

14th Congress of the International Society of Photogrammetry,
Hamburg 1980

National Report

PHOTOGRAMMETRY AND REMOTE SENSING IN SWEDEN 1976-1979

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Abstract

The National Report gives a brief summary of activities in Sweden within Commission I-VII during the period 1976-1979. Research, production and education are discussed. A bibliography over articles published during the period is presented.

SVENSKA SÄLLSKAPET FÖR FOTOGAMMETRI OCH FJÄRRANALYS
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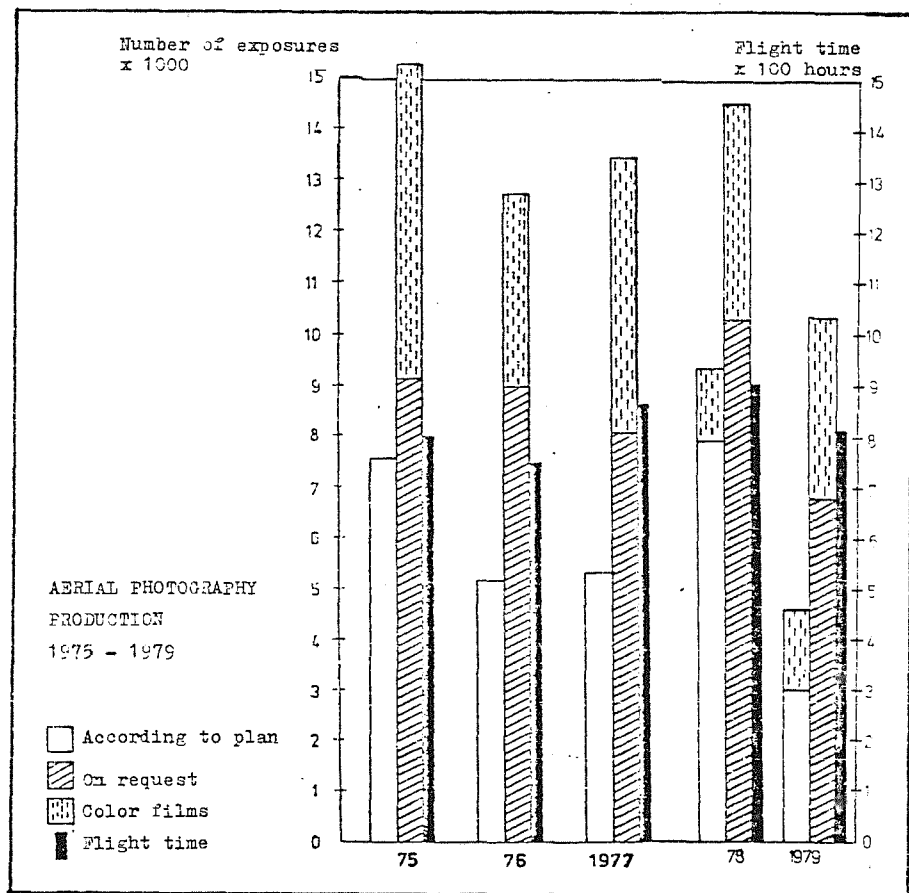
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Swedish Society for Photogrammetry and Remote Sensing

The Swedish Society for Photogrammetry and Remote Sensing consists of 300 personal members and 16 corporative members. The constitution of the council is presented in an appendix. The expanding activities in the field of remote sensing now has been emphasized by a modification of the name of the Society.

Commission I: Primary Data Acquisition

Aerial photography for mapping and interpretation purposes is nearly exclusively performed by the National Land Survey of Sweden. The production of aerial photography is shown in figure 1.



As reported earlier, aerial photography is carried out partly according to a general plan, partly on request. Requested by the National Environment Protection Board, the Mountaneous parts of Sweden (some 50 000 km²) are photographed from 9 200 m height using Color Infrared film for the purpose of vegetation mapping. In the name of Swedsurvey, the National Land Survey now also offers aerial photography and thermography missions abroad.

Aerial photography with a Hasselblad camera has been tried from a large radio-controlled model aircraft.

The Swedish company L M Ericsson has developed an in-expensive side-looking airborne radar (SLAR), which can be installed in relatively

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small aircraft. For the purpose of monitoring oil spills at sea and sea ice, the equipment has been installed in a Cessna 337 Skymaster, belonging to the Coast Guard.

Based upon the mentioned SLAR equipment and a Daedalus DS-1220 IR/UV-Scanner, the Swedish Space Corporation has developed a surveillance system for the Swedish Coast Guard. The system permits imagery from the SLAR and the Scanner to be transferred in real time to ships at sea and to operations headquarters for oil spill surveillance.

Technical development in the field of thermal scanning has been performed also at the National Defense Research Institute and at the companies AGA and Saab-Scania.

From 1980, A Daedalus DS-1210 thermal scanner has been transferred from the Swedish Meteorological and Hydrological Institute to the National Land Survey. There is a large interest in Sweden for thermal surveys over urban areas for the purpose of investigating heat losses.

A Landsat receiving station, belonging to the ESA Earthnet network of satellite receiving stations, has been installed at the Esrangle sounding rocket station near Kiruna in the far north of Sweden. The Esrangle Landsat Station is operated by the Swedish Space Corporation.

Studies on image quality has been performed at the National Defense Research Institute. The noise and contrast influence on perceived image quality has been investigated with the help of an interactive data analysis system and a graphic display terminal.

Commission II: Instrumentation for Data Reduction

During the period 1976-1979 the number of stereo plotting instruments has been fairly constant, but the number of coordinate registration equipment and numerically controlled drawing tables has increased considerably. Also the number of equipment for advanced aerial photo interpretation and for digital multispectral analysis has increased.

During the period interest has confirmed to be concentrated on analytical and digital photogrammetric methods. Complete systems for digital map data collection, storage and manipulation and for automatic map drawing has been developed at the National Land Survey and at several consulting firms. A numerically controlled ortho projector, Wild Avioplan, has been installed at the National Land Survey and effective computer programs for collection and storage of terrain elevation data has been developed. A method has been developed for transferring terrain profiles from the Gigas-Zeiss GZ-1 profile plates into magnetic tape. All orthophoto production in Sweden is now performed in the Avioplan equipment.

An optical transferring instrument for the revision of maps with the help of orthophotos or aerial photographs (OSBORN) has been developed at the National Land Survey. Also the development of instruments for aerial photo interpretation has been continued.

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Equipment and computer program systems for digital image analysis has been installed and developed in a large number of institutions, agencies and companies in Sweden during this period. Many of them deal with mapping from multispectral data, but also a number of institutions study general image processing problems. Only the IRIS and OSIRIS systems will be mentioned here. They are developed at the Royal Institute of Technology for interactive computer analysis of photographically recorded images of different sorts. The OSIRIS instrument is now put in commercial production jointly by the Saab-Scania and Hasselblad companies.

Commission III: Mathematical Analysis of Data

Developments in the fields of automatic mapping, orthophoto production and digital image analysis has been mentioned under Commission II. Activities in all these fields has been very intensive during the period.

Since the congress in Helsinki the rate of development in aerial triangulation has been relatively calm. There are presently in Sweden five computer programs for aerial triangulation used on a routine basis by different organizations. All of the programmes use the independent model method for the adjustment. Some of the programmes have features which make them especially useful in certain applications. Such features are use of water levels for height adjustment, calculation of standard errors in the determined coordinates, determination of orientation elements for stereo plotters or the possibility to calculate blocks larger than 400 models.

The geometry of remote sensing has been investigated at several places and also resulted in a thesis. Geometric rectification of Landsat data is made in order to be able to use map data as ancillary information in the classification procedure and in order to be able to use multitemporate data sets. Investigations have shown that the accuracy, when using an affine coordinate transformation, is in the order of 60 meters for a whole Landsat scene. Also differential rectification of Landsat images by using an Avioplan Orthophoto equipment shows the same accuracy.

Image processing of MSS data has been developed at several centres vividly and continuing, for the purpose of processing Landsat data and airborne MSS data.

Available computer programmes include geometric rectification, programmes for filtering of data, principal component transformation, classification and presentation of results on various devices. New developments are taking place all the time. Objectives of image processing are very varied.

Commission IV: Topographic and Cartographic Applications

As mentioned under Commissions II and III, digital methods for large scale mapping have been put into use to a large extent at the National Land Survey and at several consulting firms, e.g. VIAK and K-Konsult. Production of orthophotos at the National Land Survey is now entirely carried out in the Wild Avioplan digital equipment.

As the official map series - the Economic Map at the scale of mainly 1:10 000 and the Topographic Map at the scale of mainly 1:50 000 have

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been completed during the period, all efforts now concentrate on revision of them as fast as possible. The possibility of more intensive use of aerial photo interpretation for this purpose has been investigated. Revision is now based on interpretation of orthophotos and in stereo models completed by limited field survey.

Orthophotos are mainly used as a base for the Economic Map and for forestry maps. Orthophoto map coverage of Sweden is shown in figure 2. Orthophotos in larger scales as a base for maps for urban planning or for tourist maps have attained a growing interest.

As a part of an inventory of the mountaineous parts of Sweden the National Environment Protection Board is mapping vegetation and geomorphology in these regions from high-altitude aerial photographs in color infrared and in panchromatic film. Mapping of an area of around 50 000 km² is planned. Vegetation mapping in more than 60 000 km² of forest regions in the north of Sweden is carried out by the local county administration. Also the interest for vegetation maps in larger scales as a base for urban planning is increasing.

Commission V: Non-Topographic Photogrammetry

The responsibility for Commission V has been held by the Photogrammetric institution of the Royal Institute of Technology in Stockholm. An international symposium, "Photogrammetry for Industry", with more than 100 active participants, took place in Stockholm in 1978.

A series of developing projects have been carried out at the Royal Institute of Technology, Stockholm: X-ray and close range photogrammetry for medical purpose, methods of checking the geometrical quality of industrial products, a method of recording monuments of natural history.

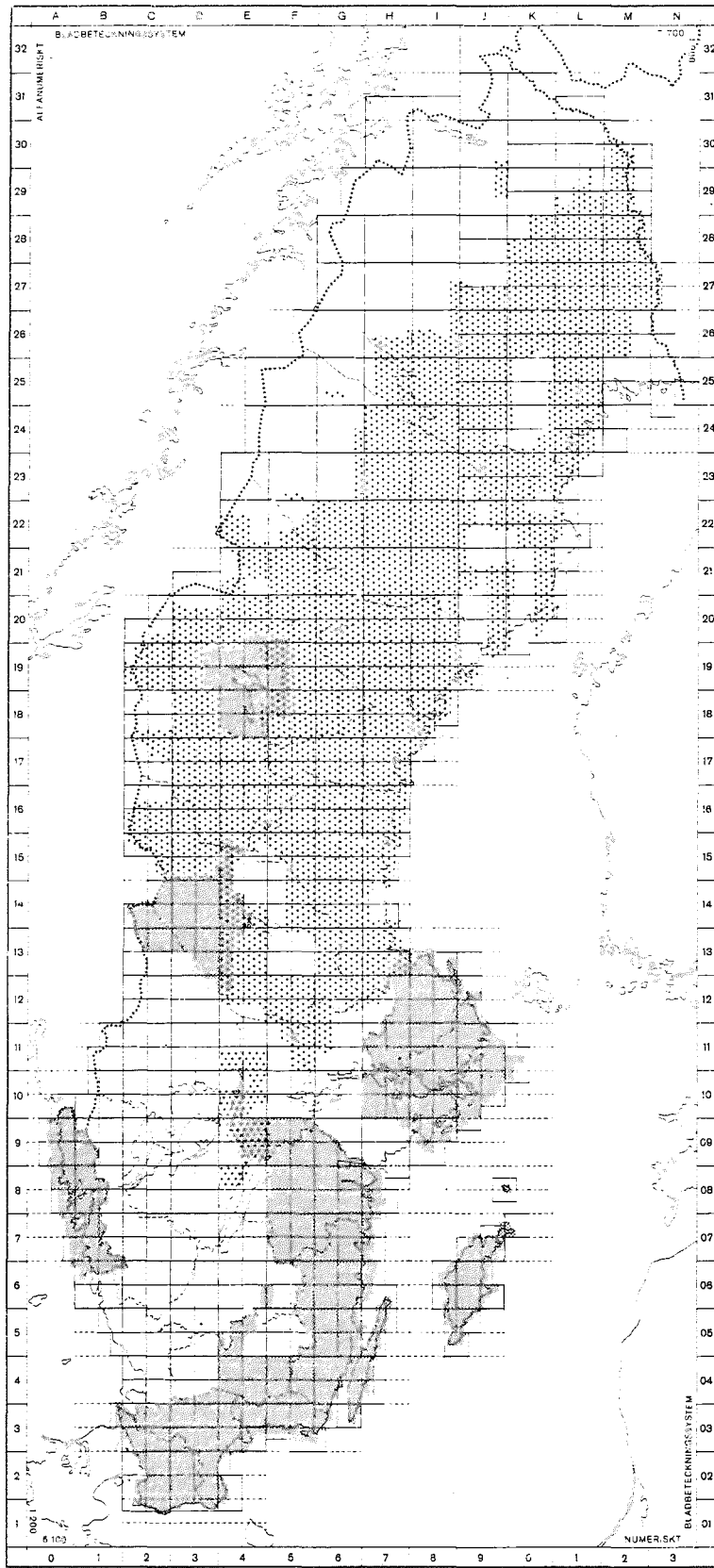
Non-topographic photogrammetry has been applied by the Central Office of National Antiquities, Stockholm. Hundreds of pairs of stereo-photographs have been produced during the last few years concerning selected objects, mostly architectural monuments condemned to be pulled down. Photogrammetry has also been applied to an archeological excavation going on during three years in the centre of Stockholm. Brickwall-substructions of many buildings from the 17-th century have been recorded and plotted. "Aerial" photographs have been taken from the top of a skylift of 15-20 m height. The groundsurface have been plotted in the scale 1:20. The archeologists are very much pleased with the result. Several boats from medieval time have been recorded and plotted in the scale 1:10. This work has proved to be very difficult with non-photogrammetric methods.

Photogrammetry has been recognized by the archeologists as a useful tool in the every-day work for the main goal: a complete recording of old remains disappearing for ever. A discussion about routines and results is continuously going on. Contact is established with the specialized Commission CIPA. Certain results and routines were presented at the symposium at Sibenik, Yugoslavia, in 1977.



STATENS LANTMÄTERIVERK

TOPOGRAFSKA KARTAN



ORTHOPHOTO MAP COVERAGE
OF SWEDEN 1980

- 1:10 000
- 1:20 000

Edition 2 - Feb 1980

Commission VI: Economic, Professional and Educational Aspects of
Photogrammetry

Education in photogrammetry on university level is given mainly at the Division of Photogrammetry of the Royal Institute of Technology in Stockholm, where all Swedish landsurveyors are educated. Courses in photogrammetry are also given at the technical universities in Lund and Gothenburg. At the Departments of Physical Geography at the universities of Stockholm, Uppsala, Lund and Gothenburg and at the Royal College of Forestry more emphasis is given to photointerpretation and remote sensing techniques.

On the technical college level, photogrammetric training is given in Stockholm, Kristianstad and Härnösand.

The general trend in photogrammetric education is that photointerpretation and remote sensing receive an increasing emphasis.

The total collection, handling and production of information on land, land use and natural resources in Sweden is being looked upon by an official investigation called LINFO. Possibilities of more intensive cooperation between governmental agencies in this field, and especially the role of the National Land Survey, are taken under consideration.

Commission VII: Interpretation of Data

1 Aerial photographs

Vegetation mapping from color infrared photographs is carried out on a routine basis in the mountaneous areas of Sweden, in forested areas in the north, along the shores of the largest lakes, and in the archipelago of Stockholm. Projects are also started in the southern part of Sweden.

Soil mapping from aerial photographs is also a routine work as a basis for urban planning, planning of roads, and for ore prospecting. Also for the official soil mapping and for localizing of earth-slide risk areas and course moraines aerial photographs are used.

In the mountaneous areas, landforms are investigated in aerial photographs, resulting in a geomorphological map over these extensive areas. This type of mapping is also developed as a basis for urban planning.

Investigation of urban areas in aerial photographs has been carried out for different purposes, mostly for land use mapping.

2 Aerial thermography

Although aerial thermography has been used in Sweden for some fifteen years, interest has grown considerably in the latest years. Areas of interest have been

- studies of local climate for reforestation, for orchards, local frost slippery on roads and for urban planning
- analysis of geohydrology and soil moisture, and seeking for course moraines
- urban energy planning, based upon a survey of heat losses from

buildings and hot water pipe lines

- oil spill surveillance at sea
- surveillance of hot water outlets from nuclear and oil power stations

3 Landsat data

A survey of geological lineaments over all Sweden has been carried out in Landsat images, which were especially color-coded for the purpose.

Great experience of analysing Landsat data has been acquired in the fields of vegetation, Land use and forestry mapping, as well as water quality and sea ice investigations.

Sweden has had one Principal Investigator on Landsat 2 data. The zoological institution at the Stockholm university has studied the ecology and dynamics of the Baltic Sea.

4 Multispectral scanning and signature studies

A large campaign with a multispectral scanner, called MSS-75, was carried out in 1975. In the following years, data has been analysed jointly by a large number of institutions and agencies. For the purpose a special data analysis program system was developed. Some of the objectives for the analysis have been: Crops, vegetation, land use, forestry, mires, water vegetation and algae. The experiment has had great importance for remote sensing development in Sweden, although mapping results were not too good. As a result of further development, the program system now can be reached via remote terminals. The most difficult problems encountered were in the fields of image geometry and radiometric corrections.

As a result of the growing interest in digital evaluation of remote sensing imagery, a number of institutions and agencies have developed or acquired digital image processing systems.

The IRIS and OSIRIS systems, which were mentioned under Commission II, have been used for vegetation studies and spectral reflection signature studies in multispectral aerial photographs.

Spectral reflection signature studies have also been performed with a portable tele-spectroradiometer.

5 Other remote sensing applications

Weather satellite data, mostly VHRR- and AVHRR-data, together with Landsat data, are used for meteorological and hydrological studies of clouds, precipitation, temperature distribution, water pollutants, snow cover and ice quality. The central authority for these studies is the Meteorological and Hydrological Institute.

A joint effort to map sea ice quality was made in 1975. A wide variety of sensors were used, e g aerial photography, aerial thermography, side-looking radar, microwave radiometry and Landsat data, and a great deal of experiences were made. A follow-up campaign was planned, based upon Seasat data, but it had to be cancelled for known reasons.

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Quite a lot of work has been made in African countries, where natural resource mapping, land use mapping and desertification studies have been performed in aerial photographs and in Landsat data.

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