

# FROM THE FIELD SHEET TO THE COMPLETE DIGITAL WORKFLOW

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***Abstract** The Swiss Federal Office of Topography has a long tradition producing and updating maps. It has been using a handheld, GPS-equipped computer during the past two years for the field checking and completion of its topographic maps. Thorough training was necessary to get the topographers used to the instrument and to the work with the vector data – and no longer on the analogue field sheet. Experiences are mainly positive, both with the personnel as well as with the receiver and the computer. A short outlook will be given on the new topographic landscape model TLM whose production will begin in 2008.*

## FROM NATURE TO MAPS AND MODELS

When the early surveyors went out to the field, they knew exactly which objects they needed for the future map. No one spoke of a “data model” at that time.



Fig. 1: Plane table survey around 1920

While surveying, the topographer automatically made a selection. The big advantage he had: he worked with the landscape in front of him, no questions remained open. All the collected information was stored on the sketch map, later drawn in ink, then transferred onto copper plates and scribed. The first accurate map of Switzerland at a scale of 1:100'000 – called Dufour Map (and now available on CD) – was produced this way. Later on, the original surveys were revised and published (Siegfried Atlas): 1:25'000 in the Central Plateau and 1:50'000 in the Alps.

## THE NATIONAL MAP SERIES 1:25'000

Where it was available, the cadastral base map 1:10'000 served as a base for the new 1:25'000 series. It was reduced and updated with aerial photographs. A thorough field check provided supplementary information. Instead of copper, glass plates were used to scribe the originals. These 249 sheets were published between 1952 and 1979



Fig. 2: The most famous peak of the Swiss Alps

## MAP REVISION 1980

Starting in 1968, a revision program divided the country into six blocks. Each year, aerial photographs were taken of one of these blocks. Under a small stereoscope, the topographer compared the new photographs with the existing map and noted on the field sheet all the changes he could see.



Fig. 3: Comparing the new photography and the existing map

Then he set out to the countryside –maybe he would have to wait until July before all the snow melted in the mountains. On the field sheet, he noted the road classes, drew a new footpath (using compass and altimeter), made short notes where necessary and marked in yellow everything that had to be deleted. To show details more precisely, sometimes he made an enlarged drawing on the back. This field sheet was the guide to the photogrammetrist for what he had to plot from the photographs. Using the etch and scribe technique, the cartographers produced a revised original on a glass plate.

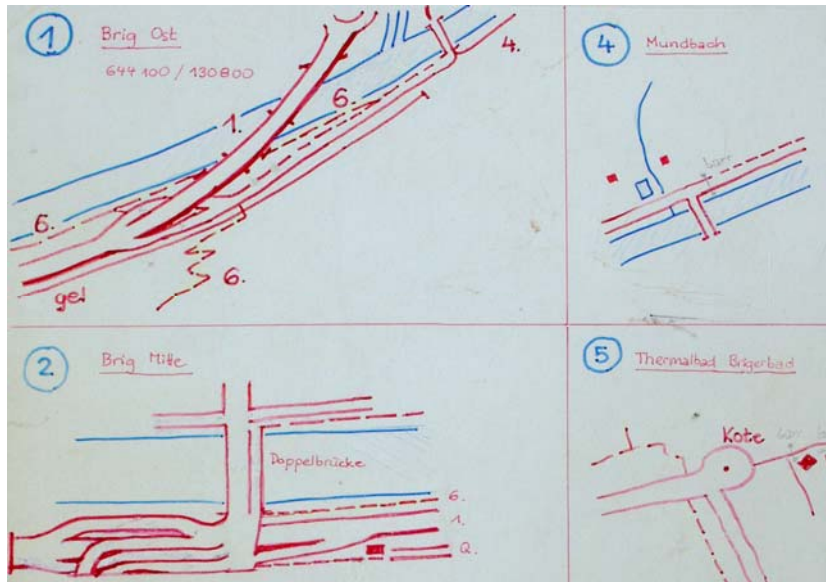


Fig. 4: Details for the future map on the back of the field sheet

## DIGITAL MODELS

The first digital elevation model was initiated in 1984: the contour lines 1:25'000 were digitized on a SciTex computer station. From there, a regular grid was calculated. Later, photogrammetric break lines were added to improve the model especially in the Alps. The production of “vector25” began in 1995 again the (analogue) map served as a base. Once a map was revised, the digital models could also be updated.

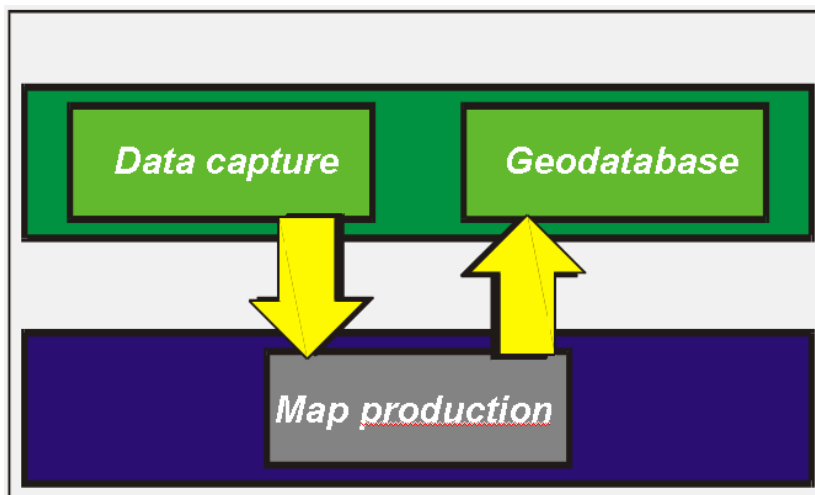


Fig. 5: Data flow for the production of the early digital models

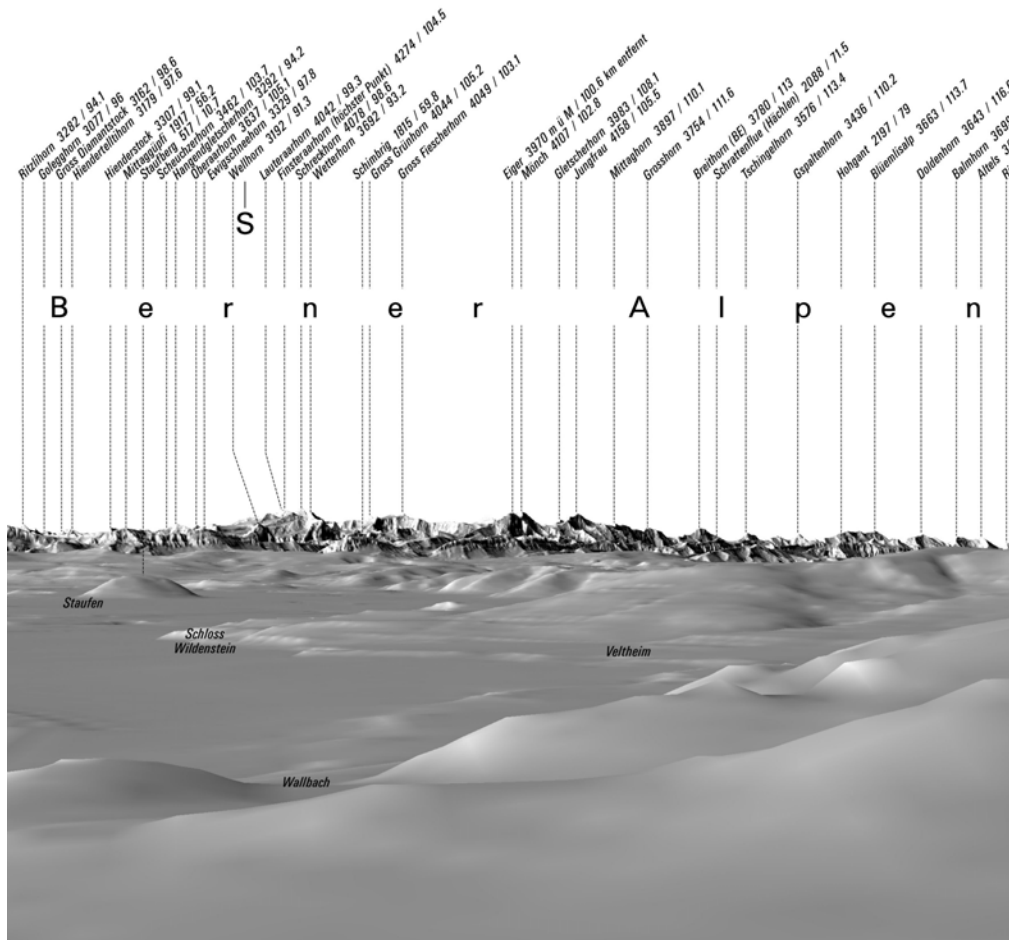


Fig. 6: Panorama calculated from DHM25, completed with names and altitudes.

## REVISION 2005

The data flow has changed: the photogrammetrist updates the vector model and from there, the necessary information is selected for the maps (or for other products).

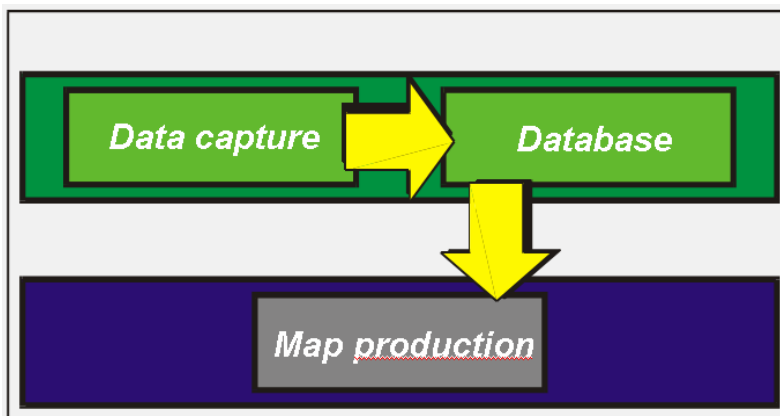


Fig. 7: Data flow for the revision of the database – and subsequently the maps.

Anything that cannot be precisely identified on the photographs will be marked with a question. Comments or corrections by users are treated at that stage. The raster image of the existing map, the existing vectors and the new vectors are stacked in the TopoPad: a GPS receiver combined with a handheld computer, weighing 1.5kg and allowing measurements even in forests.

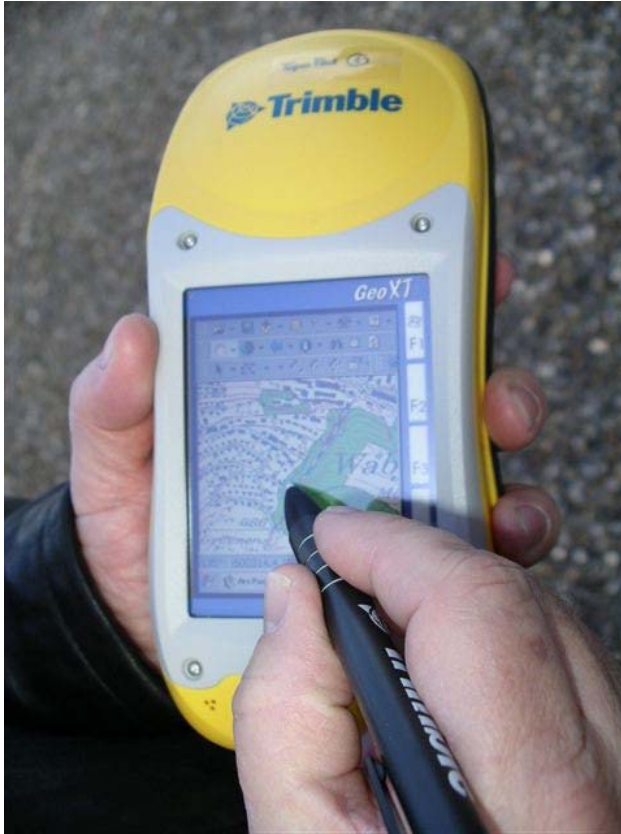


Fig. 8: The TopoPad is the new tool for field checks

As it is hard to get an overview on the small screen, a field sheet is still necessary. On a transparent overlay, the answered questions can be ticked off and the daily progress recorded.

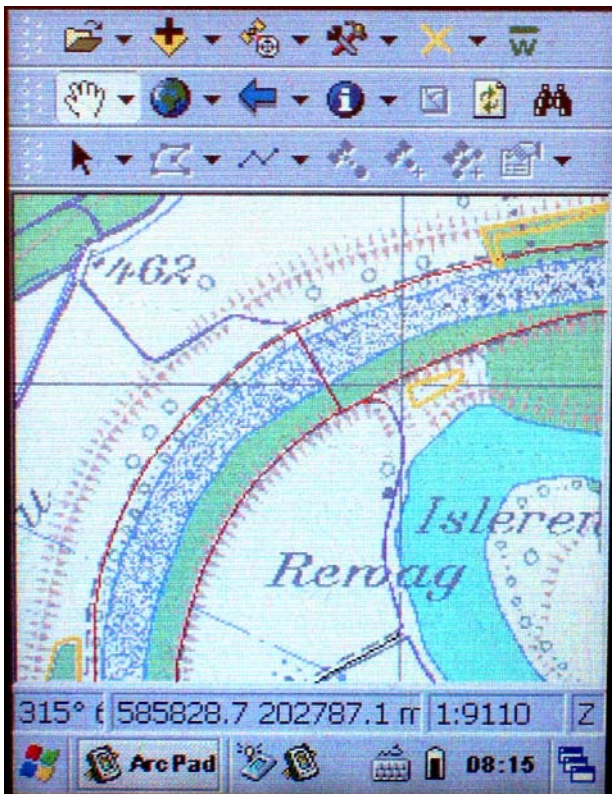


Fig. 9: The screen of the TopoPad: raster image, vectors and lots of tools

## THE TOPOGRAPHIC LANDSCAPE MODEL

Faster: roads and buildings updated every year. More precise: accuracy of  $\pm 1\text{m}$  for important features; surface and terrain models gathered by airborne laser scanning. More information: width of a road, importance, surface, sidewalks, walls, ditches, restrictions, owner, name; additional data from public or private partners. More dimensions: everything in 3D. Tests are running now and the system will be built up in 2007. Production should start in 2008.

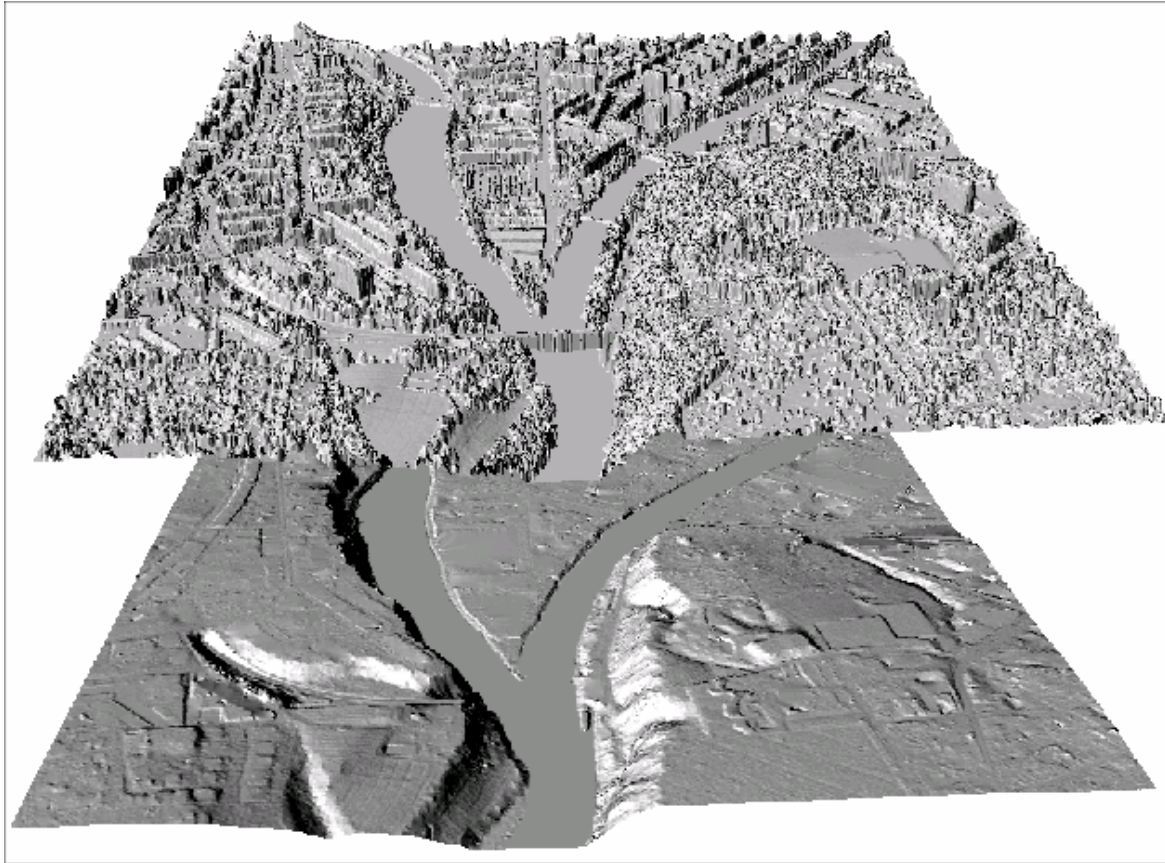


Fig. 10: Digital terrain and surface models gathered by airborne laser scanning

## UPDATING THE DATABASE 2010

The new digital camera furnishes more spectral information which can be helpful e.g. when a stream is covered by vegetation. Instead of colour films, the digital images will be used for the photogrammetric plotting.



Fig. 11: A new setup for the stereo plotting is tested

The topographer will be working on the vectors of the data base – and not on the graphic image of the map anymore. He will have to collect more detail and more attributes. This makes his job more demanding.

### MORE AND MORE (?)

Whereas a 100 years ago one single man could do all the jobs from the field survey to the neat drawing, nowadays the tasks are split up and specialists treat a small portion in the work progress. This is not necessarily an advantage but the results offer a wide range of applications.

|      | <b>Data model</b>             | <b>Data capture</b>                 | <b>Data storage</b>  | <b>Cartographic treatment</b>   | <b>Publication</b>  |
|------|-------------------------------|-------------------------------------|----------------------|---------------------------------|---|
| 1900 | Dufour and Siegfried          | plane table survey                  | sketch map           | copper engraving                | paper maps  |
| 1930 | Siegfried                     | terrestrial photogrammetry          | sketch map           | copper engraving or lithography | paper maps  |
| 1960 | National Map Series           | aerial photogrammetry, field check  | glass plates         | scribing on glass plates        | aerial photographs, paper maps                            |
| 2000 | National Map Series, VECTOR25 | analytical plotter, field check     | analogue and vectors | completely digital (bitmaps)    | orthophotos, vectors, paper maps, pixel maps              |
| 2010 | Topographic Landscape Model   | digital stereo plotter, field check | vectors              | digital (vector graphics)       | orthophotos, vectors, vector maps, paper maps, pixel maps |

Fig. 12: Development of the topographic workflow during the last 100 years

## Biography of Author



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**SWITZERLAND**

Martin Gurtner is a surveyor from the Federal Institute of Technology Zurich (Polytech) and has been with swisstopo, the Federal Office of Topography since 1974. He did levelling and triangulation jobs, but his main tasks were and still are in the Topography Division. He was the last to use the plane table for the verification of the cadastral base maps (produced by private surveyors). He collected all the written and non-written instructions for the map content and produced the “red bible” containing the specifications for each symbol. As co-head of the process Topographic Bases he is responsible for the content of the Swiss National Map Series. The project for a new topographic landscape model TLM was initiated in 1999 and is supposed to start production in 2008. He still does some field checking himself and – as an active alpinist – uses the maps on many occasions.