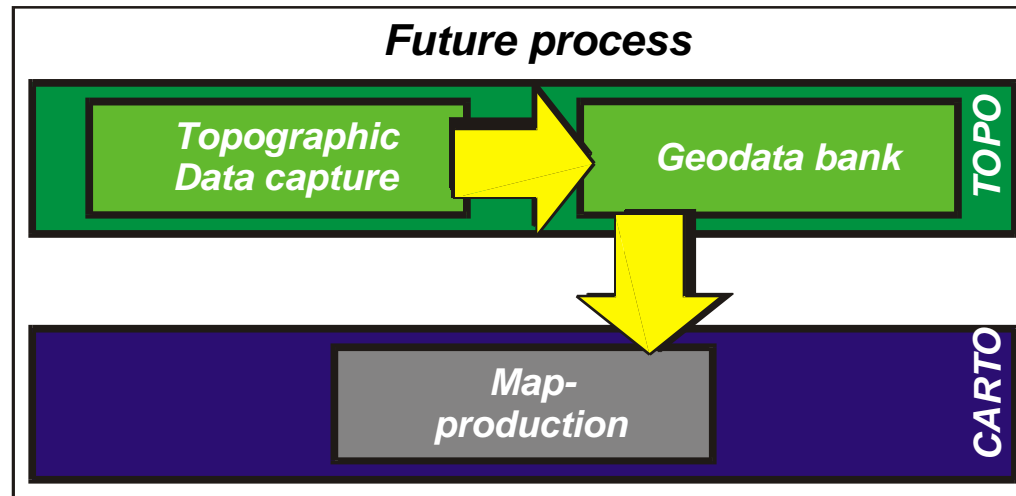


Topographic Landscape Model

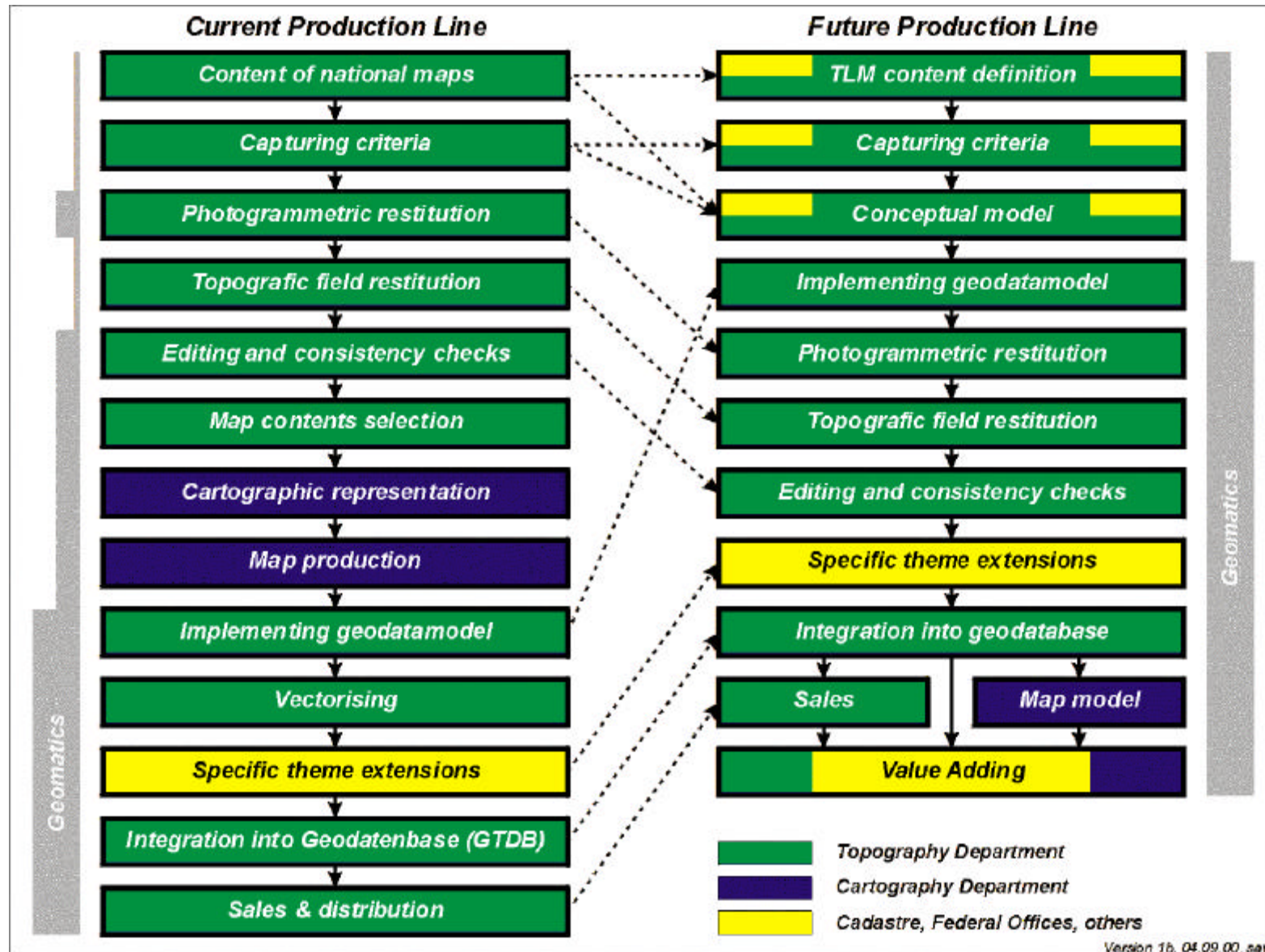
applications



Reorganising the data flow



Tasks today and tomorrow



Version 1b, 04.09.00, sav



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



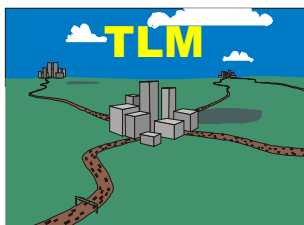
**Digital
Photogrammetry**

Field: pre- and post processing



**Field Survey:
TopoPad and GPS**

Cadastral Geodesy



Geodatabase



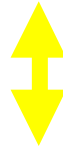
**Data editing and
data integration**



Cartography



GI-Applications



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3-D Problems

Why 3-D?

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

! Attention !

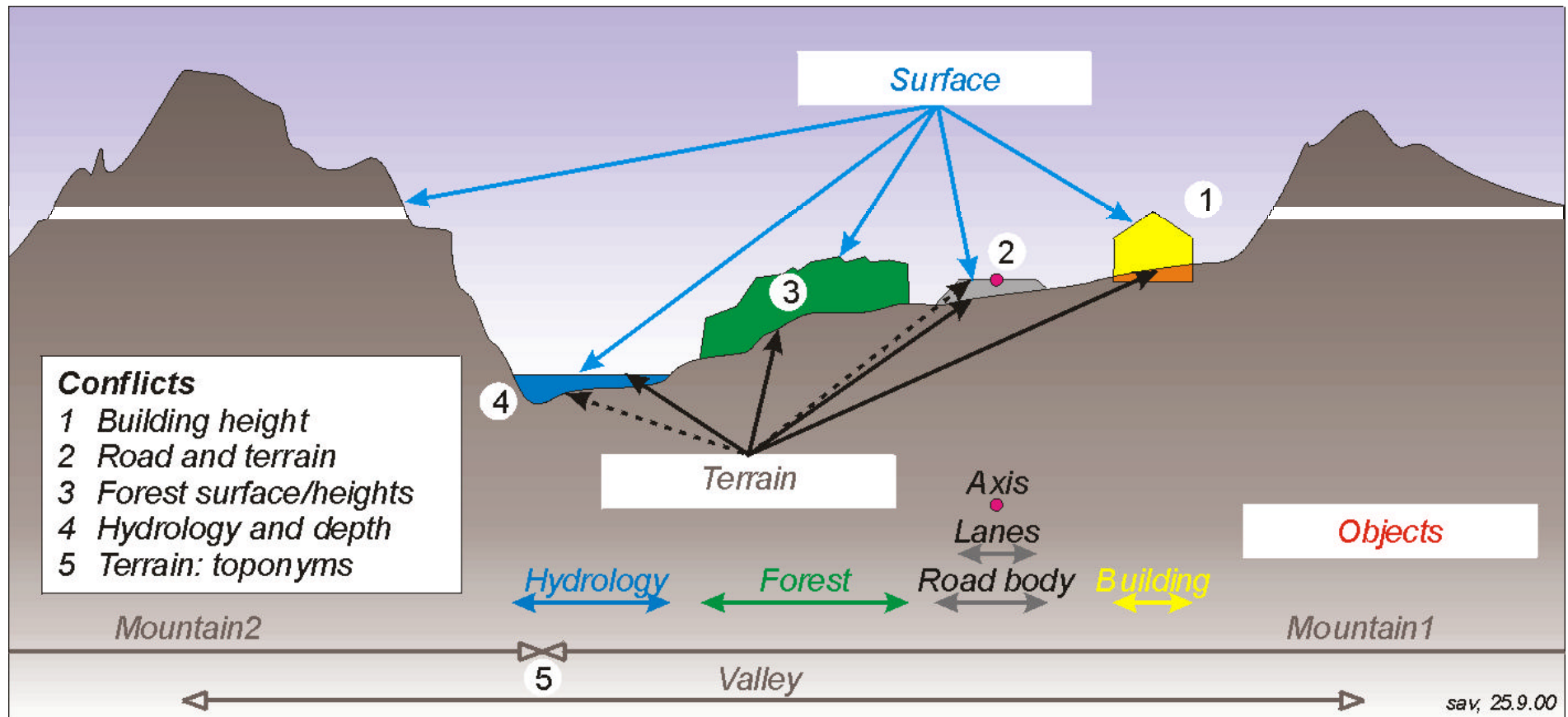
- changing the way we look at objects!

Harmony of:

- compilation
 - by photogrammetry
 - in the field
- processing
- management
- queries
- visualisation



Topography - Reality - Cognition



3-D Topography

Topological fusion:

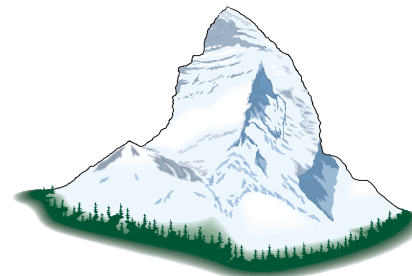
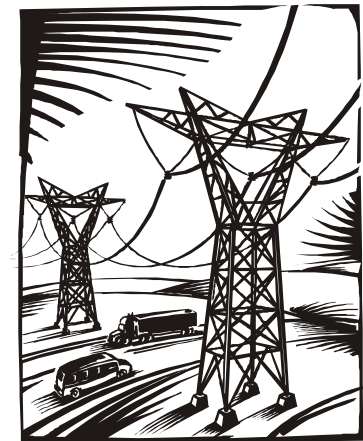
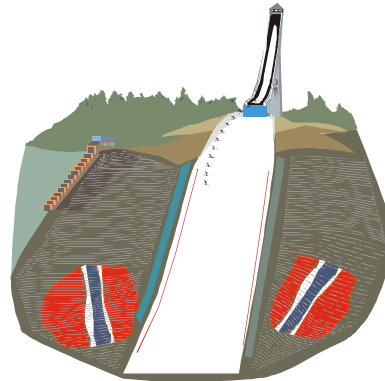
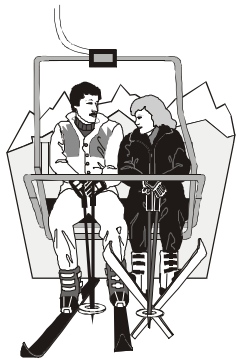
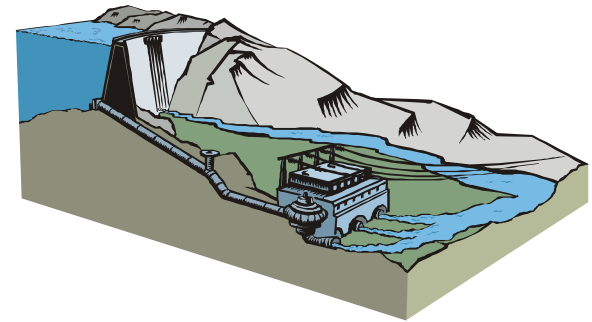
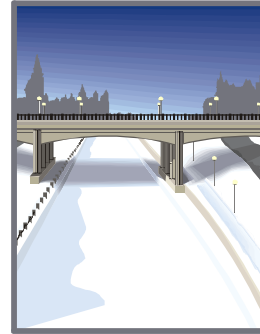
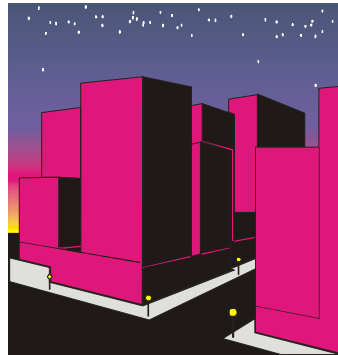
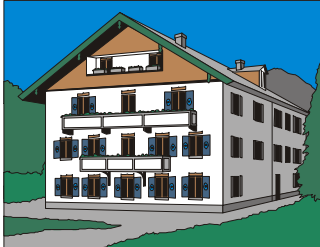
- **terrain model**
- **surface model**
- **object -
“instances”**

3-D Objects (selection)

- **buildings**
- **bridges**
- **traffic routes**
- **dams**
- **high tension
lines**
- **cable cars**
- **vegetation**
- **...**



3-D Objects

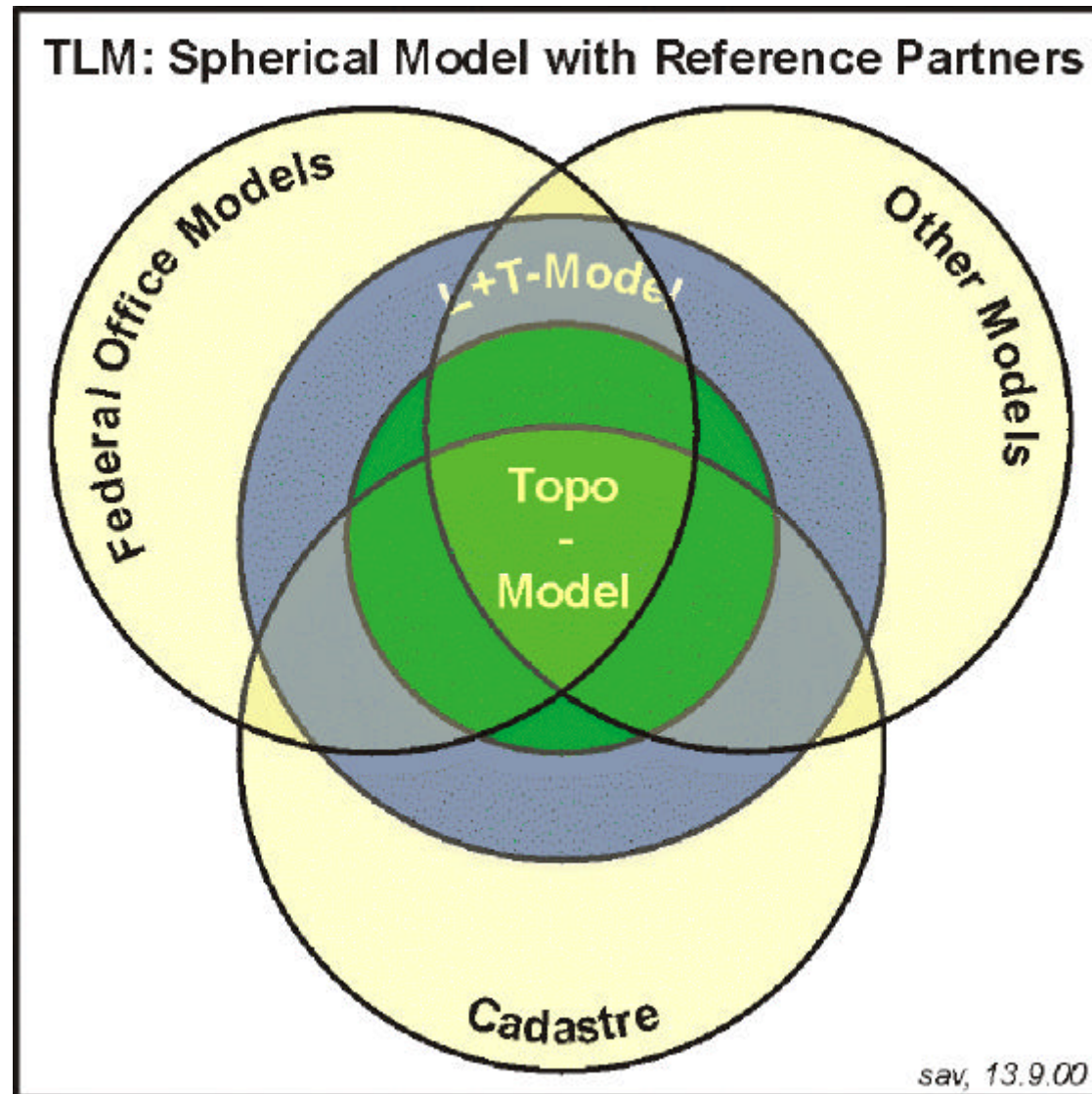


Content and Data model

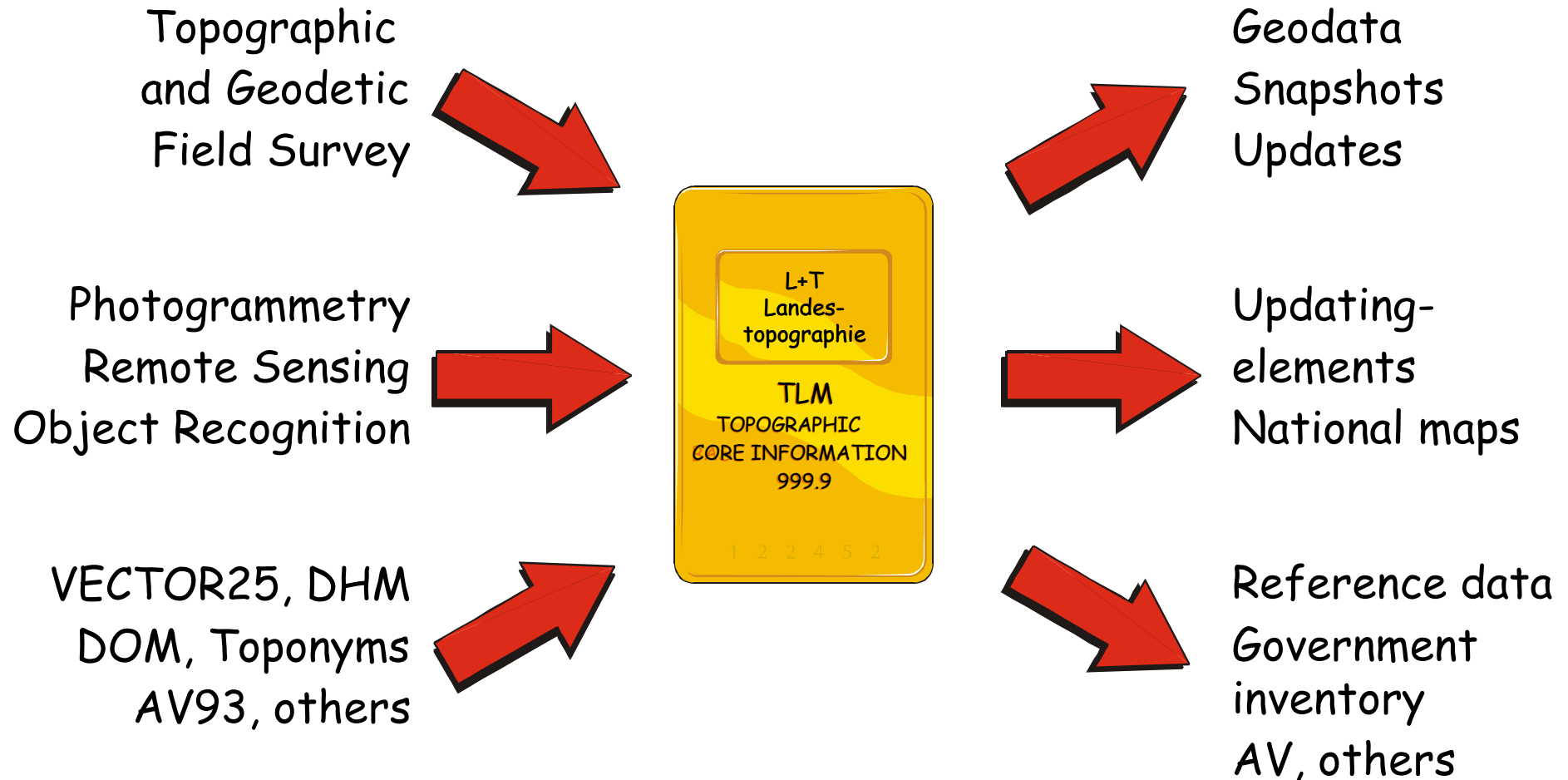
- **the TLM Spherical Model**
 - **minimum: updating the national map series (ca. 150 classes + Toponyms)**
 - **internal needs of the L+T**
 - **TOPO-enhancements**
 - **reference partners (coordination and harmonisation)**
- **conceptual design**
- **technical implementation**



TLM-Reference Partner Spherical Model



The Dataflow



Co-operation

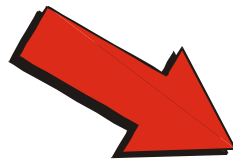
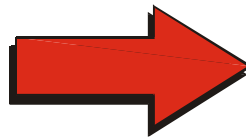
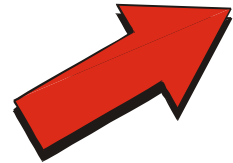


Reference partners:

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



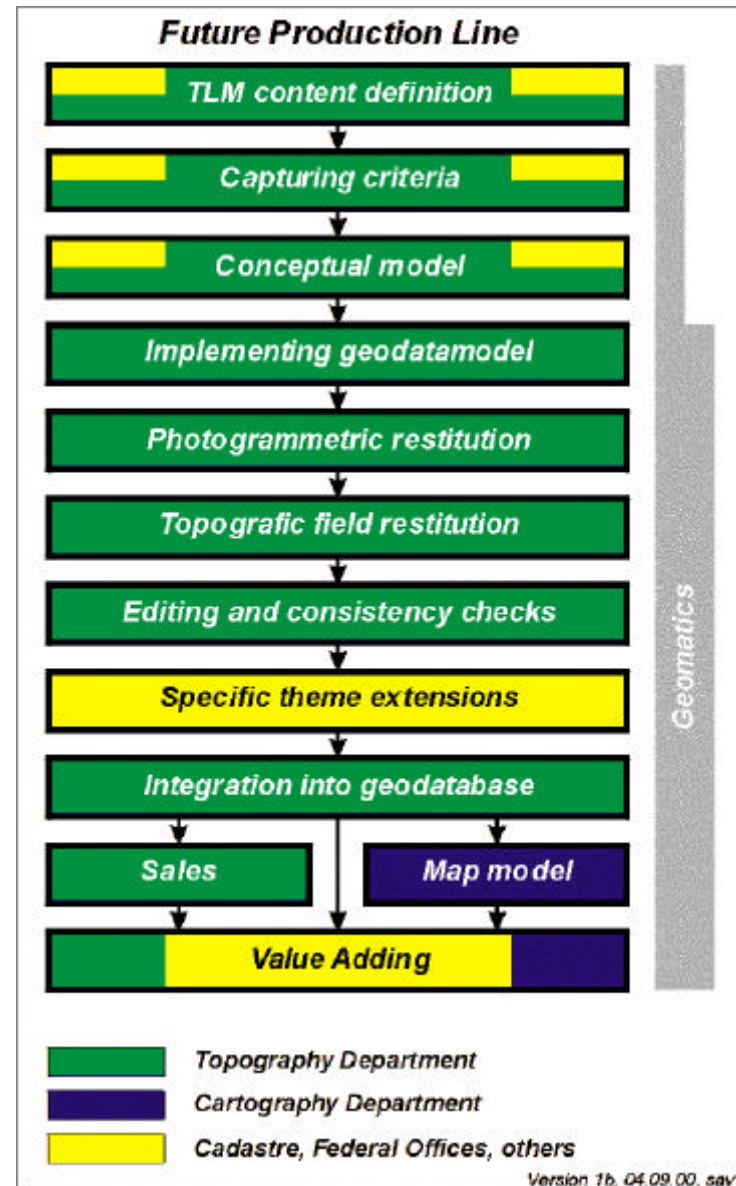
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Modelling

Restitution

Processing

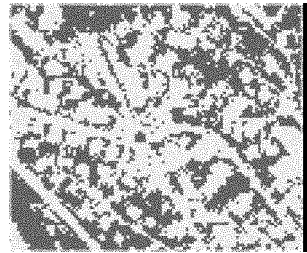


Model Harmonising

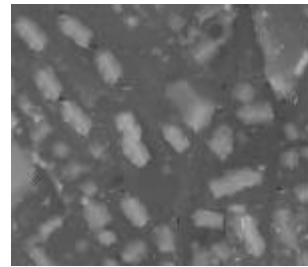
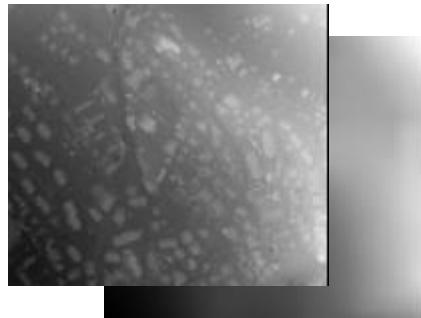
- **consistency for GIS-analysis**
- **Map products**
- **Multirepresentation database**
- **Reference-partners**
- **Understanding of the user**
- **VECTOR25**
- **Toponyms**
- **Cadaastre**
- **Hydrology (BWG)**
- **Road and communication network**
 - **NSDI**
coordination by COGIS
- **others**



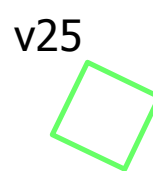
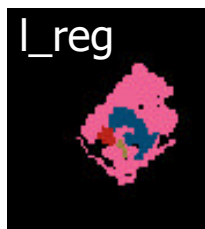
ATOMI: Building extraction



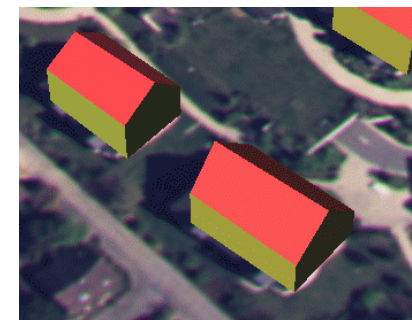
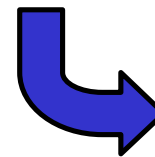
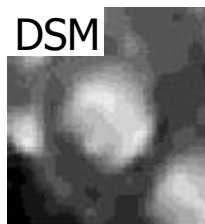
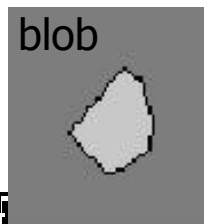
Vegetation elimination with unsupervised classification (input data derived from RGB imagery)



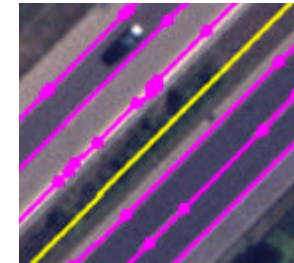
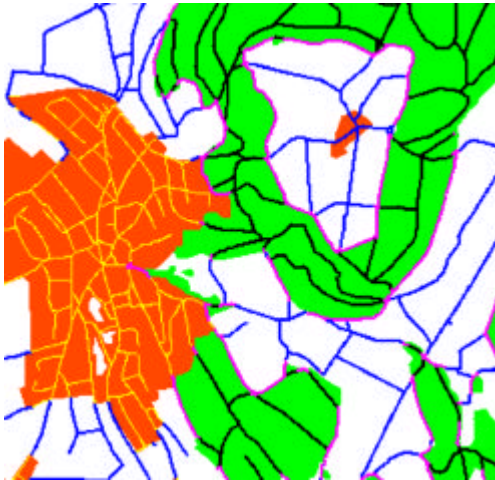
Building detection from normalized digital surface model (vegetation removed)



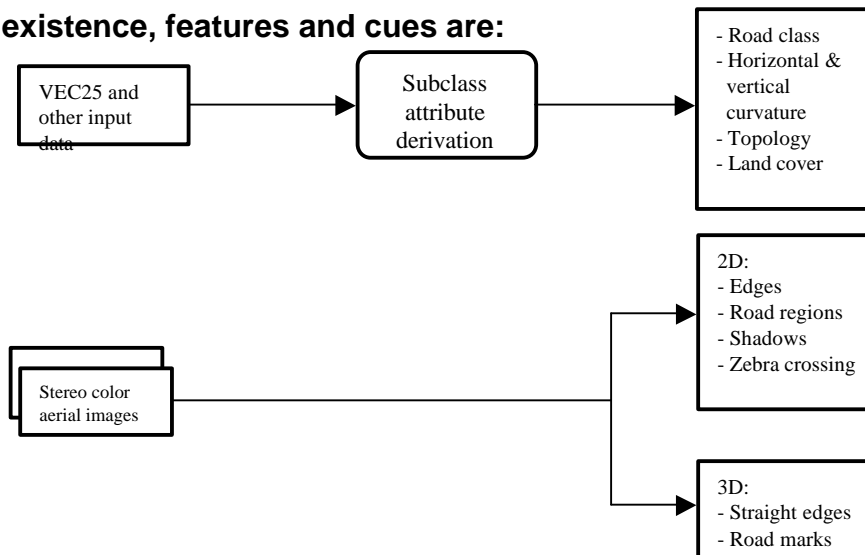
Building reconstruction using 3-D edges, classification, VECTOR25, blob shapes and DSM information



ATOMI: Road extraction



Extract different features and cues about road existence, features and cues are:



- 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)
 - ▶ concept phase (2001/2002)
 - ▶ 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 Gouvernement**
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/atom/](http://www.photogrammetry.ethz.ch/research/atom/)

