

**NATIONAL REPORT OF FINLAND FOR
PHOTOGRAMMETRY, REMOTE SENSING, GIS AND DIGITAL MAPPING
1992-1995**

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ABSTRACT:

The national report of Finland outlines activities and developments in photogrammetry, remote sensing, GIS and digital mapping during the period 1992-1995. The sectors included in the report are of government, education, research and of private sector. There are also listed addresses and www-URLs of some organizations.

1. INTRODUCTION

Mapping in Finland is practised by governmental organizations, municipal surveying offices and private companies. The national organizations concentrate on the small-scale mapping covering the whole country. Large-scale maps are made by municipal surveying offices and private companies.

Research in the fields of photogrammetry, remote sensing, GIS and digital mapping is mainly done in the national organizations, institutes and universities.

Education of surveying at the university level is centred at the Helsinki University of Technology (HUT) at the department of Surveying. Fundamentals of photogrammetry and remote sensing are given also at some other universities. Education in photogrammetry, remote sensing, GIS and digital mapping lower than university level is given in the branches of surveying in the State Institutes of Technical Education and in the municipal Espoo-Vantaa Institute of Technology.

In the field of surveying, engineer is a new degree in Finland. Education in that level is given in the Espoo-Vantaa, Mikkeli, Rovaniemi and Vaasa Institute of Technology. The first surveying engineers will be graduated in year 1996.

2. DEVELOPMENT OF PHOTOGRAMMETRY

During the years 1992-1995 development has been aimed to digital photogrammetry, GPS-based flight navigation and GPS-based determination of projection centres of aerial images. In the field of non-topographic photogrammetry, development has occurred concerning real-time photogrammetric systems. They have been taken into productive use in different industrial applications.

Because private companies did not give any detailed information about their photogrammetric production, any exact numbers of taken photos or triangulation points or the mapping area are not listed here. Here are pointed out some facts that describe the development of photogrammetry, remote sensing,

GIS and digital mapping here in Finland during the years 1992-1995.

Analogue aerial images are commonly used for topographic mapping and digital images have been used for aerial aerotriangulation in some cases. Black-and-white films are the most commonly used in topographic mapping especially concerning scales smaller than 1:15000. Colour and colour-infra films are used almost as often as black-and-white films when the scale is bigger than 1:15000. Colour-infra films are the most commonly used for forestal interpretation and classification for forest taxation.

Important is the implementation of DGPS in flight navigation and aerotriangulation. Nowadays projection centres of aerial images are determined using DGPS almost for all projects. That has helped to reduce significantly the number of the ground control points. Nearly all triangulation during this period has been done by bundle block adjustment, just in a few cases triangulation was done by analogue model triangulation. The aim in triangulation is to use digital images and that is why there have been investigations how digital aerial image production should be arranged and executed.

Orthoimages have been produced for 1:5000 scale orthoimage maps and for some experimental maps. The aim is to make orthoimages automatically using digital photos.

The non-topographic activity has mostly been in the field of real-time photogrammetry. Real-time photogrammetric systems are used applications such as: robot guidance, road maintenance and deformation measurements.

3. DEVELOPMENT OF REMOTE SENSING

The remote sensing activities have increased during this period. In Finland, the development and applications of remote sensing are mostly concentrated on getting information from ice fields to use it to help winter shipping, for land-use classification, forestry and other environmental tasks.

One environmental task is to monitor pollution and the prevalence of alga in waters. Applications concerning forestry

are e.g. forest inventory and monitoring changes in forest condition. A remarkable project in the field of remote sensing has been to check the areas of cultivated land in applications for EU-support. Ice field monitoring is concentrated to interpret the ice situation at the Gulf of Bothnia, the Gulf of Finland and the Baltic Sea. The data type used is mainly NOAA-images, another data used is ERS-1-data and the use of it has been increasing. The real-time system for transmitting satellite-data products to icebreakers is in operational use.

The Satellite Image Centre, a new national unit, was established in the National Land Survey in February 1995. The centre imports and distributes satellite images, it takes care of the initial processing of the remote sensing data, offers educational and technical services for the users. One task of the Satellite Image Centre is to take care of contacts with remote sensing organizations of other countries.

Research activities in the field of remote sensing are concentrated e.g. to develop more automatic methods for interpretation and classification of satellite images, rule-based methods, neural networks and fuzzy sets have been under investigation. The use of multi-source image data for interpretation and radiometric calibration of satellite images has been also intensively studied.

4. DEVELOPMENT OF GIS AND DIGITAL MAPPING

During the past four years, the focus of mapping activities have been on the revision, the mapping at larger scales and the production of digital maps. Typical for this period has been the remarkably increased and still increasing amount of different numerical map-data. Today the latest edition of the Basic Map, scale 1:20000, is available on raster form as datasets of planimetric details, contours, waters and fields. Most of the datasets are also available in vector form. Other products available in digital form are:

- Nordic Map Database, scale 1:2 millions
- National Road Database
- Administrative Boundaries
- Digital Elevation Model
- Land Use and Forest Classification.

The Topographic Data System consists of the most detailed general topographic data with nation-wide coverage and the map databases. Data inside it covers 23 % of the area of Finland. The Topographic database is used as a basis for variety of standard products as well as products customised to user's needs.

The producer of naval charts in Finland is the Hydrographic Department of the Finnish Maritime Administration. It has published a chart series for yachtsmen in raster form on CD-ROM in spring 1995 and coastal charts covering the eastern part of the Gulf of Finland. Nautical charts have made in numerical form covering southern part of lake Saimaa and waters between cities of Savonlinna and Kuopio. During the digitisation process, the precision of charts has been improved using e.g. a new digital coastline.

Other organizations besides the National Land Survey, which is responsible for small scale mapping covering the whole country, there are private surveying companies and municipal surveying organizations producing digital maps. They produce

normally large-scale maps for purposes like land use planning and road building. Other produced large-scale data are digital elevation models and digital terrain models. GIS has increased the need and production of digital map-data in cities and other municipalities.

The Geographic Information Centre at the National Land Survey is responsible for stimulating geographic information activities in Finland. To implement geographic information services and to develop standards and tools are its main tasks. The real-time information service on geographical data is already available. User can define queries by pointing entities, attributes and areas and by typing restricting values of attributes using some GIS application, for example MapInfo, ArcView2 etc. Service centre routes modified queries to the supplier where the database containing the needed data exists. The aim of the Geographic Information Centre is to implement the data services for geographic data covering all important national datasets by the year 1996.

5. EDUCATION AND RESEARCH

5.1. Education

Education in surveying at the university level is centred to the Helsinki University of Technology (HUT) in the department of Surveying. Annual intake is 55 students of which 22 will study surveying and mapping technology and 33 property economics and law. The average amount of graduated on M.Sc. level is about 40 persons each year. There are different entrance examinations for these two study directions. The system of two different entrance examinations was taken in use in year 1993. University level education in fundamentals of photogrammetry and remote sensing and special courses in the determination of forms and deformations, is also given at the Tampere University of Technology (TUT).

Fundamentals of remote sensing are also taught in the department of geography and forestry at the University of Oulu, in the departments of geography and biology. Education in the field of remote sensing is given as well at the University of Turku and at the University of Joensuu in the department of forestry.

One remarkable change in education during these for years has been that in Espoo-Vantaa, Mikkeli, Rovaniemi and Vaasa Institutes of Technology are now educating engineers instead of technicians. The first surveying engineers in Finland will graduate in 1996.

During the period in question thirteen M.Sc. theses, two licentiate degree theses and one doctorate thesis in photogrammetry or remote sensing have been accepted. The dissertation was:

Haggrén, Henrik: "On system development of photogrammetric stations for on-line manufacturing control".

The licentiate's theses were:

Lammi, Jussi: "Production and Use of Digital Imagery in the GIS Environment".

Niini, Ilkka: "Relative Orientation of Multiple Images Using Projective Singular Correlation".

The post-graduate and supplementary education have been offered at the HUT, at the TUT and at the University of Turku. In 1992 post-graduate seminars were held on "Statistical pattern recognition" and "Satellite image interpretation" at the HUT and the University of Turku respectively. Seminars in the year 1993 were held at the HUT and at the TUT under following topics: "National researcher seminar of surveying and mapping technology" and "The quality of mapping measurements". In 1994 a post-graduate seminar concerning remote sensing was held at the University of Joensuu. In 1995 there was not any specific supplementary education in the field of photogrammetry and remote sensing at the university level.

5.2. Research activities

Following is a short overview of research done in Finnish organizations.

Helsinki University of Technology (HUT)

Institute of Photogrammetry and Remote Sensing

Institute of Space Technology

- Image processing and dynamic modelling for 3D machine vision systems
- The use of projective transformations in reconstructing photogrammetric models
- Development of signal based image matching methods II
- Digital image processing in remote sensing
- Solid modelling
- Feature based photogrammetric reconstruction of 3D space
- 3D video digitising
- Sensor fusion and measuring model in 3D vision
- Advanced computerisation of the building information system
- 3D human body
- Airborne profilometer
- Study for the definition of airborne microwave radiometer facility
- Imaging microwave radiometer
- ESA European multisensor airborne campaign
- Retrieval of snow and sea ice characteristics from microwave radiometer data in the range 6-90 GHz
- Remote sensing of forests, snow and sea ice
- Radiometer and scatterometer land applications

Tampere University of Technology (TUT)

Department of Civil Engineering

- Production system of digital orthoimages
- Stillvideo-based system for facade measurement
- The accuracy and quality control of photogrammetric measurements

University of Helsinki (UH)

Department of Forest Mensuration and Management

- The use of digital aerial images for mapping of forest biotopes
- An expert system for updating forest resource information in the frame of multi-source information
- Use of neural networks for information collection for forestry

University of Joensuu (UJ)

Department of Forestry

Department of Physics

- A method for monitoring changes in forest condition in Finland
- Temporal, spatial and environmental classification of pine reflectance spectra

University of Oulu (UO)

Department of Geography

- Land use mapping with Landsat 5 TM imagery

Finnish Geodetic Institute (FGI)

Department of Photogrammetry and Remote Sensing

Department of Cartography and Geoinformatics

- Estimation of crop yields by using satellite images
- Effects of the atmosphere to the quality of remote sensing images
- Aerotriangulation using digital images
- The use of movable test images for valuation of the quality of aerial imaging
- Snow field mapping using satellite images
- Radiometric calibration of satellite images
- GPS in aerotriangulation (jointly with NLS)
- Digital orthoimages
- Rule-based interpretation methods for satellite images
- Optimisation of digitising of images for photogrammetric purposes
- Study of JPEG-compression for scanned aerial photographs

Finnish Institute of Marine Research (IMR)

- Real-time ice monitoring
- ERS-1 images for ice monitoring (jointly with HUT and TRC)

Geological Survey of Finland (GSF)

- Integration of image processing with remote sensing and geological data for geological purposes
- Data correction and classification methods for ground and bed-rock investigation

Finnish Environment Institute

GIS and Remote Sensing Unit

- Software development for processing NOAA/AVHRR-images
- Remote sensing data for the use of agriculture
- Remote sensing for investigation of biodiversity
- Investigation and modelling evaporation on fields and forests

Technical Research Centre of Finland (TRC)

Space Technology

- Parallel processing techniques applied to the mosaicking of large numbers of airborne video images (GLORE-project)
- Development of high quality methods for estimation of biomass from high-resolution data like TM and SPOT
- Development of methods for agricultural crop growth monitoring for Finnish conditions using satellite images with other data
- A forest fire alarm system using NOAA images
- SAR interferometry for terrain elevation model generation and for detection of land surface movements
- ERS-1 data for estimation of forest damages

- An automatic control point measurement system for satellite image rectification using numerical map-data

Oy Mapvision Ltd

- Development of real-time machine-vision systems

National Land Survey (NLS)

- Development of software for numerical photogrammetry
- Improvement of orthoimage production process

Karelsilva Oy

- Detecting correlation between geochemical anomalies and vegetation reflection using the AISA imaging spectrometer (jointly with GSF)
- Use of imaging spectrometry for water quality measurements (jointly with UH and National Board of Waters and Environment)
- AISA workstation (jointly with TRC)
- Testing AISA's geometric and radiometric resolution using the calibration testfield of the Finnish Geodetic Institute (jointly with FGI)

6. SCIENTIFIC AND PROFESSIONAL ORGANIZATIONS

6.1. Education and scientific organizations

Espoo-Vantaa Institute of Technology
Leiritie 1
Fin-01600 Vantaa

Finnish Environment Institute
GIS and Remote Sensing Unit
P. O. Box 140
Fin-0251 Helsinki

Finnish Geodetic Institute
Geodeetinrinne 2
Fin-02430 Masala

Finnish Institute of Marine Research
P. O. Box 166
Fin-00141 Helsinki

Helsinki University of Technology
Institute of Photogrammetry and Remote Sensing
Otakaari 1
Fin-02150 Espoo
URL: <http://foto.hut.fi/>

Helsinki University of Technology
Institute of Space Technology
Otakaari 7
Fin-02150 Espoo
URL: <http://avasun.hut.fi/>

University of Helsinki
Department of Forest Resource Management
P. O. Box 24 (Unioninkatu 40 B)
Fin-00014 University of Helsinki

University of Helsinki
Department of Geography
Hallituskatu 11-13
Fin-00100 Helsinki

University of Joensuu
Department of Forestry
Department of Physics
P. O. Box 111
Fin-80101 Joensuu

University of Oulu
Department of Civil Engineering
Kasarmitie 8
Fin-90100 Oulu

University of Turku
Department of Geography
Fin-20800 Turku

Rovaniemi Institute of Technology
Land Surveying Technology
Jokiväylä 11
Fin-96300 Rovaniemi

Tampere University of Technology
Department of Civil Engineering
P. O. Box 527
Fin-33101 Tampere
URL: <http://www.ce.tut.fi/>

Technical Research Centre of Finland
Space Technology
P. O. Box 13031 (Metallimiehenkuja 10)
Fin-02044 VTT

6.2. Other organizations

City of Helsinki
City Surveying Department
Viipurinkatu 2
Fin-00510 Helsinki

Finnish Society of Photogrammetry and Remote Sensing
Institute of Photogrammetry and Remote Sensing
Otakaari 1
Fin-02150 Espoo
Telefax: +358-0-465077
URL: <http://foto.hut.fi/seura/fsprs.html>

FM-Kartta Oy/FM-International
P. O. Box 14 (Teollisuuskatu 33)
Fin-00511 Helsinki

Konekorhonen Oy
P. O. Box 11
Fin-41161 Tikkakoski

MT-Survey
P. O. Box 71
Fin-04441 Järvenpää

National Land Survey
Geographic Data Centre
P. O. Box 84 (Opastinsilta 12 C)
Fin-00521 Helsinki
URL: <http://www.nls.fi/>

National Land Survey
Satellite Image Centre
P. O. Box 84
Fin-00521 Helsinki
URL: <http://www.nls.fi/>

Oy Mapvision Ltd
P. O. Box 8
Fin-02941 Espoo
URL: <http://home.kolumbus.fi/~leikas/>

SITO Oy
Pohjantie 12 A
Fin-02100 Espoo

Soil and Water Ltd
Itälahdenkatu 2
Fin-00210 Helsinki

Topographic Service of Finnish Defence Forces
P. O. Box 60
Fin-00521 Helsinki

6.3. The Finnish Society of Photogrammetry and Remote Sensing

The Finnish Society of Photogrammetry and Remote Sensing is devoted to the research and development of photogrammetry and remote sensing in Finland giving e.g. recommendations for aerial photogrammetry. The Society has about 230 members including about 20 companies.

The most notable part of the work of the Society is to publish The Photogrammetric Journal of Finland. The Society is member of the International Society for Photogrammetry and Remote Sensing.

Chairperson of The Finnish Society of Photogrammetry and Remote Sensing is Mr. Jussi Paavilainen during the period 1996-1998, co-chairperson is Mr. Juha Vilhomaa beginning at the year 1995 and secretary is Lic. Tech. Yrjö Rauste to the end of the year 1996. Previous chairperson was Ms. Anita Laiho during the years 1993-1995 and co-chairperson was Veli Pekka Valtonen in 1993-1994.

The Society has published Recommendations for Aerial Photogrammetry in Finland (issue 1/1993) and Instructions for Precise Photogrammetric Mapping (issue 1/1995), both in Finnish.

7. ACTIVITIES IN INTERNATIONAL ORGANIZATIONS

7.1. International Society for Photogrammetry and Remote Sensing (ISPRS)

Prof. Dr. Tapani Sarjakoski has been the co-chairman of ISPRS Commission III Working group 4 "Knowledge Based Systems". Mrs. Aino Savolainen is the honorary member of the ISPRS.

Contact persons of the ISPRS are:

- Commission I Risto Kuittinen
- Commission II Reino Ruotsalainen
- Commission III Tapani Sarjakoski
- Commission IV Kirsi Artimo
- Commission V Hannu Salmenperä
- Commission VI Anita Laiho
- Commission VII Antti Vertanen

7.2. Organization Européenne d'Etudes Photogrammétriques Expérimentales (OEEPE)

The representatives of Finland in the executive committee are Mrs. Pirkko Noukka and Prof. Dr. Risto Kuittinen. The representatives of Finland in Scientific Commission:

- A Tapani Sarjakoski
- B Tapio Tuomisto
- C Antti Saarikoski
- D Jukka Artimo and Juha Vilhomaa
- E Veli Pekka Valtonen
- F Juha Jaakkola.

The representatives of Application Commission are:

- I Jukka Artimo and Juha Vilhomaa
- II Matti Jaakkola
- III Henrik Haggren
- IV Kirsi Artimo.