

INTERNATIONAL SOCIETY FOR  
PHOTOGRAMMETRY AND REMOTE SENSING (ISP)

XV Congress Rio de Janeiro 1984

MEMBER REPORT

of

DENMARK



Introduction

The Danish Society for Photogrammetry and Landsurveying is this year celebrating its 50th anniversary in a period with as much activity and development as ever.

As Denmark was already mapped in small and large scales more than a century ago, photogrammetry was for many years only used for topographic mapping in Greenland. Only when photogrammetry had developed to a higher accuracy, and when, from the sixties, there was a high activity in highway construction and community development, there was a boom in modern photogrammetric mapping.

After a short period of stagnation in the late seventies, the photogrammetric profession is today very busy. Within a very short period we have turned digital. It looks as if this change is giving new possibilities for the coming years.

As mapping in Denmark is in the hands of relatively few organizations, we have chosen that each gives their own contribution to this report.

Production

GEODETIC INSTITUTE OF DENMARK

General

This part of the Member Report gives a brief and broad outline of various photogrammetric activities carried out in the period 1980-1983 by Geodætisk Institut (the Geodetic Institute of Denmark = GID) which is the official institution responsible for basic geodetic survey and topographical mapping in Denmark including the Faroe Islands and Greenland. The report describes developments of projects already presented at the congress in Hamburg, as well as new projects which have been started since then.

Denmark

The production of photogrammetric manuscripts in 1:10,000 (cf. the 1980 report), which should primarily serve as basis for

new topographical maps in 1:25,000, is continuing according to plans. From the beginning in 1966 until today 75% of the work has been completed, and the remaining part is expected to be finished before 1990 as originally scheduled.

Private contractors carry out the aerial photography of Denmark for the GID. Each year appr. 20-25% of the country has been covered in the scales:

- 1:21,000 for the above topographical mapping
- 1:25,000 for map revision
- 1:40,000 for orthophotos in 1:25,000 for map revision purposes (cf. below).

Attempting to find better and more accurate methods for map revision, which do not compromise the internal accuracy of the photogrammetrically produced topographical maps, GID has in 1982 and 1983 made some investigations, using orthophotography in 1:25,000, produced from exposures in 1:40,000, for map revision to find out whether this would be a suitable method to use in future. To this day, however, no final decision has been taken, as GID will wait for the results of the 1984 map revision campaign, which will mainly be based on the use of orthophotography in combination with field checks.

#### The Faroe Islands

The topographical basemap of the Faroe Islands is in the scale 1:20,000. It is purely based on plane table work which was carried out by the end of the 19th century. Since then it has undergone normal map revisions which e.g. have caused loss of accuracy in planimetry etc. It has therefore been decided to produce a completely new map series (also in 1:20,000) using most modern photogrammetric methods and based on new aerial photography.

The project is carried out in cooperation with the local Cadastral Survey which has a vital interest in producing new cadastral maps of the Faroe Islands simultaneously.

The work was planned to be based on black and white photography as follows:

- 1:30,000 for aerial triangulation and plotting base for the topographical maps and
- 1:15,000 for cadastral purposes.

The photo campaign started in 1982 and was continued in 1983 without being finished due to the fact that the meteorological conditions in the North Atlantic are very unfavourable for making aerial photography. Consequently, the work has to be continued in 1984. But in the meantime, however, it has been decided that the photography in 1:15,000 should be exposed on negative colour film exclusively, as experiences have shown that this material gives better interpretation possibilities which would cut down the total time of the field work needed.

Aerial triangulation, plotting, etc. is done on a fully equipped Carl Zeiss Planicomp C 100 (also including the DZ 7 drawing table) which was procured and installed at the beginning of 1983. Simultaneously with the plotting, height data, plani-

metric data, etc. are stored in the computer for later use as basis for automatically drawn cadastral maps in 1:4,000.

#### Greenland

The orthophoto maps of Northern Greenland (cf. the 1980 report) in 1:100,000 based on superwide angle photography in 1:150,000 are still under production. The project, which is somewhat delayed due to certain instrumental and reproductional problems, is now proceeding and expected to be finished within the next 4 years.

Based on the very good experiences from Northern Greenland (cf. above), where an area of appr. 300,000 km<sup>2</sup> was totally photographed in 1:150,000 in 1978, a similar photo campaign was carried out in 1981 over an area of appr. 200,000 km<sup>2</sup> in Eastern Greenland with the same excellent result by Mark Hurd Aerial Surveys Inc., which also carried out the 1978 photography in the North.

The first purpose of this new, high altitude photography would be via an aerial and a block triangulation to produce a coherent geodetic network of the total area, which - primarily because of heavy drift ice in the neighbouring sea all the year through - has extremely difficult access conditions that have a very negative influence on the possibilities of carrying out classical, geodetic survey.

### GEOLOGICAL SURVEY OF GREENLAND

#### Photogrammetric Activities

Geological maps published by the Geological Survey of Greenland are compiled from data collected during field work in Greenland and from data obtained from interpretation of aerial photographs.

Most of the 430,000 km ice-free land area of Greenland is covered by vertical photographs scaled 1:50,000 or 1:150,000. Vegetation in Greenland is very sparse, and large parts of Northern Greenland have no vegetation at all. Therefore, geological features such as foliation, lithological boundaries and faults are often very visible on aerial photographs.

The photogrammetric laboratory at the Survey is equipped with a Kern PG2 stereo restitution instrument with digital x,y,z read-out. The z-column has a motor drive option. An automatic flat-bed plotter (Kern AT) is available for on-line and off-line plotting. The data flow, including plotter and z-motor drive, is controlled by a HP-9825B desk calculator.

Software for the system, which has been developed in cooperation with the Technical University of Denmark, includes the following modules:

- Absolute orientation of the PG2 instrument
- Aerotriangulation
- Coordinate transformation (Geographical <> UTM)
- On-line calculation of geological parameters

A full-time technician operator is responsible for the daily operation of the system. His tasks include:

Installation and orientation of stereo models  
 Aerotriangulation  
 Drawing of topographic base maps  
 Instrument maintenance

Geological interpretation is carried out by geologists with field knowledge of the area being treated.

In the period from January 1980 to December 1983 about 700 stereo models have been processed which means that the average productivity is about 1 model per day. During the same period the data base, which contains data from all mapped areas, has increased by about 75 mega bytes corresponding to 3 mill. points.

#### Remote Sensing Activities

During the last four years the Survey has been involved in remote sensing projects in East and South Greenland. The aim of the projects was to develop methods for utilizing remote sensing in mineral exploration. The projects, which are partially financed by the Commission of the European Communities, are carried out in cooperation with the Institute of Mathematical Statistics and Operations Research (IMSOR), the Technical University of Denmark and with the Groupement pour le Développement de la Teledetection Aerospatiale (GDTA), France. In East Greenland airborne multispectral data from the visible/near infrared field have been used to locate oxidation zones in a 1500 km large area. In South Greenland (appr. 30,000 km) Landsat data are used in a regional survey of lineaments and oxidation zones. In addition, geophysical and geochemical data are combined with the Landsat data.

#### DANISH CADASTRAL SERVICE (MATRIKELDIREKTORATET)

##### General

Registration of land, titles, interests, mortgages, easements, etc. is divided between the Danish Cadastral Service and the offices of the Land Registry.

The Danish Cadastral Service is a department of the Ministry of Agriculture, and its major task is to keep the Cadastre. The city of Copenhagen and the Faroe Islands have cadastres of their own, and Greenland does not have a cadastre yet. All alterations of boundaries are entered in the Cadastre on the basis of documents worked out by licensed surveyors in private practice.

##### Cadastral Maps

Denmark has, since the start of the Cadastre on 1st January 1844, had a complete coverage of cadastral maps.

The majority of the maps was originally measured by plane table survey on the scale 1:4000 and is thus "island maps", i.e. very village is mapped on a separate sheet which again entails that the maps are produced in many different sizes.

In the southern part of Jutland the cadastral maps are - for historical reasons - produced by the Prussian cadastral

authorities, about 1870, on the scale 1:2000, based on traverse and chain surveys.

All the maps have daily been kept up-to-date with registered alterations of property since the start of the Cadastre.

In 1966 a systematic redrawing of the cadastral maps was started using transparent drafting film which facilitates reproduction. The master drawings of the maps are every day kept up-to-date with the approved cadastral alterations.

Since the turn of the century new plans have been produced on the basis of terrestrial surveys and since 1960 on the basis of photogrammetrical surveys.

Surveys carried out after 1934 are normally linked to the Danish national grid, system '34, resulting in 50x75 cm<sup>2</sup> sheets on the scale 1:2000 or more seldom 1:1000 or 1:4000.

Beyond being part of the Cadastre the plans are used for administrative purposes, planning, etc. by both private persons and public institutions (assessment authorities, town planning authorities, nature conservation boards, forestry administrations, road administrations, building administrations, telephone companies, electricity boards, etc.).

#### Activities

By the end of 1983 about half (approx. 8000) of the cadastral maps of Denmark have been redrawn. Unfortunately, the production is going down on lack of means.

Fixed points for cadastral measurements have been coordinated using bundle adjustment with added parameters.

The result of the coordination is a densification of the existing 2 km net of triangulated points down to a density of approx. 400 m. The photo scale is preferably 1:8000 - 1:10,000 and the overlap 60/30.

Since 1970 some 55 jobs of densification covering approx. 2265 km<sup>2</sup> (5.0%) have been executed using the mentioned method.

The accuracy is tested in the field by measuring distances between coordinated points using EDM. The standard error on a photogrammetrically coordinated point is less than 5 cm.

Since 1960 new cadastral survey for mapping purposes has been carried out by using aerial photogrammetry covering approx. 1270 km<sup>2</sup> (2.9%).

The mapping is always done in close cooperation with the licensed surveyor in private practice, the local municipality and a private photogrammetric company. The mapping is usually combined with a production of technical plans on the scale 1:1000 for the municipality.

#### Projects

##### EDP Register:

The parcel register of the Cadastre consists of about 3000 bound books. An EDP system has been developed, and for the time being the parcel register is being converted into EDP. The computerisation is expected to be completed in 1986. The EDP system is both an EDP register of parcel numbers and a

system of handling applications for cadastral alterations.

Digital Cadastral Map Base:

At the end of 1981 Datacentralen (DC) (the EDP advisor for the state of Denmark) and Matrikeldirektoratet (MD) initiated a project collaboration with the main purpose of investigating the possibilities of establishing a dynamic cadastral map by means of the highly developed interactive digital drawing technique. By a dynamic map is meant a map where the accuracy of the individual elements is continuously improved, as new local measurements and new coordinates for fixed points are received.

The approach deals with the fact that every alteration of the boundaries is documented by the licensed surveyor in the form of a measurement normally linked to control points. The new measurement is converted into digital form, and the transaction is defined for the update. For documentation purposes the original transaction in digital form is stored together with the original measurement, parallel to the archives in the analogue map system.

The set-up consists of an alphanumeric data base and a collection of graphic files. The alphanumeric data base is used to keep track of transactions in the graphic files and used for different kinds of queries. The graphic files contain line or point elements with one or more linkages to the alphanumeric data base. In the digital map the borders are line elements, and the titles are point elements. The elements are stored in such a way that the border lines by processing can be converted into polygons named by the title points.

The building up of a dynamic digital map, where the updates - and the transactions - are documented in such a way that the transactions are operative for later use, has two main advantages:

- it is possible at any stage to increase the accuracy in the digital map by new information without starting from the very beginning,
- every update is documented and can be found very quickly.

The first advantage means that during the establishment of the digital map it is not necessary to obtain the accuracy for tomorrow but only for today.

It is practicable to convert traditional cadastral maps into a reliable and up-to-date dynamic cadastral map system. The main advantage of the conversion is that the cadastral map is now successfully providing the basis for a land information system (LIS) with the capacity to correlate, analyse and output all parcel-related data contained in the system.

Pilot Project "Bornholm":

Orthophoto maps on scale 1:4000 covering the island of Bornholm (588 km<sup>2</sup>) have been produced using W.A.-photography on scale approx. 1:16,000. As an experiment these orthophotos have been used as a basis for rebuilding cadastral maps from existing island maps and elder coherent measurements.

A height data base has been established by means of different digitising methods - mainly by manual digitising of existing contour lines on scale 1:25,000 (equidistance = 2,5 m). Contour lines have been controlled by spot tests in the field, resulting in a standard error on an interpolated height of 0.5 m. A terrain model has been established for further interpolation (i.e. net structures, orthophoto profiles).

Combination of the different maps (orthophoto, cadastral map, contour lines) has been found very interesting, and user reactions are to be studied in the near future.

Considerations to produce a national orthophoto/cadastral base map and a national height data base are in progress.

#### Coordinate Register:

An EDP-based register consisting of coordinates for fixed points is being established. At present approx. 360,000 fixed points have been coordinates in the country. Among these approx. 38,000 are under the administration of the Geodetic Institute and approx. 320,000 of the Danish Cadastral Service. The number of fixed points is increasing by approx. 8,000 per year.

At present some 65,000 sets of coordinates have been entered into the register. In addition to the coordinates, the register contains some information for administrative purposes, and the mean square error of the actual coordinates.

Coordinates from the register are used as a basis for automatic plotting and digital mapping.

From the register lists of coordinates can be obtained, either on magnetic or on punched tape.

#### THE PRIVATE COMPANIES

In our National Report to the ISPRS Congress in Hamburg 1980 it was stated that:

"The progress in private photogrammetry is very much dependent on the economic situation of the country and has therefore been moderate in the last four-year period. .... So far, none of the firms have gone into digital photogrammetric mapping, but system development has started."

In this present report for the 1984 congress it can be said that never in their 25 years of history have the four private photogrammetric firms experienced a greater technological progress than during the last four years and have today an outstandingly high technical level, and a work load as hardly seen before.

Private photogrammetric firms in Denmark have - compared to colleagues in other countries - had the great fortune that the Danish government took the decision a few years ago that a major part of the country's energy supply should be based on natural gas discovered in the North Sea. This project involves the laying of several thousand kilometres of pipeline, and subsequently the country was divided into 5 regional gas distribution companies.

It was planned from the beginning that the project was to be based on already existing base maps from the different municipalities, but investigations into this material showed that enormous dissimilarities - and an astonishing lack of up-dating - that it was decided not to use any existing maps, but to produce entirely new maps for the project.

A simplified base map in scale 1:1000 was accepted involving so many thousands of hectares of mapping that all four firms became involved.

In order to speed up production and to reduce costs, five WILD "RAP" systems with computer-supported plotting were purchased by three of the photogrammetric firms involved, the systems being connected to already existing analogue plotters, e.g. WILD A8, etc.

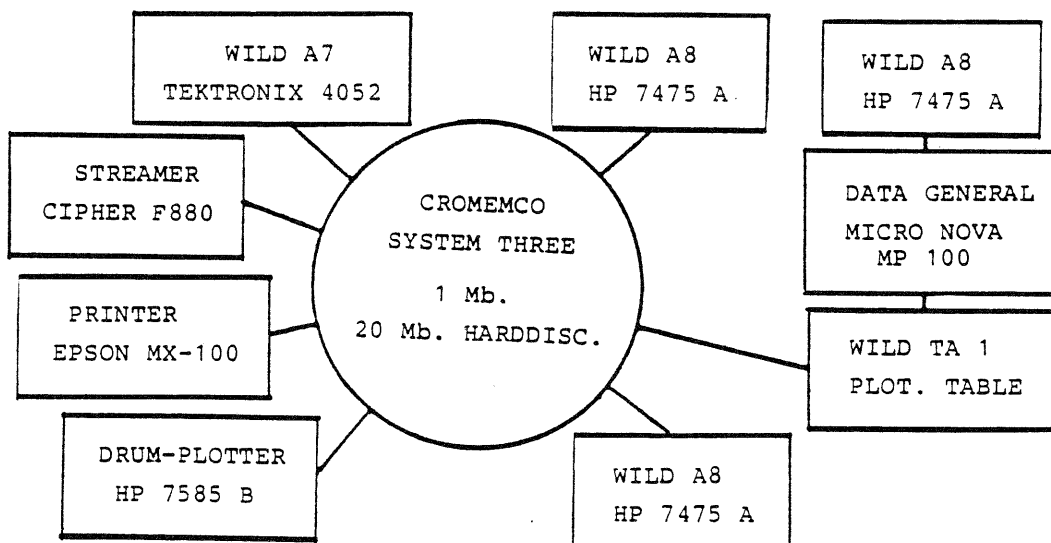
After a short time of existence the gas companies realized that they would be unable to handle the future registration of the pipelines without use of modern interactive graphic systems. Consequently, the four photogrammetric firms were required to produce digital map information immediately and long before the gas companies were supplied with the necessary hardware. The digital maps would then be implemented into a graphical data base at a later date.

In order to fulfil this demand it was necessary for the photogrammetric firms to develop the new methods of production within the short space of a year.

The development within the individual firms was as varied as their existing equipment. Those firms with the WILD "RAP" systems and their Data General Micro Nova computer expanded this software package to be a system of photogrammetric digitizing, too. One firm had a Zeiss analytical plotter and developed its own system from existing Zeiss software.

The capacity of the Data General Micro Nova system and similar systems was limited, necessitating the development of more ideal hardware/software combinations.

An example of the composition of a digital map production unit is as follows.





The production of digital base maps for the natural gas project is approx. 50,000 hectares each year and will continue over a 5-6 year period.

For the purpose of editing and other manipulation with the digital data from the stereoinstrument, the four otherwise competing firms bought in a joint venture software for interactive work.

This joint venture formed as a limited company (RIGS) has also undertaken consultancy in the use and production of digital maps as well as hard- and software systems.

The clients have primarily been the gas companies, where RIGS has been active in the preparation of tender documents, bid evaluation and at a later stage the implementation of the interactive graphic system with the companies. So far, three systems have been bought, one of the Computer Vision type and two intergraph systems.

This unique situation where utility companies invest several millions of Danish Kroner in the productions of digital maps covering a great number of Danish towns has created great concern in technical offices in the municipal administrations.

The future has become present, and nearly all large-scale mapping for municipal planning is today produced by digital methods and ready for use in tomorrow's data banks.

For the sake of exchange of data between different digital systems and between companies the photogrammetric firms very much supported the Danish Society for Photogrammetry and Land-surveying in setting up a Danish Standard for exchange of digital map data, and as the same firms produce 90% or more of the digital mapping in the country, we do believe in the success of this Standard.

Great experience has been achieved by the private firms from this extremely fast development from normal graphical map production to the most modern digital methods.



Basemap 1:1000 for Gas-distribution project



Same as above for other purposes.

## Education

TECHNICAL UNIVERSITY OF DENMARK (DTH) AND DANISH ENGINEERING  
ACADEMY (DIA)  
INSTITUTE OF SURVEYING AND PHOTOGRAMMETRY

### Education

Courses in photogrammetry are offered to civil engineering students as part of their general training in landsurveying. The basic courses in landsurveying include a 25 hour photogrammetric preview followed by nearly all the students (approx. 200 a year). Photogrammetry, however, represents a specialization in the education and is taken by approx. 25 students a year. The total time of study at DIA is 3½ years giving a degree of B.Sc. and at DTH 5 years, where the students obtain a M.Sc. degree.

The courses offered in photogrammetry and associated subjects are listed below. Each course includes approx. 135 hours of work.

Photogrammetry, theory  
Photogrammetry, lab./field course  
Digital mapping, terrain models and remote sensing  
Automatic map production and interactive graphics.

In addition, individual courses in special topics are offered.

It is possible to graduate in photogrammetry, 1-3 students are doing so every year. The thesis work takes 4 months and is often related to research programmes at the institute.

Within the last 4 years 2 students have finished their studies with a Lic.tech. (Ph.D.) degree.

### Personnel

There are 1 professor, 7 assistant/associate professors, 2 technicians and 2 secretaries employed at the institute.

### Equipment

The institute is equipped as follows (old instruments not included):

1 Wild B8, 1 Zeiss Double Projector and 1 Zeiss Jena Stereo-comparator 1818

1 Zeiss Jena Stecometer with Logic digitizers and interfaced to a HP-9815 disc top computer and paper punch

1 Zeiss Planitop, equipped with digitizers, and interfaced to a HP-9815 disc top computer and an A3 plotter

1 Kern analytical plotter with plotting table will be delivered in spring 1984.

### Research and Development Projects

#### Digital Terrain Models, Structure and Applications:

In cooperation with the Laboratory of Road Data Processing, the Ministry of Transportation, suggestions for a terrain model for estimation of noise propagation have been made. Re-

search related to developments of digital terrain models at the Danish Geodetic Institute and the Royal Danish Administration of Navigation and Hydrography are initiated.

Terrain Classification:

Theoretical studies of terrain surface description have been carried out. Covariance functions, semi-variograms, power spectra and the concept of self-similarity are applied.

Accuracy Estimation in Digital Elevation Models:

Operational methods for accuracy estimation in digital elevation models have been developed on the basis of Fourier Transforms. Data from ISPRS, Commission III, are subject to tests and accuracy estimation for DEMs measured and calculated by participants of the W.G. III/3.

Calibration of Metric and Non-Metric Cameras:

A new test field and a new computer program for calibration of metric and non-metric cameras have been developed during the last year. Investigations have been started concerning the variation of the lens distortion, when the focal distance in Hasselblad cameras is being adjusted.

Photogrammetric Measurements of Archaeological Objects:

A light-weight photogrammetric method has been developed and tested on a kayak expedition along the east coast of Greenland. Several settlements from ancient eskimo hunters have been surveyed.

Stereo X-ray Photogrammetric Measurements of a Silver Fibula from the Iron Age:

A silver fibula found in a chunk of earth was x-rayed in stereo. The photos were measured in a stereocomparator, and the calculations were done analytically. The accuracy in the measurements was better than 0.1 mm.

Photogrammetric Measurements of a Tilted Boat from an 8 mm Film:

A new life boat for the coast guard was tested for transverse stability by being dragged 360° around its axis. A 8 mm amateur film was taken of the test. To solve a question about the seaworthiness of the boat, the angle of heel of the boat on each one of the 350 photos was measured.

The interior and the exterior orientation of the camera was derived from coordinates to points on the shore, and the orientation of the boat was derived from points on the boat. The accuracy of the rolling angle was approx. 1°.

Photogrammetric Measurements of Deformation on a Human Cheek in Connection with Dental Treatments:

The cheeks of several patients were photographed before and after a tooth was removed. The volume of the swollen cheek was

measured from stereo photographs taken with two Hasselblad SWC cameras. The photos were measured in a stereocomparator, and a digital height model was established for each cheek. The volume was derived from this DHM.

Geologic Photogrammetry:

Research in geological photogrammetry is performed in cooperation with the Geological Survey of Greenland in Copenhagen and the United States Geological Survey in Denver. The research concerns the use of computer-guided photogrammetric instrumentation as an aid in structural geological measurements. During the last four years' period the use of analytical plotters has been included in order to support geological photogrammetric work in photos, taken with all kinds of cameras. An employee at ILF has spent one year in Denver making research and teaching USGS geologists in the methods.

Remote Sensing Activities:

Experiments with the use of remote sensing data for cartographical purposes have been carried out. An interactive image manipulation system, DK.IDIMS, from ESL is available at the Technical University of Denmark, but also the IBM system, ERMAN II, has been used in cooperation between IBM and ILF.

Accuracies of geometrical corrections of Landsat MSS data have been investigated for photos covering Denmark and Greenland. Ground control points have been used as well as sensor orbital parameters.

MSS data from airborne sensor (Deadalus) have been corrected geometrically, using digital elevation models. Data were pre-processed by a panorama correction.

Stereo models have been produced from Landsat MSS data introducing parallaxes by a digital terrain model. Other topographical features have been digitized and processed as an auxiliary band to support interpretation of MSS information.

Introductory experiments on radar data (airborne data from the "European SAR-580 Campaign") and scanned aerial photographs have been started to investigate the prospects of such data for cartographical mapping.

AALBORG UNIVERSITY (AUC)  
LABORATORY FOR PHOTOGRAMMETRY AND SURVEYING

Education

Education of the authorized Danish landsurveyor takes place at Aalborg University (A U C), a new university (1975) with a different structure of administration and study.

Survey teachers are part of the Institute for Social Development and Planning, where we form a group around a laboratory.

Education is problem-oriented and organized in projects.

A general course in photogrammetry is given to all survey students. It consists of 120 hours and includes exercises in ste-

reoscopy, rectification, orthophotos and restitution. The rest of the education is highly integrated with subjects as land-surveying, cartography, land information, etc. A mapping project contains map specification and determination of ground control. During the last 2 years (of 5) of study, the student can specialize. He may choose projects including photogrammetry or specialize direct in photogrammetry.

#### Personnel

The staff dealing with survey studies consists of 8 teachers (of which 1-2 deals mainly with photogrammetry), 2 technicians and a secretary.

#### Equipment

The photogrammetric laboratory is equipped as follows:

- 30 pocket and 15 mirror stereoscopes
  - 1 Orion rectifier, 1 Zeiss Ortho-3-Projector, 2 Multiplexes
  - 2 Wild B8, 1 Galileo G6 and 1 Zeiss Planitop plotter
  - 1 Zeiss Planimat, equipped with DTM data collecting system, and interfaced to a microcomputer, graphic monitor and A3 plotter for digital mapping
  - 1 Zeiss Jena stereocomparator, interfaced with a small micro for data collection, and with a large computer for on-line analytical computations
  - 1 Zeiss Jena UMK terrestrial camera
- Other equipment (computers, plotters, digital image processing systems, etc.) are available in other laboratories.

#### Students

The laboratory is equipped for approx 36 students a year following the general course in photogrammetry.

In the period 1980-84 approx. 36 students specialized in survey and mapping and graduated with thesis (corresponding to M.Sc.) in these subjects. Other students took shorter periods in these subjects and specialized in cadastral science or planning.

Only a few specialized narrowly in photogrammetry or remote sensing.

One post graduate student finished his Lic.geom. study (Ph.D.) in photogrammetry.

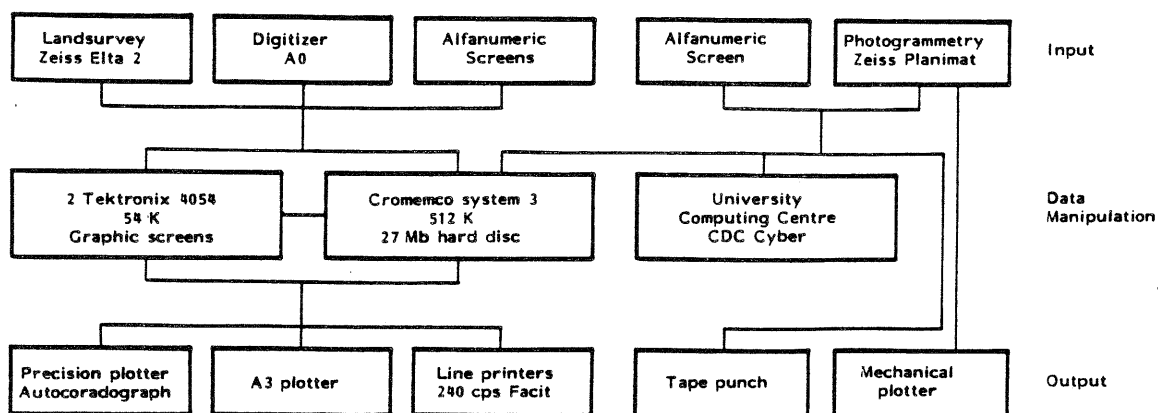
#### Research and Development Projects

##### Analytical Systems in Photogrammetry:

Development of software for analytical treatment of comparator measurements. On-line computations and bundle adjustment.

##### Digital Mapping:

Adaption and development of hard- and software.



Configuration of the AUC digital mapping system

Elimination of Gross and Systematic Errors:

Automatic gross error elimination by weight reduction in adjustments. Added parameters (self-calibration) in bundle adjustment.

Elimination of Outliers in Photogrammetric Adjustments:

The project aimed to develop and test alternatives to the conventional least squares adjustment and to give guide lines for using these alternative "robust" estimation methods.

OEEPE Projects:

Participation in "Gross error detection" and "Optimal emulsion for large scale mapping".

Radar Mapping of Southern Greenland:

Techniques were developed for radar mapping in Greenland, using the synthetic aperture radar SAR 580, made available by ESA.

Terrain Classification:

An investigation is started on models for classification of the terrain, in order to facilitate the application of digital height models. The underlying theory is the theory of the self-similarity of the terrain.

Terrestrial Photogrammetry:

Adaption of a bundle adjustment system to suit a very free position of camera stations, in this case round a drilling platform.

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### Professional Subjects

There are quite a few professional societies in Denmark. We have no official coordinating body, although we have some cooperation. Many persons are members of two or more societies.

Our society, the DSFL, represents Denmark in the ISP and deals with photogrammetry, landsurveying and mapping aspects of remote sensing. We have approx. 200 members.

We have regular meetings (8-10 a year) and seminars, arrange visits to organisations and to other countries, and publish our "News" 10 times a year. Working groups publish reports more irregular, in 1983 e.g.: Standard for exchange of digital map information.

Of other societies in Denmark we find: Dansk kartografisk Selskab (ICA), Den danske Landinspektørforening (FIG), Dansk Selskab for Telemåling (remote sensing), and geodetic, geographic, geophysics, pattern recognition societies and others!!

### Addresses

#### Government Institutions

Geodætisk Institut, Rigsdagsgården 7, DK-1218 København K.

Matrikeldirektoratet, Titangade 13, DK-2200 København N.

Grønlands Geologiske Undersøgelser, Øster Voldgade 10, DK-1350 København K.

Danske Statsbaner, Landinspektørkontoret, Bernstorffsgade 44, DK-1577 København V.

## Private Sector

Aerokort A/S, Løvegården, Hovedgaden 14, DK-2791 Dragør  
Geoplan A/S, Dagmarhus, H.C. Andersens Boulevard 12, DK-1553  
København V.

Landinspektørernes Luftfotoopmåling, LLO A/S, Kong Georgsvej  
11, DK-2000 København F.

Scankort I/S, Kirkevej 8, DK-2630 Tåstrup.

## Education

Instituttet for Landmåling og Fotogrammetri, Danmarks Tekniske  
Højskole, Landmålervej 7, DK-2800 Lyngby

Laboratoriet for Fotogrammetri og Landmåling, Ålborg Universi-  
tetscenter, Fibigerstræde 11, DK-9220 Ålborg Øst.

## Society

Dansk Selskab for Fotogrammetri og Landmåling, Fibigerstræde  
11, DK-9220 Ålborg Øst.