

THE ROLE OF THE MILITARY MAPPING ORGANISATIONS IN THE CREATION OF THE HUNGARIAN NATIONAL SPATIAL DATA INFRASTRUCTURE

László ALABÉR, Ministry of Defence Mapping Company

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1. Military Mapping in Hungary

The independent Hungarian military mapping may date its origin from 4 February 1919. Since January 2001, the military mapping tasks have, in the main, been undertaken by the Mapping Service of the Hungarian Defence Forces and the Ministry of Defence Mapping Company.

The objective role of the **Mapping Service of the Hungarian Defence Forces (MS HDF)** is to plan, execute and, aside from basic government mapping duties, undertake other tasks for the state within the jurisdiction of the minister of defence. MS HDF provides for the execution of the tasks necessary for defence map supply and professionally co-ordinates other sectors' defence related surveying and mapping activities including standardisation and regulation issues.

To fulfil this role, it:

- plans and organises mapping and military geographic provision for the armed forces;
- sets out professional standards and regulations;
- under licence, authorises and supervises survey camera aerial photography;
- operates military geographic and digital topographic databases, provides for the continuity of map update and the filing of the changes on the maps;
- represents defence interests in the determination of medium and long term mapping tasks of the country's map supply within the Co-ordination Committee on Map Supply established for scheduling and co-ordinating the tasks;
- fulfils the tasks arising from international commitments;
- directs and supervises the professional activities of MoD Mapping Company.

The **MoD Mapping Company** is charged with the implementation and direction of principal state duties within the portfolio of the minister of defence as well as the custody, handling and provision of state base data and maps.

The tasks of MoD Mapping Company are as follows:

- undertaking and commissioning surveying and mapping works within the bounds of state surveying and mapping;
- the custody and handling of national geodata, base maps and state topographic maps arising from the activities prescribed above;
- map supply for the Armed Forces (Air Force, the Border Guards, the Civil Protection Service and the defence administrative and law enforcement bodies) for payment;
- The MoD Mapping Company also produces military thematic maps (among other things, with conversion of state topographic maps according to NATO prescriptions),

military control point catalogues and other special mapping products in compliance with the demands of **MS HDF** in analogue and digital form; as well as

- stores and provides state topographic maps, mapping products and state base data for the use of the national economy in analogue and digital form;
- carries out and commissions aerial photography and other remote sensing tasks;
- conducts work in connection with geodetic provision of military engineering and other weapon systems;
- does field examining and maintenance of state control points for areas in MoD administration, preserving control points in the control point catalogue as well as replacing destroyed control points;
- operates an aerial film archive and provides remote sensing materials and
- activities in connection with the technical servicing of the 'Open Skies Programme'.

Clearly, one of the major functions of the Hungarian military mapping is the creation of state topographic maps for military and civilian users. This is the direct result of the regulations of the 76/1996 Act on Surveying and Mapping Activities, which will be outlined below.

2. The National Spatial Data Infrastructure in Hungary

The necessity of the development of spatial data infrastructure in Hungary was recognised already in the second half of the 70's, when the formation of the concept for the Surveying and Mapping Data Bank at the Research Department of the OFTH* of the Ministry of Agriculture and Food Industry* began. The results were then used in the realisation of the National Spatial Data Project.

In 1984, the Committee of Scientists of Geodesy of the X department of the Hungarian Academy of Sciences charged a subcommittee, to be led by Dr Ferenc Sárközi, with working out a recommendation on a governmental programme for the making of a **spatial data infrastructure**¹. The concept defined the base data files, the method of data acquisition, their setting, the scheduling of data capturing and their major fields of utilisation. On the basis of the concept the Chairman of the Hungarian Academy of Sciences appealed to the President of the Council of Ministers, who, in his reply of 25 January 1990, 'decided' the launch of the governmental programme and instructed the Ministry of Agriculture and the Ministry of Defence to start the necessary preparations. In spring 1990 the Minister of Agriculture issued his order on the launch of the programme. Although the initiative estimated to cost 10 to 40 thousand million forints was also supported by the Prime Minister, it was never realised because of the change of the government.

In 1992 the **National Spatial Data Project** started with a support of 330 million forints from the National Technical Development Committee (OMFB) and the initiation of 2 thousand million forints in resources, which resulted in the national standards for digital military maps and the first version of the DTA-50 database were prepared. In the civilian area the DAT standards and related specifications were created. In the course of the project the framing of the spatial data system of 24 settlements and Budapest districts could start. The National Spatial Data Project contributed to the introduction of GPS technology, the improvement of

¹ Dr. Sárközi Ferenc Térinformatikai (adat) infrastruktúra, <http://bme-geod.agt.bme.hu/tutor-h/terinfor/t59.htm>

yield estimation based on remote sensing and the establishment of the Administrative Borders Database. The governmental decision in November 1996 on the launch of the implementation of the **National Cadastre Programme** was of overriding importance for the development of GIS technology in Hungary.

The basics of the National Spatial Data Infrastructure (strategy) were approved in 1997 by the Informatics Inter-departmental Committee (in the 13/1997 decree of 15th Oct. of the Informatics and Telecommunication Governmental Committee) working within the Prime Minister's Office. This committee was charged with the formation of the national informatics data policy, which included the elaboration of the Spatial Data Infrastructure. The resolution in order to establish the national spatial data infrastructure (NTI) deemed the following points necessary to realise:

- the elaboration of the National Spatial Data Strategy;
- the establishment of the National Spatial Data House;
- the enforcement of the National Cadastre Programme;
- the creation of base maps of settlements, transport and other sectors;
- the formation of an parcel based information framework;
- the launch of the Hungarian Topographic Programme;
- the creation of a Unified Geographic Address Registry;
- the accomplishment of the Aerial Survey of Hungary Programme.

The National Spatial Data Strategy, a decision-preparatory study, was finished in August 1998. The study defined the following key elements with a view to the completion of the National Spatial Data Infrastructure:

- Setting up a strategic leading, a strategy-making and controlling organisation.
- A continuous development of the regulatory environment of GIS.
- Starting the services the earliest possible, setting up a National Spatial Data House.
- GIS support of the NATO and EU accession.
- Making products and supplying services based on state base data (integrating the “Unified Geographic Address Register project”, the “Base Maps of Settlements, Traffic and Other Sectors project” and the “National Cadastre Programme project”; vehicle navigation; business applications; action-control systems and security services).
- GIS training.

The only programme defined in the recommendations of ITB and the study whose fulfilment is going on without interruption is the National Cadastre Programme. The National Spatial Data Strategy remained a plan, whereas within the Aerial Survey of Hungary the aerial photographs have been prepared and the making of orthophotos is in progress.

The project of setting up a Data Clearinghouse is still in the definition phase, although the inventory and documentation of existing data sets are in progress. Additionally, two **metadata servers** have already been set up, METATÉR Server at the Geological Institute of

Hungary, and FISH (<http://fish.fomi.hu>) with a server at the Institute of Geodesy, Cartography and Remote Sensing (FÖMI).²

In the field of the standardisation of GIS databases working out the MSZ 7771: 1997 and the MSZ 7772: 2001 National Standards was a significant step.

The first standard is the conceptual model on digital basic map (on multicadaster map) issued by the Hungarian Board of Standards nomenclatured as MSZ 7772-1:1997. The standard has been proven with reference to the digital base map instructions. The MSZ 7772-1:1997 standard and its instructions have been applied and proved fully appropriate for practice during 3 years of surveying practice in the framework of the National Cadastre Programme. The second standard is the conceptual model of Digital Topographic Data Base.³ These standards define the requirements of the Digital Topographic Database, which constitutes the GIS basis of the Hungarian Topographic Programme. The drawing up of the detailed requirements and specifications on the basis of the standards is in progress.

Unfortunately, in the past five years, no significant progress has been made in co-ordinating and creating the organisational framework. Supporting the financial background for the National Spatial Data Infrastructure causes some difficulties.

3. Topographic Mapping

The creation of authentic and up-to-date reference data is an integral part of the Spatial Data Infrastructure. The execution of this expensive and laborious task requires a significant contribution by military mapping in making and supplying state topographic maps.

3.1. Legal regulation of topographic mapping

The production and supply of state topographic maps is regulated by the 76/1996 Act on Surveying and Mapping Activities. The Law states the definition of state topographic maps: *"The State Topographic Map is a map made in large, medium or small scale, covering the entire country in a colour-printed hard-copy on paper or film, or in digitalized form, which contains the planimetric and relief features of the natural and man-made terrain elements of the earth surface along with the lettering without any reference to proprietorship."*⁴ Furthermore the Law stipulates the compulsory use of State Topographic Maps: *"As the base of state and local governmental GIS the state maps and basic data shall be used."*

The proprietor of the State Topographic Maps is the Hungarian State, which proprietary rights are practiced through the corresponding Ministries. Related to the production of State Topographic Maps the Ministry of Agriculture and Regional Development and the Ministry of Defence assume the responsibilities for the harmonised execution of their corresponding obligations.

The division of labour between the two responsible Ministries is regulated by the Joint Decree No. 21/1997: "On execution of some rules defined by the 76/1996 Act on Surveying and Mapping Activities" (III.12.). According to this, the production of large scale (1:10 000) State Topographic Maps falls within the jurisdiction of the Ministry of Agriculture and Regional Development, whereas the **medium and small scale (1:25 000 - 1:250 000) State**

² Panel – GI, Pan European link for Geographical Information, © European Communities, 2000, ISBN 3-901716-22- GeoInfo Series nr.21, Series Editor Andrew U. Frank, Institute for Geoinformation Technical University of Vienna, Vienna, chp 4, p. 10.

³ Dr. Szabolcs MIHÁLY: TWO STANDARDS ON DIGITAL MAPS AS PART OF THE HUNGARIAN NSDI, International Conference FIG, Working Week 2001, Seoul, Korea 6–11 May 2001

⁴ Fttv. 14. §.

Topographic Maps are the responsibility of the Ministry of Defence. Evidently, the responsibilities are shared in the same way for the related digital databases.

3.2. The condition of topographic maps

The civilian and military mapping services both pay extraordinary attention to the production of topographic maps. Unfortunately, lately less and less resources are available for the maintenance of the map system. The present state of Hungarian topographic maps can be characterised by the following:

- Primarily they are in analogue form (traditional paper maps);
- Their content is outdated to a great deal. The topographic maps are usually 20 to 25 years old and their revision is essential;
- In many cases the civilian and military map systems are overlapping in scales (1:25 000, 1:100 000, 1:200 000), their duplicate production incurs unjustifiable extra expenses;
- Digital data are scarcely available, and the existing "databases" do not meet the requirements of up-to-date GIS.

The latest update of the 1:25,000; 1:50,000; 1:100,000 and 1:200,000 scale topographic maps began in 1983 and was finished in 1997. The completed map sheets have full country coverage at all scales. The update of the content was carried out on the basis of aerial photographs and field verification. Smaller scale maps were created by derivation and generalisation.

The creation of the 1:250,000 scale Joint Operational Maps (JOGs) commenced in the past years. The maps are produced on WGS-84 datum and in UTM projection.

A revision of content and conversion into digital form of the 1:50,000 scale maps as well as their re-editing onto WGS-84 datum and in UTM projection is in progress.

3.3. Digital products produced by military mapping organisations

Military mapping has been dealing with digital elaboration of maps since the early 1980's. The GAB, Geodetic Data Base and DTA-200, Digital Topographic Database at 1:200,000 scale was completed in the second half of the 1980's, followed by the 10 × 10 and a 50 × 50 m grid density Digital Elevation Models (DDM-10 and DDM-50, respectively) and the DTA-50 Digital Mapping Database at a scale of 1:50,000.

Geodetic Data Base, the geodetic basis of topographic maps, holds data of the fundamental to the 4th order triangulation network and twin point network. The manifold utilisation of the database is ensured by the accessibility of the point co-ordinates in different projection systems.

The creation of the **DTA-200** database commenced in 1988. Since that time this database has been used by several institutions as the base for their autonomous thematic database.

For the territory of Hungary, DTA-200 includes:

- national road network;
- railways;
- settlements and their names;
- hydrography and names of hydrographic features;

- international and county borders;
- spot heights;
- hydrographic and shipping constructions;
- road distance data;
- names of larger geographic entities.

Data acquisition was carried out by manually digitalising maps in scale of 1:200 000 and 1:500 000. The data file is accessible in .DGN, .DXF and .DWG data formats, and in Gauss-Kruger and Unified National projections with a full extent of 7.2 Mbytes.

In 2002 we started our on-line mapping service using the DTA-200 database, which can be found on the www.mapper.elte.hu/hunet200 web page.

The **Digital Elevation Model** holds height data above sea level for grid points of a 10 × 10 m and a 50 × 50 m grid for the territory of Hungary. The data source is the relief reproduction original with the contour lines of the 1:50,000 scale military topographic map series issued between 1985–91. The file is available in Unified National Projection raster data structure with a sheet designation according to the Unified National Mapping System at scale 1:100,000. Nevertheless, creating a file with smaller density is also possible. The file is available in Gauss-Kruger projection as well. The total extent of the data file with 10 × 10 m grid density is 2.5 GBytes; with 50 × 50 m density it is 100 Mbytes.

Our most significant work, **DTA-50** Digital Mapping Database is produced on the basis of the 1:50,000 scale topographic maps. As a general skeleton map, on one hand, this map makes possible the automatic processing of topographic maps and, on the other, it can be used as the basis of a future GIS application.

The Digital Mapping Database contains some 700 features in the following categories:

- marginalia;
- control points;
- settlements;
- constructions (industrial, mining, telecommunication, etc.);
- bridges and crossings;
- hydrography;
- hydrographic and shipping constructions;
- relief;
- vegetation and soils;
- boundaries.

The size of the DTA-50 data file is 0.8–1.0 GBytes in Intergraph, Mapinfo, Arcinfo, .DXF and .DWG data formats and 0.4 GBytes in .DGN format. The size of a sheet with average information density is approximately 3.1 Mbytes. The data file is accessible both in Gauss-Kruger and Unified National Projections and is available on CD-ROM as well. The update and supplementation of the content of the database is continuous.

DTA-50 serves as a mapping base of several important databases accessible on the Internet:

- **TEIR** territorial information system operated by **VÁTI NPO**;

- **DSM** digital street maps of Hungary operated by **GeoX Ltd**;
- **MIU** smart street network of Hungary operated by **GeoX Ltd**.

The Mapping Agency of the Hungarian Defence Forces, our legal ancestor, started to operate its Internet Data Servicing Centre in May 1999. At present, the website of the MoD Mapping NPO can be accessed via MS HDF's server at www.mhtehi.gov.hu. The publication of the DTA-50 on the government net was put in service in 1999. This service, however, is only available for registered users – users with authorisation – for the time being.

Two years ago we started the creation of an **Internet Catalogue of Survey Camera Aerial Photographs**. MoD Mapping Company produces a great number of survey camera aerial photographs. Similarly to the last years' practice, 30% of the country is photographed every year at 1:30,000 - 1:40,000 scales, which, besides mapping tasks, can be utilised in many other fields of national economy. The system is in a trial phase now.

The catalogue allows:

- storing and visualising technical data of survey camera aerial photographs;
- visualisation of quick look images of the aerial photographs.

4.3. The Hungarian Topographic Programme

Considering the present status, it is inevitable that the demands of both military and civilian purposes of topographic mapping require the development of a modern, unified, digital topographic mapping system. Since almost all sectors of economy are users, this aim can be implemented by an independent, infrastructural development project, the *Hungarian Topographic Programme*.

The object of the Hungarian Topographic Programme is the development of a topographic database and map series suitable for defence, administrative and national economic purposes as well as for fulfilling the requirements of NATO and EU integration and Hungarian demands for professional use. It shall meet the complex requirements both in content and form and can become a uniform, interdisciplinary base infrastructure of modern GIS. In this way, the compatibility of systems of different purposes and content can be achieved.

As for its content, the Hungarian Topographic Programme is a complex system designed for data capturing, data processing, data storing, the generation of products, revision of changes and data servicing tasks, putting classical topographic mapping on modern platforms. Its basic technical component is the digital topographic database and map series, the parts of which can be utilized independently. Another integral part of the Hungarian Topographic Programme is the creation and continuous maintenance of the digital topographic database and map series as well as the establishment and operation of the technology extended for servicing, and the organizational frame necessary to the fulfilment of the tasks.

The leaders of the military and civilian mapping organisations have agreed that the production of a digital topographic database serving as a basis of the MTP is a joint task. A decision preparation study from the summer of 1997 already stated that the creation of DITAB was to be completed within a reasonable time. Different demands for each scales, especially defence requirements on the scale range between 1:25,000 to 1:250,000 do not allow any delay in the implementation of the programme. Since the capacity demand to produce the 1:10,000 scale map series surpasses the joint requests for the production of the state topographic map series in all other scales, it seems to be useful to make a reduced

version of the topographic database. In the first phase, a database with the data content (data density) corresponding to the 1:25,000 scale maps and with an accuracy of data acquisition corresponding to the requirements set against the 1:10,000 maps should be set up. This mapping base will be suitable to form the cartographic databases of the 1:25,000 to 1:250,000 scale range directly. In the future it can be continuously supplemented with the planned full data content to correspond to that of the 1:10,000 scale.

The first actual joint work between the civilian and the military mapping agencies in MTP was the finalising of the common, new standard of topographic database, MSZ 7772-2. The standard is under review for acceptance at the Hungarian Committee of Standardisation. The standard strongly connects to the accepted Digital Base Map Standard MSZ 7772-1. The conception of the standard also connects to the DIGEST standard used by NATO.

Another important step in preparation of the programme was a pilot project, completed in March 2000. In the frame of this project the Mapping Agency of the Hungarian Defence Forces, in co-operation with six GIS companies, completed the loading of a sample sheet with reduced DITAB data content.

The document *System plan of the defence sector of a GIS supporting the creation of state topographic maps and data provision* was completed in May 2001.

According to our plans, a prototype of the Digital Topographic Database covering 350 km² will be prepared in 2002 along with the detailed specifications of the creation of the database.

4. Summary

The past few years have been characterised by dynamic change in society, the development in technology as well as in map making. There is a tendency in Europe and other parts of the world towards setting up a global, more specifically a European, spatial data infrastructure that is based on the similar infrastructure of the different countries. The Internet, the GPS and the GSM are such technical tools, which are not only to be used for mapping purposes but also have to be aimed to serve different customers. We have to supply products that make the use of these tools even more effective. Military mapping has to provide accurate and precise reference data to display spatial information.

The accession to EU and the digital revolution of our age comes with new challenges. Agriculture, environmental protection, local administration, disaster management and regional development all require precise and up-to-date spatial information. Special attention has to be paid to the satisfaction of civilian needs for spatial information.

We will need more than simple maps and databases but rather a NATIONAL SPATIAL DATA INFRASTRUCTURE based on a well-established strategy. Military mapping by maintaining and updating the topographic maps that it assumes responsibility for plays a significant role to achieve this goal. One of the most important tasks for us in the future is to establish the Digital Topographic Database, which will result in a higher quality service in supplying spatial information.

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