
**DANISH SOCIETY FOR PHOTOGRAMMETRY AND SURVEYING**

# DENMARK
# NATIONAL REPORT
# 1996 – 2000

## XIX CONGRESS
## International Society for Photogrammetry and Remote Sensing
## Amsterdam 2000

Poul Frederiksen, Editor

**KEY WORDS:** National Report, Denmark, Photogrammetry, Remote Sensing,

**ABSRACT**

The national report of Denmark outlines activities and developments in photogrammetry, remote sensing and GIS during the period 1996 – 2000. The report comprises contributions from the government, education, research and private sectors.

## 1. NATIONAL SURVEY AND CADASTRE (KMS)

### 1.1 Topographic Mapping - Denmark

During the last 4 years the production of the digital topographic database covering Denmark was speeded up and the aim is now to finish the coverage of Denmark at the end of year 2000. A part of the database is an elevation model (DHM) based on digitised contour lines originating from the analogue map series 1:50.000. The accuracy of the model turned out to be insufficient and now the DHM is corrected to fit objects in TOP10DK measured in the terrain surface. The work follows the production rate of TOP10DK and will also be finished by the end of year 2000.

At the moment 71% of the area of Denmark is finished, external production is finished for an other 20% and only 9% is still under production. Except from a very few islands all plotting was done using external producers selected by tendering. In total 23 tenders were carried out leading to 8 different producers from Denmark, Sweden, UK and Hungary.

In 1998 the board of directors decided to reorganise the independent updating of the analogue map series 1:25.000, 1:50.000 and 1:100.000. At the moment work is carried out to develop new map design for these map series based on the TOP10DK databases.

The establishment of the database has proven to be a success and out of 14 counties in Denmark 10 has purchased the database and is using it. Also government administration has recognised the database and is in the process to implement the use of the database in daily administration. Recognising the fact that Denmark is covered by a digital database by the end of year 2000 work was started in 1998 to work out procedures how to update the database. A full-scale pilot test was carried out in 1998/1999 updating a county and in 1999/2000 14% is updated. From Mid 2000 app. 20% is going to be updated every year giving an updating cycle of 5 years.

### 1.2 Greenland

During the period the aerotriangulation covering al ice-free areas of Greenland was completed. A total number of 3532 photos scale 1:150.000 was aerotriangulated giving KMS the possibilities to start mapping projects overall in Greenland where needed ensuring an absolute accuracy better than 30 meter. This year the most poorly mapped area of Greenland

on the eastern cost was started in order to improve the current map 1:250.000 of Greenland. The plotting includes app. 900 models scale 1.150.000.

### 1.3 The Faroe Islands

Very little resources were put into the mapping of the Faroe Islands since the last report 1996 in Vienna. The mapping program was finished as scheduled and at the moment the base map 1:20.000 is only undergoing minor editorial changes when sheets are out of stock.

Lars Tyge Jørgensen

## 2. PRIVATE PHOTOGRAMMETRIC COMPANIES

### 2.1 KAMPSAX GEOPLAN

During the period 1996-2000, photogrammetric map production in Denmark has continued the development towards on one side competitiveness on the world market and increased sophistication with more complex and structured data suited for use in geographic information systems.

This is documented below in the description of two major mapping projects in Denmark and in the description of new specifications for base mapping in Denmark.

Digital photogrammetry has been consolidated and expanded now with a substantial share of all mapping being digital orthophotos and DTM with data capture both on high-end systems as on PC-digital workstations.

The company has increased its turnover considerably. In view of the lower prices this represents a dramatic increase in the volume of data produced. A growing share of the turnover is for the international market with an export of over 50% of the production. Kampsax has subsidiary companies in Germany, Spain, Sweden, Bolivia and India specialised in mapping and associated services in total representing a large capacity and growth.

**2.1.1 New standard map specifications.** In 1999, a new set of standard map specifications for base maps, the TK99-standard (Technical Maps 1999), has been agreed on with the Association of Local Authority Technical Directors. Compared to the previous specifications from 1993, the trend against base maps, more suited for use in geographic information systems has been carried one step further. The basic idea is that the user who wants to use the data in a GIS should be able to do so right away.

**2.1.2 Major map products.** The Danish Road Directorate and the Danish counties have specified a map standard for road administration. These base maps will be used in GIS and calculating areas of the different elements of the road to be used in planning of maintenance is one of the important aims. Until now, Kampsax Geoplan has performed mapping of motorways and highways in three Danish counties and for the main part of the State Motorways.

With the Danish Ministry of Food, Agriculture and Fishery as client, Kampsax Geoplan has fulfilled a mapping project of the Danish agricultural areas. Groups of fields, with stable borders as roads, fences, etc. have been mapped and attributed with an individual number. The maps are kept yearly updated. The field maps are used for the ministry's control of subsidiaries from the European Union. Each year every Danish farmer receives a print of this map containing his estate with the Colour Orthophoto as background to be used as the basis for the yearly application for agricultural subsidies.

**2.1.3 International projects.** Kampsax Geoplan is executing a number of large projects around the world, some in mapping others more complex involving field work and GIS. In 1999 Kampsax Geoplan won a tender for a Cadastral project in Bolivia for adjudication and cadastral survey and Mapping of 2 mill hectares. We have subsequently established a large and well functioning office in Bolivia, which is managing and executing the huge task of mapping, public campaigns, adjudication, surveys and legal documentation. The challenges are cultural, professional as well as associated with the terrain. In the Yungas area the landscape is dramatic and the access roads few. There are spoken a number of different languages and illiteracy is widespread. Radio campaigns have proven to be useful and effective in reaching the landowners, which generally receive the cadastral teams well. The project will be executed over approximately 3 years.

**2.1.4 Digital photogrammetry.** Way back in 1994 Kampsax Geoplan started with digital photogrammetry and this method covers the main part of the production today. A great number of digital orthophotos have been produced for individual customers. A total coverage of Denmark with digital orthophotos, based on aerial photography in colours, in photo scale 1:25,000 has been carried out based on photos from 1995 with a resolution of 80*80 cm and photos from1999 with a resolution of 40*40 cm.

**2.1.5 Equipment.** Kampsax Geoplan is using the photogrammetric cameras Zeiss TOP 15 with T-Flight management systems, FMC and gyro-stabilised mounts. The company is using 9 analytical instruments (Leica BC-3, SD2000, Zeiss P2, P3) and 14 digital instruments (Helava and Intergraph) in Denmark and 22 analytical and digital instruments in subsidiaries abroad.

Vagn W. Laursen

## 2.2 BLOMINFO A/S

BlomInfo A/S is the Danish subsidiary of the Norway based Blom ASA group, which is dealing with information technology, mapping and marine surveys. BlomInfo A/S was established in mid-1998.

**2.2.1 Key competencies.** BlomInfo A/S has decided to focus on three key competencies, all in relation to geographic data: data capture, data integration and data distribution. It is the aim of BlomInfo A/S to be strong and competitive on these three key competencies, which are forming a value chain.

**2.2.2 Activities in Denmark.** Since the start in 1998, BlomInfo A/S has developed rapidly and is now carrying out projects for a large number of clients in Denmark and abroad.

- BlomInfo A/S has carried out mapping and updating projects for the Danish Survey and Cadastre in the TOP10DK project.
- Updating of technical base maps for a large number of municipalities.
- Base mapping for planning of motorways.
- Digital Orthophoto of Greater Copenhagen and a number of municipalities.
- Data conversion of about 31.000 gas house connections.
- Data conversion of sewers and water pipe lines, 500 mapsheets.
- Elaboration of a nation wide, digital cartographic database.
- Development of Map-on-the-WEB-system for several municipalities.
- Development of Map-on-the-WEB-system for Ministry of Food and Agriculture.
- Technical project management, implementation of Smallworld at Telia A/S.

**2.2.3 Activities abroad**

- Detailed Technical Map, DTM and Orthophotos for City of Riga, Latvia
- Technical Assistance, Lithuania, linking Property Register, Building Register and Cadastral Map

**2.2.4 Equipment.** BlomInfo A/S is using the following equipment: 4 Intergraph SSK digital photogrammetric workstations - 2 Zeiss P3 / P33 analytical stereoplotters - MicroStation / Geographics for editing - MapInfo, ArcView, GeoMedia for GIS and Trimble 4700 GPS.

**2.2.5 Co-operation.** BlomInfo A/S has a close co-operation with the mother company Blom in Norway as well as other subsidiaries of the Blom group, for instance in Sweden, Germany, Norway, United Arabic Emirates, Indonesia and Poland.

Søren Buch

## 2.3 THE SCANKORT-LLO GROUP

The internationalisation of the mapping sector has continued. Photogrammetric production is becoming increasingly digital which also facilitates introduction of elements of mass production, but at the same time, the digital map products become more and more sophisticated in order to meet GIS requirements.

**2.3.1 The SK-LLO Group.** The Scankort-LLO Group comprises two Danish companies:

- SCANKORT, which was founded in 1970 as a photogrammetric company
- LLO A/S, which was founded in 1961 by the Danish Chartered Surveyors

Through many years of collaboration the companies behind the Scankort-LLO Group have acquired a common company culture and extensive experience within the fields of surveying and mapping as well as consultancy. Resources of the 2 companies are pooled and deployed for the maximum benefit of any task performed by the Group.

The Scankort-LLO Group, which has approx. 40 employees, offers both specific services and consultancy within the fields of aerial photography, digital mapping, orthophotos, technical surveys, GPS surveying, utility mapping, geographic information systems and software development.

The major part of our activities are carried out for Danish clients, but over the years, substantial international experience has been established related to activities in Greenland, the Faeroe Islands, Scandinavia, the Baltic States, Germany, Great Britain, Spain, Russia and North Africa.

The offices of the Scankort-LLO Group are centrally located near the railway station and main road of the old town of Taastrup 15 km West of Copenhagen.

**2.3.2 Map specifications.** The standard map specifications for base maps have been revised resulting in a new set of specifications, TK99. A process which the Scankort-LLO Group has been heavily involved in by performing the role as secretary to the TK-committee.

TK99 has now become a very comprehensive set of specifications including also sections on updating, contracting and rights. Almost all photogrammetric mapping requested by municipalities and counties are made according to TK99.

**2.3.3 Digital photogrammetry.** A digital photogrammetric production environment has been established including 4 Zeiss PHODIS digital workstations and 1 Zeiss SCAI scanner. The production line has been in operation for 2 years, and the part of the photogrammetric production of the Scankort-LLO Group that is fully digital is steadily growing.

**2.3.4 Aerial photography.** The Scankort-LLO Group has updated its stock of cameras to include the Zeiss TOP 15 with associated flight planning software. This camera type is our main tool for data acquisition and it will be deployed on a major aerial photography job in Greenland during the summer 2000.

**2.3.5 Orthophotos.** Orthophotos are becoming more and more popular and gaining an increasing share of the photogrammetric market. They are used either as separate products or in combination with a vector map. The clients are mainly municipalities and counties.

**2.3.6 Selected equipment**. The Scankort-LLO Group disposes of a wide range of equipment. Our photogrammmetric production facilities include:

- two twin-engined aircrafts for aerial photography
- three Zeiss cameras
- one Zeiss high precision scanner
- four Zeiss digital stereo instruments
- eight Zeiss analytical stereo instruments

Birger Eng

## 3. RESEARCH AND EDUCATION

### 3.1 AALBORG UNIVERSITY (AAU) - Department of Development and Planning, Laboratory of Geoinformatics & GISplan Laboratory

**3.1.1 Photogrammetry.** Staff members of the Laboratory of Geoinformatics initiated and carried out the OEEPE project "Automatic orientation of aerial images on database information". Participants of several countries as well as B.M. Pedersen and J. Höhle from AAU developed new methods to the given problem and applied their methods to test material delivered by AAU. Analysis of the results as well as the proposed methods are published in the Official Publication No. 36. of the OEEPE.

Investigations on automatic generation of height models were carried out by L. M. Wind. Other investigations dealt with the production of 3D models of buildings and their photo-realistic and dynamic presentation. The interactive learning program "Learning about digital photogrammetry (LDIP)" was rewritten for universal use on the Internet and extended with new topics. J. Höhle participated as co-chairman in the ISPRS working group VI/2 on computer-assisted learning and teaching. Several projects dealing with topics in digital photogrammetry and remote sensing were carried out by groups of students as part of their $8^{th}$ , $9^{th}$ or $10^{th}$ terms study.

The Laboratory of Geoinformatics procured a new digital stereo-workstation (Zeiss Phodis) and a new digital camera (Rollei d7) and used them in the research work mentioned above as well as in project work and exercises of the students.

**3.1.2 Distance learning.** Besides the 5 year education of the Danish Chartered Surveyors the staff of the geoinformatics laboratory carries out (in collaboration with the GISplan laboratory of AAU and some other external teachers) a distance learning course in Geoinformatics which leads to a Master degree in Technology Management in that field.

**3.1.3 GIS.** Geographic Information Systems (GIS) is subject to research in two laboratories of the Department of Development and Planning, Aalborg University: The Laboratory for GeoInformatics and the GISplan Laboratory. In the Laboratory for GeoInformatics the research activities have focused on a number of technical and organisational problems, including

- organising of data in GIS
- modelling of geodata
- maintenance of data in GIS
- implementation and use of GIS

In the GISplan Laboratory the research has concentrated on integrated use of GIS and multimedia technology, etc. In this connection the application possibilities for GIS in relation to physical planning and land management have been in focus. The use of WEB GIS applications has been subjected to research in the GISplan Laboratory as well.

Joachim Höhle & Bent Hulegaard

### 3.2 TECHNICAL UNIVERSITY OF DENMARK (DTU) - Department of Planning, Surveying Section.

The Surveying Section of the Department of Planning carries out teaching and research in surveying, photogrammetry, and GIS at the Technical University of Denmark. The staff comprises 1 full professor, 3½ associate professors, 1 technician, and 1 secretary. Detailed information is found on www.dtu.dk

**3.2.1 Teaching.** A basic course in practical surveying is given to 180 students a year. Besides courses are offered in GPS and Adjustment Theory, Basic GIS, Advanced GIS, and Photogrammetry. 20 - 40 students each follow these courses. Students that want to specialise in GIS, GPS, or Photogrammetry supplement the courses with individual project oriented studies. 6 - 10 students a year make their thesis within the above mentioned subjects.

**3.2.2 Arctic Technology.** Arctic technology has become the subject of newly established courses and research in collaboration between the Surveying Section and the Department of Geology and Geotechnical Engineering at DTU. A series of courses have been held in Sisimiut, Greenland, and the aim is to establish the first part of a civil engineering study in Sisimiut, where young Greenlanders can make a start which will eventually lead to a master degree in arctic technology.

**3.2.3 Metadatabase on geographically related digital maps & databases in Denmark.** The National Survey and Cadastre has established a metadatabase in close co-operation with the Dept. of Planning. Apart from these two partners, a series of data producers and users of geographic data have participated in the initial work, just as private as well as public organisations are contributing to an ongoing development and improvement of the database. The information laid down in the metadatabase stems directly from those organisations and institutions that produce or are responsible for the data. Individual information in the database follows the European Standard for metadata on geographic information CEN ENv 12657. The metadatabase can be found on www.geodata-info.dk

**3.2.4 GIS in Denmark 2.** The publication "GIS i Danmark 2" comprising 26 articles by 33 authors has been prepared in a co-operation between Institute of Geography at Copenhagen University, Department of Development and Planning at Aalborg University and The Department of Planning at DTU to give an overall view of GIS activities in Denmark.

**3.2.5 Photogrammetry.** Research in Photogrammetry have been limited to the continuation of projects in geologic mapping from small frame photographs (the multi model method). The PC-based digital stereo workstation Intergraph SSK has been purchased for teaching purposes.

Keld Dueholm & Ole Jacobi

### 3.3 UNIVERSITY OF COPENHAGEN - Institute of Geography

Institute of Geography has a long tradition of using remote sensing and GIS to assist the research of various geographical disciplines. GIS is used in physical environmental assessments, studies of agricultural systems and urban structures and growth. The institute offers a large variety of courses in several fields of geoinformatics at undergraduate as well as PhD-level. For further information about course offerings please refer to our educational information page on our web-site www.geogr.ku.dk

Main areas of activities in remote sensing are development of methodologies for applications of NOAA AVHRR data in monitoring agro-climatological parameters, assessing vegetation production and the extent of bush fires on the African continent. Furthermore, high-resolution data from SPOT, Landsat and SAR-data are used in mapping of change detection and classifying crops in specific agro-ecological regions. The marine environment is studied using SeaWiFS satellite data and CASI airborne scanners to derive sediment and chlorophyll concentrations.

The Windows 98/NT based WinChips professional image processing software (being developed since 1986) is steadily improved by the Chips Development Team (CDT). It features a lot of standard as well as specialised routines for image processing of satellite images as well as aerial photographs. For further information please browse the CDT web-site at www.geogr.ku.dk/chips

Thomas Balstrøm

### 3.4 HORSENS POLYTECHNIC (TUCH) - Section for Cartography, GIS and Land Surveying

**3.4.1 Education.** TUCH has two fields of education where photogrammetry is part. Firstly the Danish language programme for Map- and Land Survey Technician (KLT), which soon will grow from a 1½ year to a 2 year programme, and secondly an English language programme of 1 year for Cartography and Geoinfo Technicians (ICGC). The Danish KLT has photogrammetry as a core subject at a lower level, and later a higher level assignment concerning GPS measuring of control points for a photogrammetric project, of course with relevant theory also. Photogrammetric plotting is tried, but not perfected. As a final major elective project the students can specialize in any technological field they wish, including photogrammetry or remote sensing, and a few choose the area. The KLT class also has remote sensing on an introductory level. The approach for the ICGC class is similar, but with slightly more photgrammetry and no assignment in surveying of control (pass) points. We use Australian software TerraScan for remote sensing, TUCH also has a full license for ITCs ILWIS remote sensing software. Very little research is carried out in the field of photogrammetry at TUCH.

**3.4.2 Staff.** The section is staffed with 4 academic teachers and 3 technologist. All the teachers have some background in photogrammetry, by the way of academic and/ or practical experience, 1 of the teachers has several years practical background in production photogrammetry on a variety of plotting equipment. Extrenal specialist teachers are also hired.

**3.4.3 Equipment.** The college is equipped with numerous pocket stereoscopes and table stereoscopes, 5 ITC stereotrainers and 1 Wild BC-1 analogue stereoplotter. Combining these analogue teaching instruments we enter the digital environment via our own large format Contex scanner. With the on-going education reforms in our fields of study plus TUCHs own interest in building (terrestrial) photogrammetry, we are strongly considering investing in a digital photogrammetric workstation.

Jarl Rolighed Larsen

### 3.5 AARHUS SCHOOL OF ARCHITECTURE. - Department of Restoration, Urban and Building Renewal, Laboratory for Photogrammetry

In the instruction on the third and fourth year of study surveys of historical architecture have been made. The surveys are to be used in connection with building archaeological studies and as projection basis for the subsequent projection of restoration assignments.

Instruction in the use of photogrammetric survey includes instruction in instruments for use in surveying control points and later in the laboratory instruction in relevant software for calculation of co-ordinates, plus subsequent use of stereocomparators for photogrammetric surveys. The photographer at the Aarhus School of Architecture instructs in recording of stereo imagery and in film development and image processing. The drawings are made in AutoCAD.

The laboratory has three stereocomparators: a Zeiss Jena stecometer, a Zeiss Jena table model and an Adams MPS2.

In recent years the subjects of study have been chosen in Denmark and Germany. Subsequent assignments are selected examples of how students have used photogrammetry.

**3.5.1 Brandenburg an der Havel.** In 1996 the studies took place in Brandenburg an der Havel, Germany. Studies were made of five different buildings and included surveys and building archaeological studies.

One of the buildings is “Altstädtischer Markt 8”. The building consists of 2 gable houses built in 1514 and 1564, respectively. Today the buildings function as one building. Plans and sections are orthogonally surveyed, whereas front and back facades are photogrammetrically surveyed. The front facade is a brick, plastered renaissance gable end with tortuous ornamentation on the upper part. The baroque back facade is timber framed and was built in 1726.
The photogrammetic fieldwork was done in two days, and drawing of the surveys was made in MiniCad version 5.0.2. by 3 architecture students and 1 archaeology student.

**3.5.2 Nyborg Castle.** The castle was originally a four-wing royal castle from the beginning of the 13$^{th}$ century. Today only the west-wing and the east-tower remain. The west-wing stands as a number of building phases erected during the Middle Ages. The studies included among other things a survey of the west-wing in plans, sections and facades.

Plans and sections are surveyed manually orthogonally, whereas the facades are surveyed photogrammetrically. A polygon of monitoring stations was established around the castle. The two first points of the polygon have been mounted parallel to the interior orthogonal system of measurement. The polygon also included the east-tower and consisted of a total of 16 stations.

The fieldwork there took a week and was carried out in March 1999. The survey itself was carried out in the photogrammetry laboratory at the Aarhus School of Architecture in the course of the autumn 1999. 2 architecture students and 1 archaeology student participated in the project.

Gert Bech-Nielsen

### 3.6 DANISH CENTER FOR REMOTE SENSING (DCRS), DTU

**3.6.1 Topographic mapping by SAR.** Using advanced SAR data from the Danish airborne SAR, EMISAR, a research project was initiated in 1998 as a collaboration between the Technical University of Denmark and the Danish National Survey and Cadastre to investigate the potential of using SAR data for production and updating of cartographic maps. The ultimate objective of the research is to be able to perform quickly and efficiently compiling and updating of topographic maps using satellite and airborne remote sensing data. The specific objectives for the project are to

- evaluate requirements of today for topographic mapping with a view to present and future remote sensing capabilities.
- evaluate the potential of the polarimetric and interferometric SAR to detect the necessary object classes to be used for the thematic map content, and to assess the complementary information gained relative to the results of the traditional methods.
- evaluate the accuracy of methods for retrieval of the necessary map information from SAR data.

**3.6.2 Information extraction.** In view of the available processing techniques, three different approaches for information extraction are investigated; namely classification and characterisation of area objects (e.g. agricultural

fields and forests), feature detection (e.g. roads and buildings), and change detection. In addition, necessary pre-processing steps, such as speckle reduction, line and edge detection, and geometric correction, are also studied. Using the multi-frequency, multi-polarisation, multi-temporal polarimetric and interferometric SAR information available from EMISAR methods for detection of classes like forests, lakes, wetlands, heath, agricultural areas and urban areas have been studied. In general, classification of agricultural crops is possible using SAR data, and polarimetric and/or multitemporal acquisitions ensure a high accuracy. In general, it is possible to discriminate between forest and non-forest areas with a high accuracy, especially the hedges stand out clearly.

The utilisation of SAR images for mapping of urban areas is relatively difficult due to the very complicated scattering mechanisms for the radar signal in these areas, which consist of a mixture of man-made structures and vegetation. A major Danish city has been mapped by both polarimetric and interferometric SAR to study the application of SAR for urban mapping. Using this data set, a semi-automatic road detection algorithm has, for instance, been implemented and tested with encouraging results. During the last decade, the use of SAR images in change detection has been discussed and demonstrated in the literature now and then. In the framework of this project, a major effort has been put on a more detailed analysis of the detected changes themselves. An important question asks: "How large are observable intensity changes in the radar images due to slightly different flight paths (the ideal situation for change detection are identical flight paths) and processing artifacts (e.g., slight displacements of single targets), but in particular due to natural and man-made changes within the imaged scenes?" Several objects within each class were identified and marked in the radar images by means of aerial photography. In ongoing work, the typical backscattering characteristics and variations of the different object classes are analysed and compared to backscatter changes due to removal, adding, or change of an object at a certain position.

**3.6.3 Map updating.** The application of SAR for extraction of thematic information and height information for topographic maps is a topic of ongoing research. The technique has great potential both due to the independence of the radar signal of weather conditions and daylight, and to the well-defined and stable measurement characteristics, which will enable the utilisation of automatic or semiautomatic methods for information extraction. Consequently, a more frequent updating of maps will be possible. Since the radar sensors cover a range of the electromagnetic spectrum, which until now has not much been utilised, additional information (relative to the traditional optical sensors) can be gained which might be useful in the production of topographic maps.

Henning Skriver

### 3.7 DANISH INSTITUTE OF AGRICULTURAL SCIENCES (DIAS) - Remote Sensing Group

The Remote Sensing group at DIAS is currently involved in three operational projects and three research projects.

#### 3.7.1 Operational Projects.

- **Control of Area Based Subsidy (CABS) Project.** Mapping agricultural landuse of four sample areas within Denmark for the assessment of the accuracy of farmer returns seeking subsidies for agricultural production, in accordance with EU practices. Ongoing project.
- **Support for Landuse Mapping in Bhutan.** The group is advising the Bhutanese government mapping agency on practices and procedures for the mapping of landuse by the use of satellite image data. Twelve month project.
- **Development of GIS database for Doi Inthanon National Park in Thailand.** The group is collaborating with colleagues from Thailand in the historical mapping of the landuse within the environs of the National Park at five yearly intervals since 1975, using satellite image data. A three year project.

#### 3.7.2 Research Projects.

- **Investigation into the use of Remote Sensing in Precision Farming.** The group is building a camera system, of four cameras, to acquire multispectral image data from a kite. The system has been constructed, the cameras are being calibrated, and imagery will be acquired from March 2000. The image data will be used with extensive soils data of selected sites in Denmark, to assess the level of correlation between both soil color and crop growth, as derived from the camera system, and the key soil parameters of water holding capacity and humus content.
- **Development of techniques for the analyses of Hypertemporal Image data.** Techniques are being developed to analyze hypertemporal image data, and to investigate the hypertemporal characteristics of agricultural covers.

- **Mapping Forest Classes in Thailand.** Both large (Ikonos, radar) and moderate scale (TM, Spot) satellite image data will be used to map forest classes in theDoi Inthanon National Park in Thailand. Currently extensive field data are being collected in support of this project.

**3.7.3 Other Activities.** In addition to these activities, the group is also the Danish Point of Contact for the Corinne Landcover data of Europe. Members of the group have participated in a variety of conferences in the USA, Canada, South Africa, and various places in Europe. The activities of the group are maintained at the web site http://original.agrsci.dk/jbs/telem/index_uk.shtml

Keith R. McCloy

### 3.8 GEOLOGICAL SURVEY OF DENMARK AND GREENLAND (GEUS)

In the period 1996-2000 GEUS has changed the production of new maps thus all new maps are now "born" as digital maps. Most maps will only be published as CD-ROMs (ArcView, Arc/Info and MapInfo formats) but some are subsequently printed as traditional maps.

**3.8.1 Mapping - Denmark.** The 360 existing analogue surface geological map sheets 1:25.000 have been updated and converted to digital form. Moreover a nation-wide seamless digital geological map 1:200.000 has been made. A digital terrain model of the prequaternary surface has been produced as a contour map. The latest product is a digital map showing the types of sediments in the sea bottom around Denmark (lat. $54^o$ – $58^o$ N, long. $8^o$ – $16^o$ E) in the scale 1:500.000.

**3.8.2 Mapping - Greenland.** The production of digital topographic base map at scale 1:100.000 has been continued; approximately half of the complete set of aerotriangulated frames covering the ice free part of Greenland have been plotted. Photogrammetry is also used for some of the geological mapping. Along with geological data from other sources a GIS is created, which is used as input to the digital cartographic production of printed maps. The digital plotting is done using a Kern PG2 with in house developed software and for digital photogrammetry a Leica Helava workstation with Socet Set and Pro600 is used. The GIS work uses ESRI software with in house and commercial customisations.

Bjørn Hermansen

## 4. DANISH SOCIETY FOR PHOTOGRAMMETRY AND SURVEYING (DSFL)

The Danish Society for Photogrammetry and Survey represents Denmark in ISPRS. DSFL was founded in 1934 and was one of the first societies to join the International Society for Photogrammetry and Remote Sensing.

### 4.1 Objective.

The objective of the society is to work for the theoretical and practical development and use of photogrammetry, remote sensing, and other technical surveying methods. However, GIS and digital mapping are important components of the society activities as well.

### 4.2 Members.

The society currently has some 550 members. 125 of these are private companies, public institutions, organisations and other societies. DSFL is a non-profit and independent organisation financed by a low member fee and by the income of seminars, meetings and short courses. The members of the society are individual professionals from a wide range of occupations. Thus, the society has a wide-ranging contact with the Danish community and it is an important forum for discussions of professional matters.

### 4.3 Activities.

The society works and disseminates information through lectures, committee work, seminars, short courses, publications, etc. A magazine of 6-10 pages is published by the society 10 times a year. It contains notices of coming meetings, minutes of previous meetings, information regarding updates of the DSFL format, and articles covering other relevant professional activities including international meetings.

The member meetings are normally organised as lectures. Subjects presented include remote sensing, digital photogrammetry, surveying concerning bridge and road constructions, digital map production, digital data exchange, GPS applications and theory and geographical information systems.
The society arranges visits to private companies and public institutions, exhibitions, study tours abroad, one-, two- or three days seminars and courses.
Seminars (300 - 400 participants) and workshops (100 - 150 participants) are organised in co-operation with The Danish Cartographic Society and The Danish Academy for Spatial Information.
In 1983 DSFL issued a proposal for exchange of digital map information. Experiences acquired during the years have inspired to a number of extensions and changes of the standard - changes that are adapted immediately by map producers and users. The format – known as the DSFL-format - is not officially approved. It is, however, a de facto standard that is widely used by public and private map producers, technical administrations, engineering companies and utility owners. In 1998 a web site was established www.dsfl.dk including information on the society, meetings, publications and updated versions of the DSFL data exchange format.

**4.4 Co-operation.** DSFL co-operates closely with The Danish Cartographic Society (DKS), The Danish Society for Remote Sensing and with the Danish Academy for Spatial Information (DAiSI) and has close contact with its sister organisations in the Nordic countries. By January 2001 it is expected that DKS, DAiSI and DSFL will merge into a new society named **GeoForum - Danmark**.

Poul Frederiksen

## 5. USEFULL WEB-SITES

| | |
|---|---|
| National Survey and Cadastre | www.kms.dk |
| Kampsax Geoplan | www.kampsax.dk |
| BlomInfo | www.blominfo.dk |
| Scankort-LLO Group | www.scankort.dk |
| Aalborg University, Dept. of Development and Planning | www.i4.auc.dk |
| Technical University of Denmark, Dept. of Planning | www.ifp.dtu.dk |
| University of Copenhagen, Inst. of Geography | www.geogr.ku.dk |
| Danish Center for Remote Sensing | www.emi.dtu.dk |
| Danish Institute of Agricultural Sciences | www.agrsci.dk |
| Geological Survey of Denmark and Greenland | www.geus.dk |
| Metadatabase | www.geodata-info.dk |
| Danish Society for Photogrammetry and Surveying | www.dsfl.dk |