

> ESRI projects

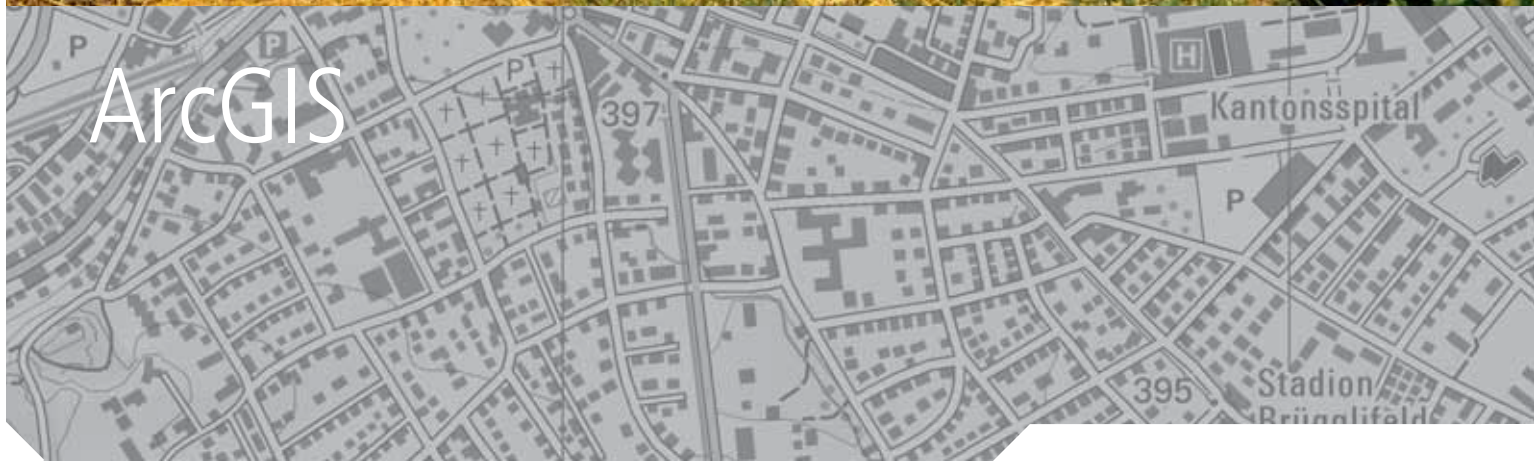
New
swisstopo-ESRI
projects:
TOPGIS and
Genius-DB

Here

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ArcGIS





> The customer: swisstopo

The Swiss Federal Office of Topography (Bundesamt für Landestopografie swisstopo, www.swisstopo.ch) is the national agency responsible for geographical reference data and derived map products in Switzerland.

Located in Wabern near Bern, swisstopo is a modern production organisation whose nearly 270 employees create and maintain the basic geodetic, topographical and geological data for the whole of Switzerland. swisstopo also publishes and updates the internationally recognized Swiss national topographical map series at a variety of scales.

Over recent years, a National Spatial Data Infrastructure (NSDI) has been established in

Switzerland to promote the interoperability of digital geographical data between the various suppliers and users. As the responsible body within Switzerland, swisstopo is heavily involved in this task, through its twin objectives of offering high quality spatial reference data and derived products, and promoting their use throughout the national economy.

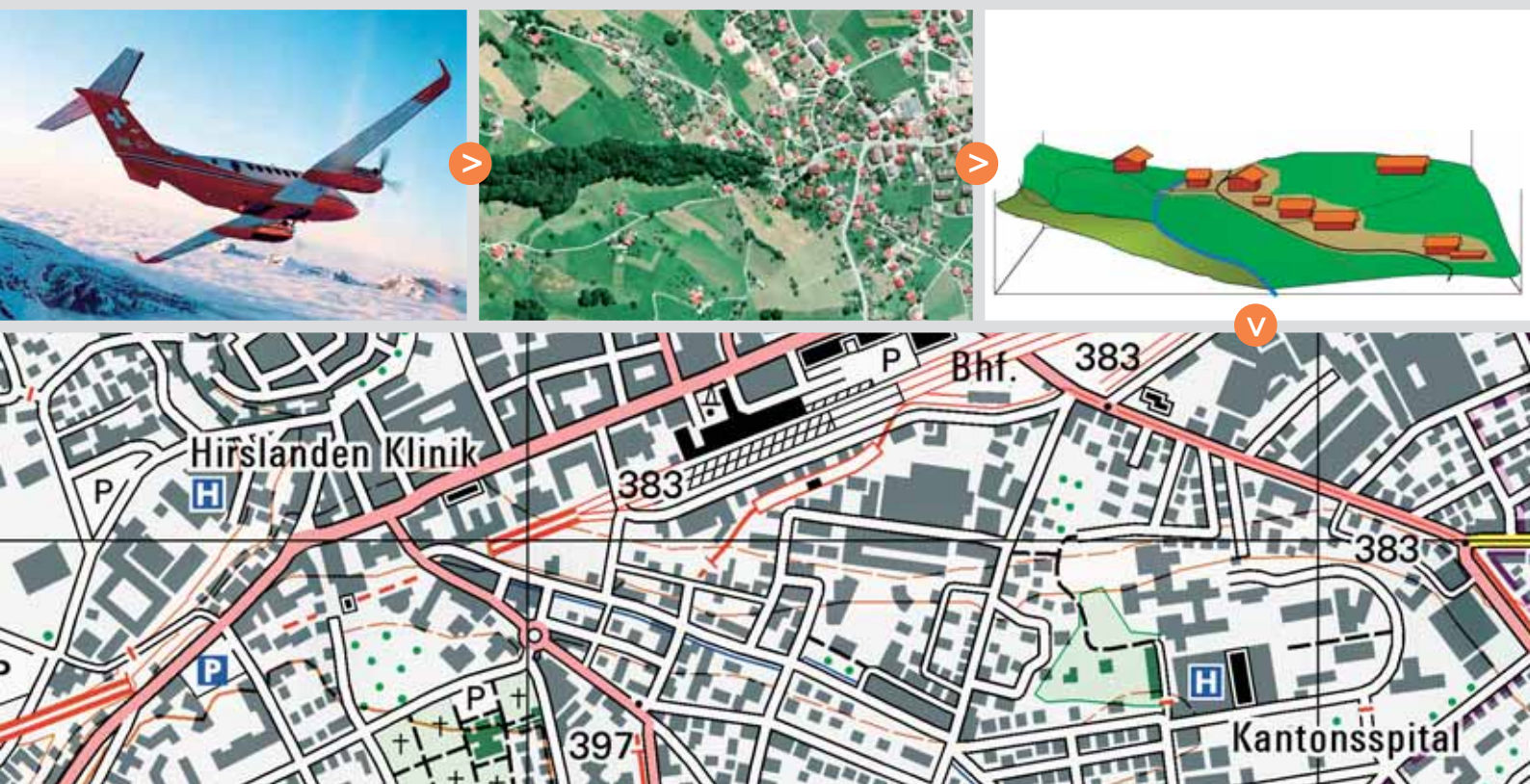


Figure 1: From data capture to map.
 Figures courtesy of swisstopo.

> The need

swisstopo is completely changing how they produce geographical data and maps. For this, they are moving away from a workflow where digital vector reference data are derived from generalized maps. Also, they are integrating the systems used to create and maintain both geographical reference data, and the cartographic data and map products derived from this reference data.

swisstopo's new workflow is mainly being implemented through two core projects: TOPGIS and Genius-DB. This workflow offers several key advantages over the existing production process at swisstopo:

- > A Topographic Landscape Model (TLM) is the basis for Digital Cartographic Models (DCMs) from which swisstopo's maps are derived.
- > The TLM and DCMs are stored in one system (ArcGIS), and updates to the TLM are propagated to the DCMs.
- > The timeframe between collection of aerial images (ultimate basis for the TLM) and finished map products is shortened considerably from over two years down to about nine months.

> TOPGIS

The new system for reference data production

swisstopo is eliminating the current map-based VECTOR25 dataset and replacing it with a Topographic Landscape Model (TLM). This is a major shift in their internal production flow, and also for their customers who require accurate vector geographical reference data. The TLM is swisstopo's future vector landscape model. It will be very up-to-date across all of Switzerland and also parts of neighbouring countries, seamless across this area, 3D, and very accurate with better than 1 meter accuracy in all three dimensions.

The TLM will be accompanied by a new Digital Terrain Model (DTM-TLM) which is designed to be consistent at all times with the TLM. The DTM-TLM is derived principally from LIDAR data, and both the TLM and the DTM-TLM will be photogrammetrically updated based on ADS40 imagery.

For the capture and administration of the TLM and DTM-TLM, a high performance infrastructure is being built called TOPographic Geographic Information System (TOPGIS). As the central production infrastructure for the TLM, TOPGIS is a modern, database-centered system for data capture, editing, management and storage. System operators work in simultaneously various modes:

- > on the TLM in 3D mode (using stereo digital photogrammetry),
- > on the TLM in 2.5D mode (using mono-plotting from orthophotos),
- > on the DTM-TLM (using stereo digital photogrammetry).

The approach realized with TOPGIS will make updating geographical reference data easier and more frequently possible (at present, updates are tied to the six year map production cycle). The TLM will be updated at least yearly following the so-called policy of "top up-to-dateness". For the time being, this currency standard will be introduced for roads and buildings. The availability of up-to-date data can only be achieved with the help of cooperating organizations (e.g. cantons, communities, cities) who will provide swisstopo with relevant data for integration into the TLM. This data is collected in the course of their usual activities.

TOPGIS will be built on ESRI ArcGIS 9.x and also use Leica's Stereo Analyst for ArcGIS to seamlessly integrate digital photogrammetry. TOPGIS will supply the infrastructure as well as the comprehensive GIS-functionality for processing and administrating the TLM in a central database. As a core component in swisstopo's future geodata infrastructure, TOPGIS will provide GIS data to a large number of current and future products.

Work for the TOPGIS project began at ESRI in 2006. The system will enter into full-scale production in 2008.

Selling Points

- > High performance hardware and software infrastructure for capture and administration of digital topographical landscape data
- > Topographical landscape data where primary geometry is 3D
- > Better than one meter accuracy of primary geometry in x, y and z
- > 2D, 3D, and photogrammetric editing in one system
- > Data capturing in the field
- > Efficient integration of data provided by cooperating agencies
- > Elimination of external system interfaces, unnecessary data storage redundancy, and time consuming data transfers between systems

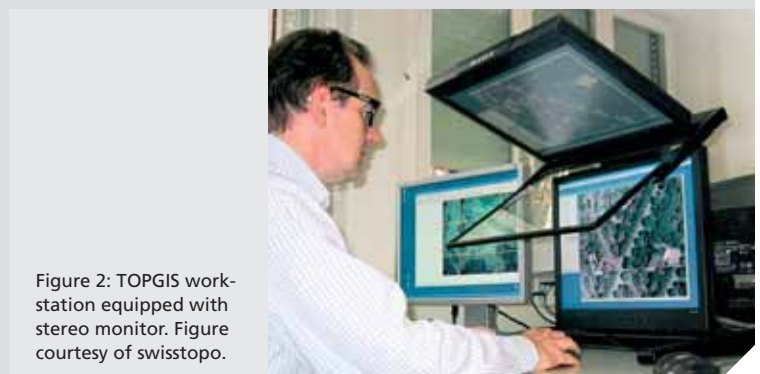


Figure 2: TOPGIS workstation equipped with stereo monitor. Figure courtesy of swisstopo.

> Genius-DB

The new system for cartographic production

Genius-DB is swisstopo's future, GIS-based cartographic map production system. Genius-DB will support the management and editing of swisstopo's Digital Cartographic Models (DCMs), is built based on ESRI ArcGIS Desktop, and will take full advantage of the cartographic representations technology that is new in ArcGIS 9.2.

Data are input to the Genius-DB system from the Topographic Landscape Model (TLM), passing first through a cartographic generalization system which is the responsibility of a third party. Figure 3 shows that a series of DCMs are built, corresponding to the various map scales of the Swiss national map series. DKM25 (corresponding to a map scale of 1:25.000) and DKM50 (1:50.000 map scale) are directly derived from the TLM, whereas DKM100 is derived from DKM50. To support the cartographers' work, especially in handling future changes (so-called incremental updates), relationship links are maintained between TLM and DCM features.

Like the TLM, DCMs are seamless over the whole of Switzerland. However, DCM data are 2D and cartographically updated: first by the automated, external generalization process, and then by various automated, semi-automated, and manual editing proc-

esses within the Genius-DB system. Several map products are created from DCM data, the most important being the national topographical map series. Additional thematic map products can also be created from the same data. Furthermore, the DCM data are used to derive digital cartographic products.

A major goal of Genius-DB is to improve the efficiency of handling incremental data updates. By leveraging relational geodatabase technology and the automation processes available in ArcGIS, this is not just achievable, but highly optimized. Moreover, it is paramount for swisstopo to have efficient cartographic editing, while maintaining their world-renown standard for map quality. ArcGIS 9.2 with its new cartographic representations functionality is seen as key to maintaining this high quality standard. Furthermore, in addition to an existing set of vector editing tools in ArcGIS, a new set of cartographic editing tools has been added in ArcGIS 9.2. These tools are specifically designed for efficient and intuitive cartographic editing (see figure 4).

Work for the Genius-DB project began at ESRI in 2006. The system will enter into full-scale production in 2009.

Selling Points

- > High performance cartographic production system for high quality maps and digital data products
- > Cartographic production system based on GIS data
- > Efficient cartographic editing using specifically designed tools
- > Efficient incremental update that leverages geodatabase technology and automated GIS processes
- > Safe and easily managed data stored in an enterprise, relational database management system
- > Built-in support for multiple map products from the same cartographic data

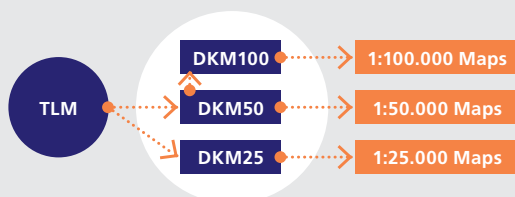


Figure 3: Derivation of DKMs and national map series from the TLM. Figure courtesy of swisstopo.

Figure 4: Representation editing tools allow for efficient and intuitive cartographic editing.



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