

# National Mapping Agency of Belgium

With a history stretching back to 1831, the National Mapping Agency (NMA) of Belgium has always respected the scientific approach. In 2006 it underwent a complete restructuring of work processes to become what it is today, an ultramodern organisation headed for the past five years by Ingrid Vanden Berghe.<P>

In Brussels, home of the European Commission, a summit predictably delays road traffic, so that it is with some sense of reward that we arrive at the historical setting of Abbey ter Kameren, where the National Geographic Institute (NGI) is sited, along with the Belgian National Mapping Agency (NMA).

## From 1831 to Today

Director-general Ingrid Vanden Berghe receives me in the classy meeting room, where cabinets exhibit historical geodetic instruments. "In 2006 we celebrated our 175th anniversary with an exhibition in the Royal Museum of Arms and publication of the book: Belgium by Maps," she tells me. "The history of NGI dates back to 1831, initially as *Dépôt de la Guerre et de topographie* (military and topographic depot) which aimed to create, collect and disseminate maps of areas of military interest. Its founding is, of course, closely connected to the revolution of 1830, which made us independent from the Netherlands. The focus back then was on creating topographic maps and determining the Belgium-Dutch border". Twelve years later the task of NGI's predecessor was extended to the creation of the official topographic map of the entire territory, a task requiring high-level knowledge of mathematics, astronomy and geodesy. So 1846 marked the introduction of a scientific approach still carefully conserved up until today. Nowadays, over 50% of NGI employees are educated to Master (16%) or Bachelor (35%) degree level; the director-general herself holds a MSc in Bioengineering Science. NGI is an autonomous public entity under the supervision of the Minister of Defence of the Federal Government.

## ITGI

The NGI strategic plan for 2001-2005 indicated that an Active Geodetic Reference Network (AGN) should be created, and a digital elevation dataset (DEDS) together with new products, including maps, atlas, data on DVD, and web services. Furthermore, the entire territory should be covered by digital basic topographic data stored in one seamless dataset (ITGI). "By 2007 all these aims had been achieved," confirms advisor-general Jean Théâtre. "In the past we, like all other NMAs, used computer technology as an aid in creating paper maps, by storing points and lines together with mapping codes. However, the lines did not know from each other that they might form a polygon delineating, for example, a building. Such a spaghetti structure is not feasible for modern GIS, where the topographic map provides not only a backdrop but also a dataset that may be queried, often in combination with other datasets. "We have invested huge effort over many years in the move from map thinking to dataset thinking," Jean Théâtre continues, "and the main achievement of the Strategic Plan 2001-2005 is a central, seamless dataset covering the entire territory, called ITGI. For this we had to convert existing Top10 vector, DTM, 3D line, Top50 Vector and digital orthoimages into predefined data models according to ISO 19110. The 3D-line consists of a set of xyz coordinates of points and lines with attributes selected from around fifty classes." One of the users is Belgocontrol, a major client and autonomous governmental organisation tasked with maintaining safety of the airspace, from ground up to 8,000m. The 3D-line data, enhanced with building data and DEMs of the area around airports, is used to avoid collision with existing and future constructions, such as wind turbines. Jean Théâtre enlarges, "Linking ITGI with datasets of geodetic points, toponyms and street names and datasets from third parties enables creation of a pallet of products." All end products are derived from the data-centric model of ITGI, including Top10 and Top50, both in vector and raster format, and orthoimages. Going to smaller scales requires generalisation, and this is done in a computer-assisted environment.

## SDI

Belgium has a population of nearly eleven million people and is crossed by language barriers; Dutch in the north, French in the south; while less than 1% of the population has German as mother tongue. To reflect cultural diversity, three communities have been established based on these languages. Economically inspired division has resulted in another trio: the Flemish Region, the Brussels Capital Region and the Walloon Region. The competencies of the Federal Government and the three Regions are arrayed in parallel, a practical consequence of which is a lack of political hierarchy; the three regions have great autonomy in many fields. The Flemish and Walloon Regions each have five provinces. In 2004, NGI and the General Administration of Patrimonial Documentation (Cadastre, Land Registration, State Properties, Mortgages Services), both active at Federal level as key producers of basic geo-data, established the Federal Platform for Geo-information aimed at creating a Spatial Data Infrastructure (SDI). The Flemish SDI started in 1995 on an informal basis and was consolidated by regional decree in 2000. The Walloon SDI is being developed and operated on a project basis. The URBIS initiative in the Brussels Capital region has more limited scope: a single institution has the mandate. "For NGI, the competencies of which cover the entire territory, it is not easy to cope with regional and cultural identity and federal structure," confesses Ingrid Vanden Berghe. "Indeed, Belgium has a complicated administrative structure, so an integrated national approach to building the Belgian SDI is not easy to achieve. Any decision-making process has to be built from bottom up, trying to convince people and organisations to work together without the possibility of imposing collaboration, and this makes a common approach a hard endeavour."

## Footprint

Employing slightly over 260 people, NGI is prepared for the challenges of modern ICT. In 2006 technical production and services tasks were restructured and new production processes introduced. There are now four departments: Phototopography, Geodesy, SDI and

Applications. "Nearly half of the employees are aged between 45 and 55, so over the coming ten years we will be confronted with many retirements and loss of expertise," says Ingrid Vanden Berghe. One of the cornerstones is training; the budget increases every year. Three quarters of the annual budget of around Euro18 million consists of federal subsidies. Further revenues are generated from the sales of paper maps, atlases and so on, performing specialised work for third parties, and issuing licences for use of data; each contributing roughly one third. Since 2002 NGI has increased its reserves by several tens of thousands of euros annually, and saved for future investments. "We are not involved in any kind of property registration or cadastral work," Ingrid Vanden Berghe continues. "Countries where NMAs do so find themselves in a more favourable budgetary situation than our own, in terms of revenue generation and independence from government funding."

### Photo-topography

"Aerial photographs form the basis for updating our topographic maps," Jan Beyen, responsible for photogrammetric skills, tells me. "In the past, air surveys were done by airforce planes, but today surveys are outsourced at European level. Three years is the update cycle for orthoimagery and the theme buildings, and so every year about a third of the territory is flown. As a result of our new strategy, all themes must have undergone a complete update at least once every six years, including the height component and toponyms. In the past this was fifteen years. Since recent road network information is of the utmost importance for our clients, updating is done yearly, mainly using external sources. The photos are either at scale 1:21,000 or 1:31,000, and recently we moved from black & white to colour." In order to manage the changes, internal capacity focuses on the new processes while updating, in particular of building data, is currently partially outsourced. "Previously, photogrammetric data collection was supported by MicroStation, but today we have chosen for Geomedia in combination with the ImageStation Stereo for Geomedia," Jan Beyen elaborates. "Such a change requires careful guidance because of start-up problems, which are inevitable and cause stress and temporary decrease in productivity. But I am very sure that we have made the right choice."

### Geodesy Department

Organisationally, the Geodesy department is involved in front-end and tail-end topographic activities: georeferencing of aerial images and map completion after photogrammetric restitution. "Ten persons are occupied with collection of Ground Control Points (GCPs) while twenty people are doing ground surveys for map completion," says Pierre Voet. "So around thirty people are working in the field, sometimes also at the request of third parties, to survey, for example, military zones." Pen computers equipped with ArcView and GPS are used for map completion. Missing topography and attributes are sketched on the vector map with an aerial photo backdrop. Updating is thus shared between a photogrammetric operator and a ground surveyor. "This does introduce a need for extra co-ordination," Pierre Voet agrees, "or may even lead to lack of feelings of ownership by the individual, and thus a reduced sense of responsibility. But there are advantages too: more efficient use of equipment and focused professionals. For example, photogrammetric operators require stereoscopic viewing skills while surveyors need car driving skills and a communal attitude. Yes, the production schedules are tight, but production flow is monitored and alternative solutions put in place where necessary." The geodetic horizontal (xy) reference system consists of around 4,000 points on which survey instruments can be positioned, and the same number of orientation points. The height reference system consists of around 19,000 marked points. "AGN is the national GPS infrastructure," Pierre Voet continues. "Since Belgium embraces the concept of open and free access to public information, there is no subscription structure; all land surveyors are free to ring in on the server to obtain corrections. They only need to pay the phone bill." The complicated Belgian government structure also implies that responsibility for the 61 permanent GPS reference stations is spread over the three regions. The 36 stations in the north are monitored by the Flemish Positioning Service (Flepos), the 24 points in the south by Walcors, and the one point in the Brussels area by NGI.

### Symbolisation

One interesting product is the 1:20,000 map created by "gluing" together four, reduced-size 1:10,000 maps. Both size and semantic content are identical to the base-map, so that the map is overcrowded with symbols. "Clients are complaining that the map is difficult to read," Frédérique Spitaels of the symbolisation team remarks. "Of course, the information content of a map is always in competition with its worth as a communication tool, but now the information is overemphasised; the number of symbols on the 1:20,000 is nearly twice as high as on the 1:25,000 map, while the scales are similar." Olivier Swartenbroekx, head of the team, adds, "We have started a project to change symbolisation to enhance readability while preserving content. Users have been confronted with the prototype and suggested improvements, and we are now working on the finishing touches. The next step is to develop a process to derive the map from ITGI at the highest possible level of automation."

### Core Business

Like many government organisations, NGI is struggling to define its core business and competencies. For example, printing of maps is mainly done in-house, on three Roland presses installed nearly two decades back. Should printing be discontinued and outsourced? "Printing of maps requires a level of skill, knowledge and commitment which can be hardly found in an outsourcing context," according to Ingrid Vanden Berghe. So the solution is to continue in-house printing and invest in replacing the outdated machines. The recently bought computer-to-print plate (CTP) machine enables transfer of digital maps directly to print plates without use of chemicals. Maps are also printed on the four-colour machine belonging to the Ministry of Defence; NGI is entitled to use this modern press three days per month. Over half a million topographic map sheets and nearly 200,000 tourist map sheets leave the presses annually.

Box:

### Tasks and Legal Authority

1. Establishment and maintenance of the geodetic reference frame, both planimetric xy coordinates and the height component.
2. Creation and maintenance of aerial-photo coverage of national territory
3. Creation of topologically structured topographic datasets and production of derived map series.
4. Processing of geographic data from airborne and space-borne remote sensing.
5. Providing commercial services to third parties.
6. Carrying out applied research aimed at development of relevant disciplines and publishing of results.
7. Determination and dissemination of standards and directives concerning content, quality and exchange format of topographic datasets.
8. Provision of education in relevant scientific and technical disciplines to own employees, employees of public and private organisations and foreign trainees.
9. Management of archive centre for preserving aerial and satellite images, and historical and contemporary maps, including a scientific library specialising in geodesy and cartography.
10. Marketing own products and services.

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