

# **MAPPING AND CARTOGRAPHY IN FINLAND**

Finnish National Report

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## **GENERAL**

This report provides a general summary of mapping activities in Finland. Emphasis is on national mapping. The report updates the report presented to the XVII International Conference of the ICA in 1995. Compared to the earlier reports, the current one pays more attentions to the cartographic aspects of the Finnish mapping activities and on the other hand the treatment of the other related areas, like photogrammetry and control surveys, are omitted nearly completely.

## **EDUCATION AND SCIENTIFIC RESEARCH**

### **Education**

Higher education (M.Sc.) in geodesy, photogrammetry, cartography and geoinformatics is provided in the Department of Surveying at Helsinki University of Technology (HUT). On average 35 students complete master's degrees in surveying every year. Higher education in cartography is also provided at three other universities, in the departments of geography.

Since 1992 surveying engineers (B.Sc.) are trained at four institutes of technology, where there is a four-year curriculum in surveying and mapping, about 100 students graduates each year. In addition, the vocational schools offer two and three-year courses in general surveying; about 150 students complete professional examinations every year.

### **Research**

The Finnish Geodetic Institute (FGI) is a research institute for the Government of Finland, which employs some 40 researchers. The FGI performs high precision geodetic measurements and carries out research in geodesy, gravimetry, photogrammetry, remote sensing, cartography and geoinformatics. The FGI is also maintaining the Finnish permanent GPS-network, FinnRef, comprising of 12 GPS-stations. Related to the activities of ICA, researchers at the FGI in the Department of Cartography and Geoinformatics have been active especially in the ICA generalisation and visualisation working groups.

The Instrument laboratory of the Technical Research Centre of Finland performs specialised research in remote sensing.

HUT is also engaged in extensive research work. The main fields are digital methods in photogrammetry, spatial data management, digital mapping including GPS techniques, and visualisation and analysis of geodata.

### **The Sixth Edition of the Atlas of Finland**

In 1899, the first national Atlas of Finland was published. Since then, four editions of the Atlas have been published – in 1910, 1925, 1960 and 1977–94. As a series, they present an image of the regional development of Finland and of the progress made in geography and cartography. The sixth edition has been published on March 24, 1999 in commemoration of the 100th anniversary of the Atlas. In the new edition Finnish geographers present perspectives on Finland, its past, present and future in a regional context. The atlas is published by the Geographical Society of Finland and the Werner Söderström Publishing House.

## **GOVERNMENTAL ORGANISATIONS IN MAPPING**

### **The National Land Survey of Finland**

The main governmental organisation for national mapping is the National Land Survey of Finland (NLS). The NLS is responsible for Finland's cadastral system, registers pertaining to real estate and general mapping assignments. It also promotes the shared use of geographic information. Its functions are broken into two result target areas: land survey and mapping activities. The main mapping services of the NLS are: to produce, make dense and maintain the national control network, to carry out photogrammetric and remote sensing operations, to produce basic topographic maps and thematic maps, and to carry out mapping and cartographic works to special order.

The NLS was reorganised at the beginning of 1999. The organisation consisted earlier of 21 District Survey Offices, seven national operational units and the central

administration. Organisational reform, prepared during the year and put into effect on January 1, 1999, reduced the number of District Survey Offices to 13 and national operational units to five. At the same time one of the national units, the Satellite Image Centre was privatised. The new company, Novosat Ltd, is 60 % owned by the Novo Group Plc and 40 % owned by the NLS.

### *Cartography*

The NLS is responsible for national mapping. The Basic Map series 1:20 000 was completed in 1975 and it extends the whole area of Finland, 338 000 km<sup>2</sup>. Digitising of data started in early 1970's by automating some steps in the fair drawing process. Now the latest edition of the Basic Map is available in both, raster form and vector form. Scanned maps, however, will not meet the need for up-to-date digital data in the long term.

The Topographic Data system consist of the Topographic Database containing the most detailed general topographic data with nation wide coverage and the map databases, which are generalised from the Topographic Database. The Topographic Database is the most accurate data in position on Finland's topography. The positional accuracy of the data corresponds to the scale of 1:5000-1:10 000. This continually updated database is an excellent foundation for any geographic information system. The data compilation is done in vector form with MAAGIS-software in VAX/VMS environment. The Topographic Data System covers 83 % of the area of Finland and will cover the total land area by the year 2000. The Topographic database is used as a basis for variety of standard products as well as products customised to users' needs.

The Basic Map 1:20 000 is produced from this data. The Basic Map 1:10/20 000 is a topographic map covering southern and central Finland. It is produced in the scale of 1:10 000. Real estate boundaries and some small cartographic editions are done to make a printed product. The colour separated films are done from vector-postscript converted later to raster. The Basic Map 1:20000 is printed in four colours. The Topographic Map 1:20 000 covers northern Finland. The mapping work is carried out in co-operation with the Topographic Service of the Finnish Defence Forces. In all,

the 1:20 000 map series consist of 3750 map sheets covering the whole country. One 1:20 000 scale sheet shows an area of 10x10 km<sup>2</sup>.

The Topographic Map 1:50 000 will cover the whole country in year 2002. One 1:50 000 scale sheet shows an area of 30x40 km<sup>2</sup>. The production of the Topographic Map 1:50 000 is also based on the data from Topographic Database. Some generalisation is done in production of the map database. The process for printed map is similar to the Basic Map 1:20 000 production. About 250 map sheets of the Basic Map 1:20 000 and about 40 map sheets of the Topographic Map 1:50 000 are published yearly using the Topographic Data System.

The 1:20 000 Basic Map and 1:50 000 Topographic Map are also available on CD in raster format. Other products available in digital form are:

- National Road Database
- Digital Elevation Model
- Administrative Boundaries
- Land Use and Forest Classification
- Databases 1:100 000, 1:250 000, 1:500 000 and 1:1 -1:4,5 million
- Nordic Map Database 1:2 million

The following map series are available in printed form:

- Basic Map 1:10/20 000 and Topographic Map 1:20 000
- Topographic Map 1:50 000
- General Map 1:500 000

The Base Map 1:5000 is a combination of orthophoto background and superimposed cadastral boundaries. The scale of aerial photography for orthoproduction is 1:16000. Boundary data are produced by numerical means.

### *Co-operation in neighbouring areas*

The NLS, along with 14 countries, is a participant in a Baltic Sea Geographic Information project, as well as the GIT project in the Barents Region jointly run by Finland, Sweden, Norway and Russia, and the GIS-Sever project on the eastern border with Russia. In Estonia and Russia, the NLS was involved in accelerating land reforms, training in cadastral survey and real estate evaluation and also participated in the establishment of cadastral registers.

## *Cadastral*

The roots of the Finnish cadastral go back to the 17th century. At present it covers the whole Finland. The Cadastral consists of attribute data (real estate register) and of a cadastral (index) map. The cadastral is based on legal land surveys, which are carried out by governmental and municipal land surveyors. In the survey operations the surveyor prepares a survey map (for cadastral map) and survey documents (for real estate register).

Some 25 000 survey operations are carried out annually. The most common survey operation is parcelling-out. The land surveys annually cover an area of 2000 km<sup>2</sup>. The survey maps are mostly in scales from 1:500 to 1:5000. They are based on new field measurements, on the old survey maps or on the use of aerial photogrammetry. The survey (parcel) maps are nowadays produced digitally.

The real estate (parcels) is recorded in real estate registers maintained by governmental or municipal land surveyors. Rural areas and some urban areas are in the governmental register, and the town plan areas are in the municipal registers. Registers are already computerised. The Ministry of Justice is also computerising its own ownership and mortgage registers on the basis of the above real estate registers. All the registers will be available to the public.

The cadastral map of rural areas is in the scale of 1:10 000 and 1:5000, and of urban areas in scales from 1:500 to 1:2000. At the moment about 94 % of the total area of the country has been digitised and stored in database. The work should be completed in 1999. Real estate boundaries are also printed on the Basic Map.

The largest development project of the year 1998 was the implementation of the JAKO information system. Development of the JAKO system began in the early 1990s. The aim was to create an information system where cadastral maintenance, conducting of cadastral surveys and an efficient information service could be carried out in a single system. Another aim was to shorten the duration of cadastral survey processes. Information regarding cadastral attributes and positional data which previously had to be run with about twenty different programs now comprise an entity which is

managed through a graphic user interface. JAKO is one of the world's largest geographic information system based on a centralised database. The JAKO-information system was introduced at the beginning of the spring 1998 and was made fully operational by September. The problems with the implementation had only minor impact on customer service and both customers and interest groups have given positive feedback on the new information services offered by JAKO. Staff coped with the transition period exceptionally well. Two thirds of the NLS staff were trained in using the new tools and in doing their work differently.

## *Geographic information services*

The NLS has the responsibility to stimulate geographic information activities in Finland. Shared use of geographic information is achieved when those who require information are brought together with those who produce it, thereby creating a market for geographic data. The data on real estate and topography produced by the NLS are offered in digital form for customers, for example via the information network. NLS has been closely involved in the development of the network services of the NLS in accordance with the principles of shared use.

Via the ordering service on Map Site, which is an Internet service for browsing topographic maps of Finland, a customer can obtain data on-line from the real estate market price register, the control station register and the digital cadastral index map, browse seamless maps in various scales, scroll a map or search a window by place name or co-ordinates. The service recognises 30 000 place names for searching. Maps are printable as any document in www. Map Site service is free of charge, but needs registration. Maps are available to the user 24 hours a day, whenever connected to Internet.

MapSite was published on September 1996 after a test use period. Another Internet service called Professional's MapSite was published in January 1997. In addition to the service provided by the MapSite, it provides maps with the scales of 1:8000, 1:20 000 and co-ordinate information. It will contain more place names for search and frequently updated maps. Users of Professional's MapSite will pay

an annual fee. Use of the MapSite in 1998 was also increasing – over 3 million searches were made.

The geographic information directory already contains descriptions of almost 300 geographic information data sets, including both nation-

wide and local data sets. Maintenance of the geographic data description directory began back in 1991, but only with the Internet has the directory been available to everyone. In 1998 there were more than 400 000 hits on the geographic data description directory pages.

### **The Geological Survey of Finland (GS)**

One of the most important publishers in thematic cartography is the GS, which performs geological investigations and searches for quaternary deposits and bedrock resources. GS publishes mainly two types of maps; maps of quaternary deposits and bedrock maps.

The quaternary deposits maps are primarily published in scale 1:20 000. There are 1200 sheets from which about 450 are not yet published. There are also 25 (9 published) sheets in scale 1:50 000 from the northern Finland. New maps are produced numerically and the old maps are to be digitised. There are also older sheets of quaternary deposits maps in smaller scales, 1:100 000, 1:400 000 and 1:1 million which are no longer in further production. Most of the map sheets are in digital form.

The bedrock maps are published in scale 1:100 000. At the moment there are 250 sheets, new maps are produced in digital form and the older printed maps are to be digitised. There are 27 sheets in scale 1:400 000, but they are no longer reproduced. There is also one new map covering the whole of Finland in scale 1:1 million.

In addition GS publishes the North-Calot map series and Mid-Nordic maps in scale 1:1 million. GS also performs geo-chemical mapping and geophysical mapping.

### **The Topographic Service of the Finnish Defence Forces (TS)**

The Topographic Service is the map service establishment of the Finnish Defence Forces. As the GIS Centre of the Defence Forces it is responsible for collecting, processing and maintaining digital terrain data for different defence applications. In addition to the special maps needed by the Defence Forces and the Frontier Guard, the TS has taken part in the production of the national topographic map in the northern Finland. All this is done in close co-operation with the National Land Survey.

### **The Finnish Maritime Administration (FMA)**

FMA takes care of all mapping and map production of navigational charts in Finland. In 1988 FMA introduced a software called FINGIS for chart production. This system is still on full operation in Chart Division together with MapPublisher image processing system. It has been used for the recompilation of 28 coastal charts (1:50 000) and 5 port charts (1:10 000 – 1:25 000) covering Gulf of Finland and part of the Gulf of Bothnia. In addition, five chart series for yachtsmen (1:50 000) covering Gulf of Finland and one chart series of Saimaa Lake district has been produced.

All coastal charts will be produced digitally in 2003. During the digitising process, charts have also been improved in precision, by using new digital coastline data. Also other information on these charts, for instance cultural features and geographic names, have been updated and corrected.

FMA has recently taken the new Hydrographic Information System (HIS) into production use. The HIS is a result of a three-year development project driven together with the Swedish Maritime Administration. The main advantages of the HIS for the FMA are the facility to collect and manage all types of digital data in a centralised database and to produce Electronic Navigational Charts (ENC).

The FMA has also started a new project for replacing the well served FINGIS system with a new printed chart production line. It will not only bring improvements to the chart compilation work but also facilitate close integration with the HIS-based data management and ENC production.

A colour scanner has been used to convert charts into raster formats. Postscript files have also been converted directly into raster formats. Chart series for yachtsmen in raster format together with navigational software have been published since 1995 on CD-ROM.

## CARTOGRAPHY IN THE CITIES AND MUNICIPALITIES

Finland is divided into 452 municipalities and cities, which act as local authorities in the country. Local authorities are primarily responsible for public services in Finland. Education, social welfare and health care, as well as maintenance of the technical infrastructure are the most important services. In this respect mapping and maintenance of updated spatial databases is of special value. Larger municipalities and all cities in Finland have active cartographic, legal land survey, mapping and GIS organisations, which are also responsible for producing maps and charts of the municipality area. The amount of employees, who work on land survey/GIS field in municipalities, is in total approx. 2100 persons.

The Finnish Association of Local Authorities collects yearly statistics of the surveying branch. Following information has been collected from that data. The coverage of the data is not 100 %, however, because not all municipalities and cities have answered the questionnaire, but it gives a good estimate about the situation.

### *Base maps and utility maps*

Regarding base maps, most of the cities have completed the digitisation of them. Regarding

utility maps, ten cities reported to have completed the digitalisation work. Data in Table 1. gives more detailed information about the extent of digital maps in cities.

### *Real estate boundaries*

Real estate boundaries data, a part of cadastre system in cities, have been digitised to a large extent, the total area of digital maps in 57 cities being 12318 km<sup>2</sup>.

### *Printed tourist maps and address maps*

Cities have published new editions of their tourist / address maps in scales 1:10000 -1:50 000. Most cities have their tourist map originals in digital format and those are continuously updated. 28 cities had their tourist maps in Internet in 1998 and 21 cities had a tourist map CD product in the market during 1998.

### *Environmental and recreation maps*

Some cities published special editions of their address map database in scales 1:20000 - 1:100000, for example Greater Helsinki Region recreation map was published in 1998, an edition of 300 000 printed maps. Sport Authorities of the cities in the area distributed it free of charge.

### *Base map coverage*

Scale	1:500	1:1000	1:2000	1:4000/1:5000
Number of cities	46	60	60	42
Total (km <sup>2</sup> )	2103	2163	3934	7479
Average (km <sup>2</sup> )	45	36	65	178

### *Utility map coverage*

Number of cities	22	21	13	3
Total (km <sup>2</sup> )	895	676	318	358
Average (km <sup>2</sup> )	40	32	24	119

**Table 1.** Statistics indicating the coverage of digital data for base maps and utility maps.





## **PRIVATE SECTOR CARTOGRAPHY**

On the private sector there are two big organisations, which take care of nearly all of the commercial cartographic publishing in Finland, namely Karttakeskus Oy and Geodata Oy. There are also some medium-sized consulting firms, which also perform mapping, like FM-International Oy, Soil and Water Ltd and Finnish Consulting Engineers Oy. In addition, there are also several smaller companies distributed all over the country having their important role in local large-scale map production and cartographic publishing.

### **Karttakeskus Oy**

Karttakeskus delivers traditional printed maps as well as digital map databases and software ranging from logistics to sales monitoring. Karttakeskus can rely on its long experience and expertise in publishing all kinds of printed maps, e.g. road maps, town plans and recreational outdoor maps. There are different scales in road maps which cover the whole country: the GT maps in scale 1:200 000, the AT map in scale 1:800 000 and the YT map in scale 1:1,6 mill. There is also a Road Atlas of Finland in the scale of 1:200 000 for the Southern and 1:400 000 for the Northern Finland. Karttakeskus constantly develops new high-class and up-to-date products, the completely renewed (in 1999) series of GT road maps given as an example. All maps are digitally produced.

Karttakeskus also produces maps for order. These maps vary from large-scale town plans to very small-scale world wall maps. In most cases both in publishing and maps for order Karttakeskus relies on its own databases.

Karttakeskus's CD products for consumers are marketed under the brand name Genimap. The core of these CD products lies in the logistic software providing the users a possibility to find the optimum route from starting point to destination. The newest product GT Suomi CD road map contains road maps, town plans, road names and addresses covering the whole of Finland, as well as an advanced route optimising software. The product also includes the GPS feature. In addition, Karttakeskus produces CD sea charts in co-operation with the Finnish Maritime Administration.

### **Geodata Oy**

Geodata Oy is a newcomer in the field of cartographic publishing. The company was bought two years ago by Werner Söderström Oy (WSOY), an old Finnish publishing house. At the moment the company is a part of SanomaWSOY-Concern, which is the second largest media publisher in the Nordic Countries. Geodata takes care of the production of all kind of special maps within the concern; this means among others the production of road maps and atlases, town plans, town atlases, school wall maps, school textbook maps, calendar maps and atlases as well as world atlases. Part of this production is done in co-operation with foreign publishers. All map production is digital.

Geodata has also published a road map series covering the whole of Finland. The scale is 1:250 000 and the number of sheets is 17. All 17 sheets were published in January 1999. On the backside of the sheets there are town plans of major towns as well as the regional maps of most important economical regions of Finland. The 1:250 000 map is also available as a CD-ROM. The Roadmap of Finland is a double-sided sheet covering the whole country in the scale of 1:750 000. In atlas cartography the most important work has been the editing and production of the Nordic editions (FIN, DK, SWE, N) of the Reader's Digest World Atlas. In addition to cartographic publishing, Geodata is also a specialist in GIS.

Geodata uses for its products source data, which are produced by other organisations and authorities. However, the company has also created its key databases by itself. This means that it is also the copyright owner of the base data used for the final product.

The open commercial competition will widen the selection of maps available for the consumers. It also affects to the production technology, which must be reliable, quick and cheap. This is a challenge for the cartographers.

### **Mapping abroad**

In addition to the works mentioned above, Finland takes part also into the development projects, which produce maps for developing countries. Especially the Company FM-International (formerly Finnmap Oy) has a very long experience in this type of map production. The maps produced are mainly

topographic base maps in scales 1:10 000, 1:25 000 and 1:50 000. The countries where FM-International has ongoing projects on topographic mapping are Turkey, Bangladesh,

Nepal, Vietnam and Cambodia. Depending on the situation the production methods are either traditional or digital.

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