

XIV Congress of the International Society for Photogrammetry  
Hamburg 1980

COMMISSION IV  
WORKING GROUP IV-1

PRESENTED PAPER

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DIGITAL MAPPING

ABSTRACT

For about four years now a project aimed at the development of a coding and data processing system for digital mapping has been going on at the Department of Photogrammetry in Stockholm. The general purpose of the project and some of its characteristic features, for instance a special technique for coding ("co-ordinate coding"), was described in a paper presented to the XIII ISP Congress in Helsinki, 1976. The project is now in its final stage. The paper that will be presented to the 1980 Congress describes some of the interesting features of the system, such as the structuring of data base and files, coding, connection and correction procedures, the structure of transfer files for communication with other IGS-system.

## DIGITAL MAPPING

The scope of the project and some technical aspects on it, were related in a paper presented to the ISP Congress in Helsinki in 1976. Only features of special interest will be treated here.

As the system is intended primarily for photogrammetric data capture there has been an endeavour to adapt the coding procedure to conditions prevalent in a photogrammetric instrument. For example, to generate code digits with a frequency and a rapidity equivalent to the capacity of photogrammetric work, the use of a key-board was not considered enough efficient. Neither would an ordinary type of menu-technique meet the requirements. Therefore a method called "Co-Ordinate Coding" was tested. As the result was good the method has been accepted. It should be noticed, however, that key-board coding can be used as well. Though, so far, no operator has used co-ordinate coding long enough to become experienced, there are evidences that it is as rapid and reliable as expected. The method has logical and mnemotechnical advantages which makes it easy to learn. It is described more in detail below. The rapid way of generating a code digit - by pressing the foot-switch of the co-ordinate registration device - offers good possibilities to introduce variations in the coding by giving "sub-codes" to terrain details included in a "primary code".

The hardware configuration described below admits the operator to work in an interactive way. Figure 2.



Figure 1

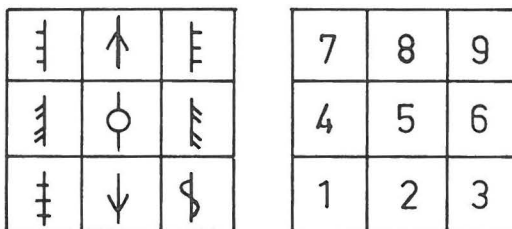


Figure 2

In Sweden an "object catalogue" including a recommendation of a general system for the coding of objects has recently been worked out. To make possible a communication between different digital systems in Sweden one has also worked out a standard for transferring data from one system to another. There has been a desire to make our system adaptable to the general coding system and to the transferring standard. This ambition along with hard requirements on procedures for correction, connection, editing, etc have caused us to devote much effort to the structuring of data files, storing and selecting data in the data base, and so on.

## THE CO-ORDINATE CODING PROCEDURE

The principle of the method is as follows:

After having adjusted the measuring mark to a terrain detail and registered its co-ordinates  $x$  and  $y$ , the operator makes a slight change of the position of the mark and then a new registration. This small change in co-ordinates is interpreted by the system as a code digit. The digits are generated as shown in figure 2. To generate the code digit 5, a new registration is made without changing the position of the measuring mark. The code 55 means two new registrations in the same point. Figure 2 illustrates some logical and mnemotechnical advantages of the method.

If, for example, the symbol of a fence is wanted on the left side of a line the digit 4 is registered. A forward oriented arrow is generated with the digit 8, and so on. All orientations of symbols are defined in the direction of the movement in the model of the measuring mark.

### HARDWARE CONFIGURATION

The hardware configuration of the mini-computer system in use in the project, is shown in figure 3. The stereoinstrument is equipped with linear encoders for  $x$  and  $y$  and with a rotation encoder for  $z$ . The encoders are connected to a Kongsberg PDS-M8 which is connected on-line to the computer. The computer is a General Automation 16/440 with a main storage of 128 kbytes, and two disk units (5 and 10 Mbyte) as secondary storage. Other peripheral units are a Tektronix 4006-1 graphical terminal, two alphanumerical terminals, a Calcomp 1037 drum plotter (860 mm width), a line printer, a console typewriter, and paper tape reader and punch. The mentioned units are connected on-line.

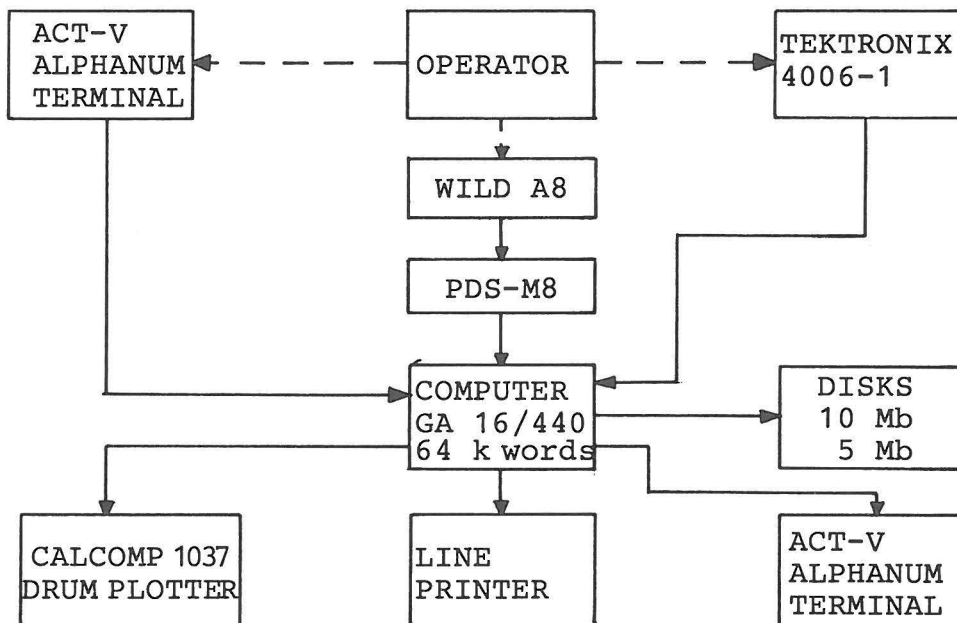


Figure 3

## DATA BASE

While measuring is in progress, registrations and codes are stored in a chained list in the main storage. This and a small number of measured points, gives a possibility of correcting and connecting in a simple way. When storing the measurements permanently in a secondary storage a sequential reading of a large number of points will give too long searchtimes for interactive correction, connection and plotting. By using an indexed data organisation with proper searchkeys, and files with direct access input/output, the searchtimes will be more suitable for interactive work. Totally we use seven files with different tasks. A schedule of the files is shown in figure 4.

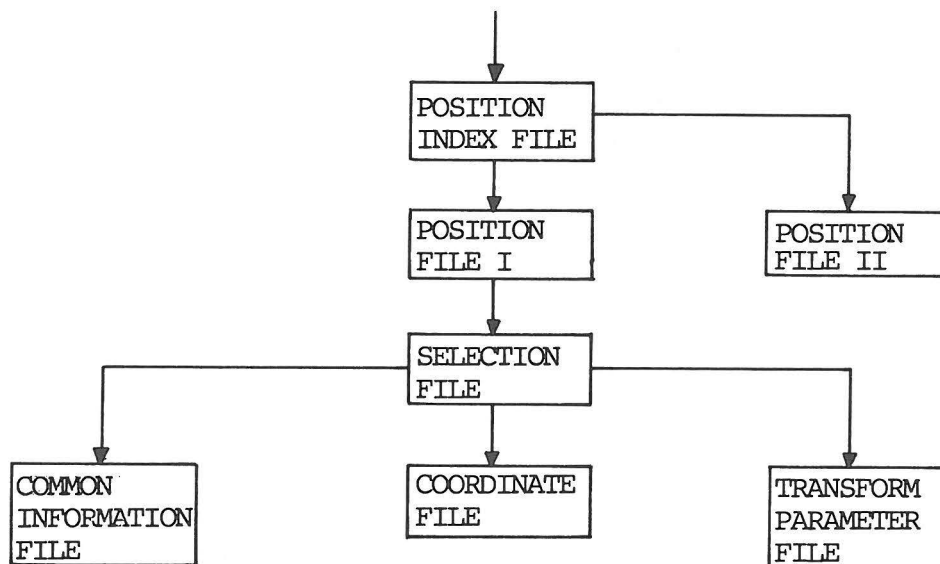


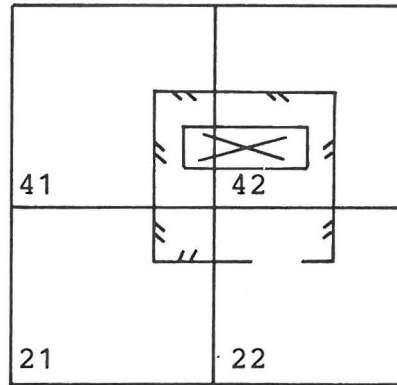
Figure 4

To do the position search the mapping area is divided into squares, size  $50 \times 50 \text{ m}^2$ . Every square has a record in the position index file. This record contains an address to the two position files. Position file I gives a description of objects situated in one particular square, wholly or partly. Position file II gives a description of squares in which one particular object is situated. In position file I every object has an address to the selection file. This file has one record for every object. The record contains addresses to the co-ordinate file, the parameter file, and the common information file. In the co-ordinate file model co-ordinates and codes for measured points are stored. The parameter file contains transformation parameters for the stereomodels. In the common information file alphanumerical information of measured objects can be stored. This two-level organisation with chained lists makes searchtimes depending on the number of objects in each square, but independent of the total number of measured points.

The storage of terrain details in the data base is shown in figure 5.

POSITION INDEX FILE

	ADDRESS TO POSITION FILE
•	•
21	4
22	1
•	•
•	•
41	5
42	6
•	•



POSITION FILE I

	ADDRESS TO SELECTION FILE	OBJECT CODE	LINK
1	1		0
2	1		0
3	1		0
4	1		0
5	2		3
6	2		2

POSITION FILE II

	SQUARE NUMBER	LINK
1	22	0
2	42	1
3	41	2
4	21	3
5	41	0
6	42	5

SELECTION FILE

	ADDRESS TO COORDINATE FILE	ADDRESS TO TRANSFORM PARAMETER FILE	ADDRESS TO COMMON INFORM FILE
1	1	1	0
2	7	1	1

CO-ORDINATE FILE

	X	Y	CODE	LINK
1	x <sub>1</sub>	Y <sub>1</sub>	c <sub>1</sub>	2
2	x <sub>2</sub>	Y <sub>2</sub>	c <sub>2</sub>	3
3	x <sub>3</sub>	Y <sub>3</sub>	c <sub>3</sub>	4
4	x <sub>4</sub>	Y <sub>4</sub>	c <sub>4</sub>	5
5	x <sub>5</sub>	Y <sub>5</sub>	c <sub>5</sub>	6
6	x <sub>6</sub>	Y <sub>6</sub>	c <sub>6</sub>	0
7	x <sub>7</sub>	Y <sub>7</sub>	c <sub>7</sub>	8
8	x <sub>8</sub>	Y <sub>8</sub>	c <sub>8</sub>	9
9	x <sub>9</sub>	Y <sub>9</sub>	c <sub>9</sub>	10
10	x <sub>10</sub>	Y <sub>10</sub>	c <sub>10</sub>	0

Figure 5

## REFERENCES

### Literature:

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