COMPUTER MAPPING WITH DATED EQUIPMENT

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Abstract

This paper outlines a recently developed mapping system and relevant software. The system utilizes available analogue equipment and computer processing to produce a modern mapping unit.

The system was designed for users who are unable to afford expensive modern analytical equipment. It allows for the processing of aerial photography and automated map production. The software is designed to allow each of the steps to be executed separately or in a set sequence. (The output of one stage of the process feeding the next stage). Equipment incorporated in the system consists of:

1. A comparator and/or a stereoplotting machine;

2. A digital reading device (with or without tape facilities);

3. A line to a computer, a minicomputer or a microprocessor with plotting facilities.

The system collects data (planimetric and topographic), adjusts photogrammetric observations, plots contours from either scan line information or salient points and finally plots from collected data points.

Introduction

A large number of commercial organizations, government authorities, academic institutions and others throughout the world own photogrammetric equipment of the sixties and seventies and have access to computer facilities. Few of the above organizations are in the lucky situation to be able to re-equip with the costly equipment of the late seventies and eighties which has all the modern facilities and will produce at the pressing of the appropriate button. With slight modification of the existing photogrammetric equipment and access to a computer or a minicomputer or microprocessor, modern mapping from aerial photography can be performed using the software described.

Hardware Requirements

1. Photogrammetric control extension data may be collected by a comparator or a stereoplotting machine. Either must be fitted with encoders to encode the information for storage on tape or disk via a digitizer or directly into a computer and its storage facilities.

2. A computer, minicomputer or microprocessor with storage facilities is required to store photogrammetric observations for the generation of photogrammetric control based on survey control. The same computer or other electronic processor may be used to do the processing of observations.

3. A plotting table for the plotting of processed information by computer with a line to a graphics terminal (or without it) completes the hardware requirements.

Software

The software consists of a sequential series of programs feeding each other with no human intervention other than change of parameters. The software is written in FORTRAN IV and is being updated at the present.

The parameters point to options such as:

Was a comparator used? If yes, refine co-ordinates and compute independent model co-ordinates. If no, independent model co-ordinates are expected as input.
Refinement of comparator observations and model formation is a preliminary step when comparator data are used.

1. Block Adjustment.

The first program processes independent model co-ordinates into homogeneous block co-ordinates based on survey control supplied before the block adjustment computations start. The program works in segments, each segment checking for incompatible information. The output of the program is printed out and used in the setting up of the photogrammetric models for preparation of a data base for contouring and planimetric drawing. The data base is stored on variable storage facilities of a digitizer or a computer.

2. Contour Drawing.

The data base is set up in such a way that height information is stored first. The height information may be in the form of a fully ordered digital terrain model produced by scan lines or in the form of salient points randomly distributed over the surface of the area to be contoured. The program connects the points of the area into a triangular mesh with height values of the vertices of the triangles actually observed (not interpolated).

Contours are thus generated by primary linear interpolation directly from observations. The points of equal contour values are connected by straight lines or using a third order polynomial smoothing routine. Tests are conducted to detect irregularities and precautions included to avoid crossing contours overshooting in gorges and to ensure that contours flow smoothly and logically. In terrain where break line information is required, to depict the terrain truly, such information may be included in the data base. The contour threading starts from the lowest value of contour and proceeds to the highest. Checks are included to avoid omission of contours. For an example of computer generated contours compared to photogrammetrically prepared contours see Fig. 1.

3. Drawing of Planimetry.

The input for planimetric drawing is a data base consisting of discrete points determined by co-ordinates and labels (code numbers) which define the quality of detail (symbols) uniquely. The data base is set-up by observing the appropriate detail and store it together with the qualitative label.

The program will draw straight lines by connecting discrete points where the linework is required to be straight. Regular curve segments expressed by mathematical formulae are drawn to satisfy the formula.

Map symbols and marginal information are drawn by subroutines, each subroutine drawing a specific symbol. A total of 38 subroutines capable of drawing almost all symbols required for a topographic map are available.

Provision is made for four colours.

4. Drawing of Written Information.

The program is capable of numbering spot heights and trigonometric stations, drawing names of towns, rivers, lakes and of other detail. It can also superimpose a grid, number it and draw a scale bar and all legend information. All marginal information appears in the appropriate colours.

Conclusion

The system was developed to give the user, owner of good but somewhat outdated equipment a chance to use new technology without the need to spend large amounts of money. It must be emphasized that some expense in the modification of equipment is involved. A degree of familiarity with programming and computer systems is also required.

The information required to introduce the system is contained in the thesis by H.H. Lee:

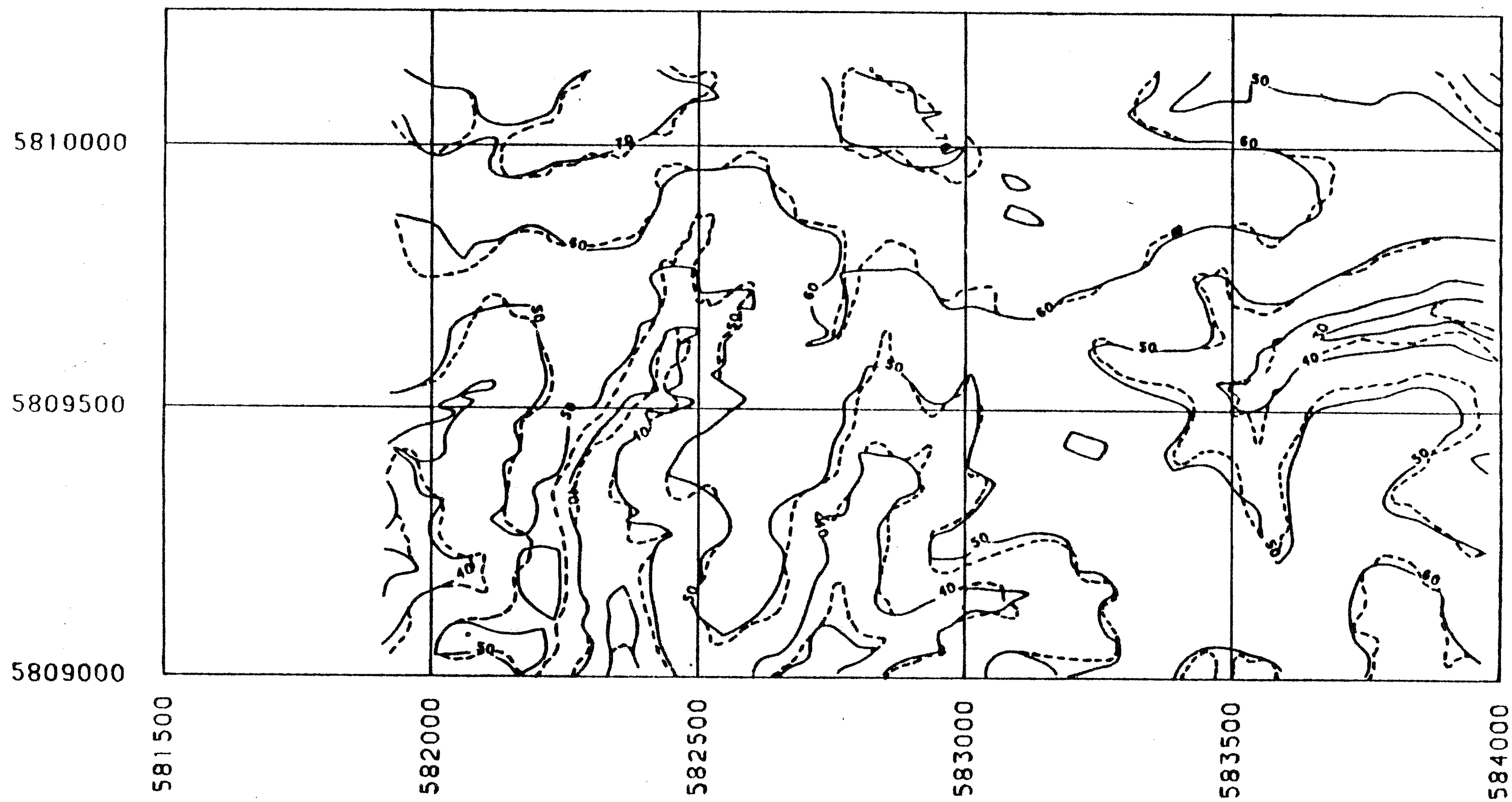
An Integrated Computer Mapping System.

A copy of thesis and of the listing of all programs can be obtained from the Royal Melbourne Institute of Technology, 124 La Trobe Street, Melbourne 3001, Australia for the cost of reproducing the documents. Contact with the author Mr. Lee is also possible through the R.M.I.T.

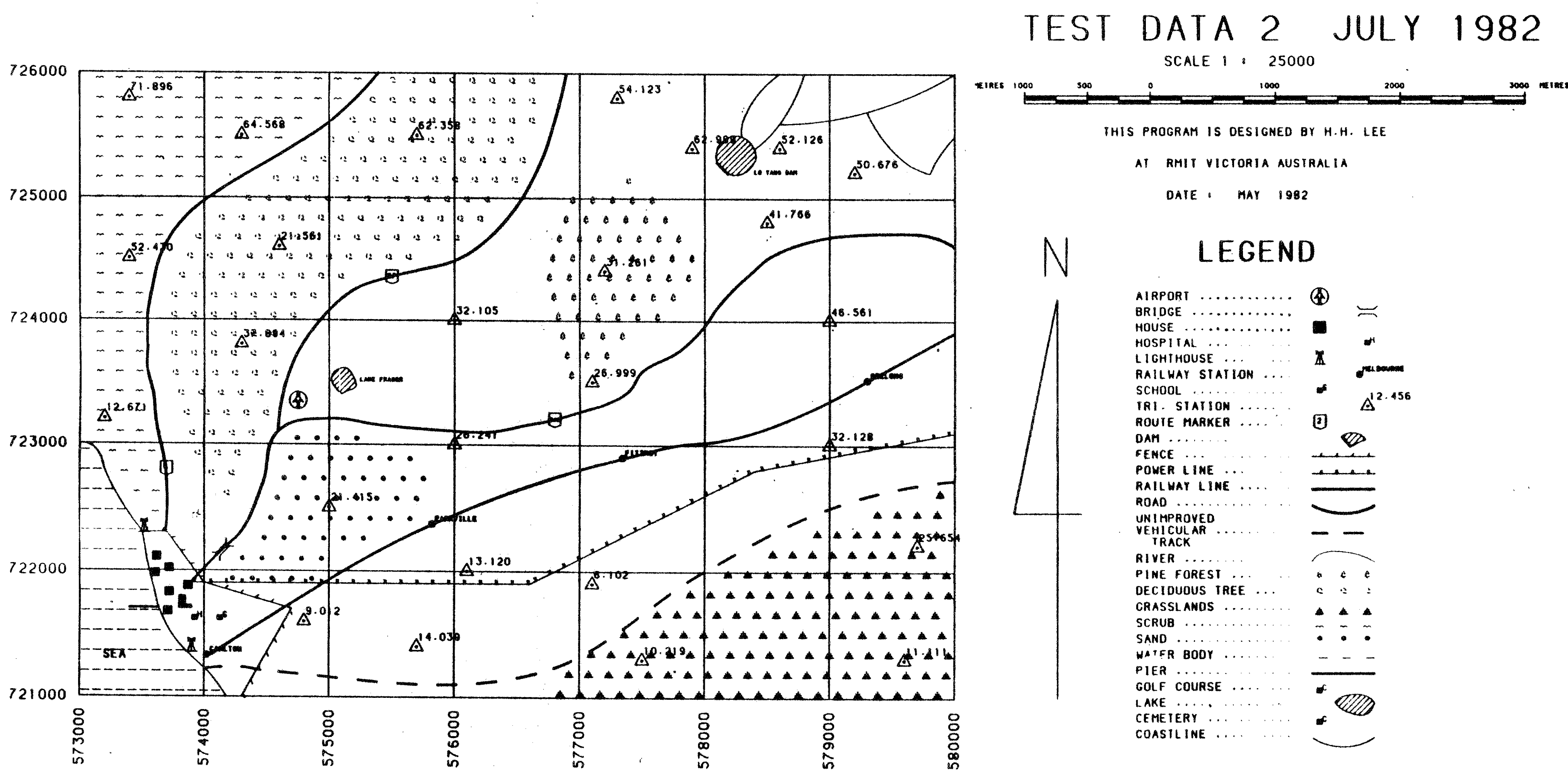
TEST DATA JAN 1983

SCALE 1 :10000

CONTOUR INTERVAL :. 10.000 METRE(S)

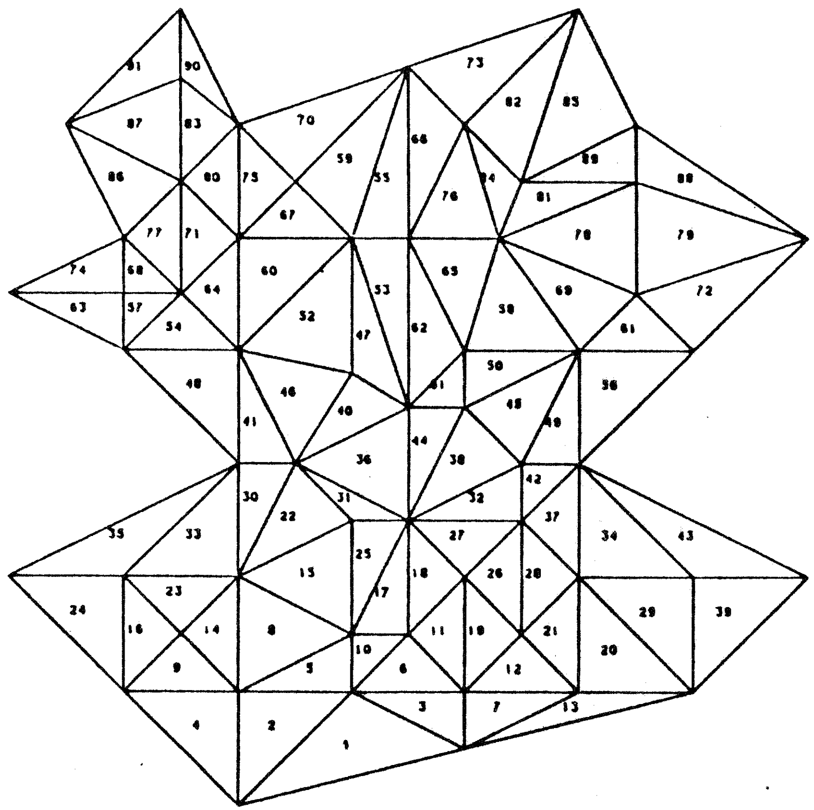


Dashed lines: photogrammetrically plotted
Full lines : computer plotted


TEST DATA 2 JULY 1982
SCALE 1 : 25000
METRES 1000 500 0 1000 2000 3000 METRES
THIS PROGRAM IS DESIGNED BY H.H. LEE
AT RMIT VICTORIA AUSTRALIA
DATE : MAY 1982
N
LEGEND
AIRPORT
BRIDGE
HOUSE
HOSPITAL
LIGHTHOUSE
RAILWAY STATION
SCHOOL
TRI. STATION
ROUTE MARKER
DAM
FENCE
POWER LINE
RAILWAY LINE
ROAD
UNIMPROVED VEHICULAR TRACK
RIVER
PINE FOREST
DECIDUOUS TREE
GRASSLANDS
SCRUB
SAND
WATER BODY
PIER
GOLF COURSE
LAKE
CEMETERY
COASTLINE
12.456
726000
725000
724000
723000
722000
721000
573000
574000
575000
576000
577000
578000
579000
580000
SEA
71.896
64.568
62.358
52.470
21.561
32.884
12.623
21.415
9.012
14.039
13.120
32.105
26.241
26.999
8.102
10.219
54.123
62.985
52.126
50.676
41.766
46.561
32.128
11.111

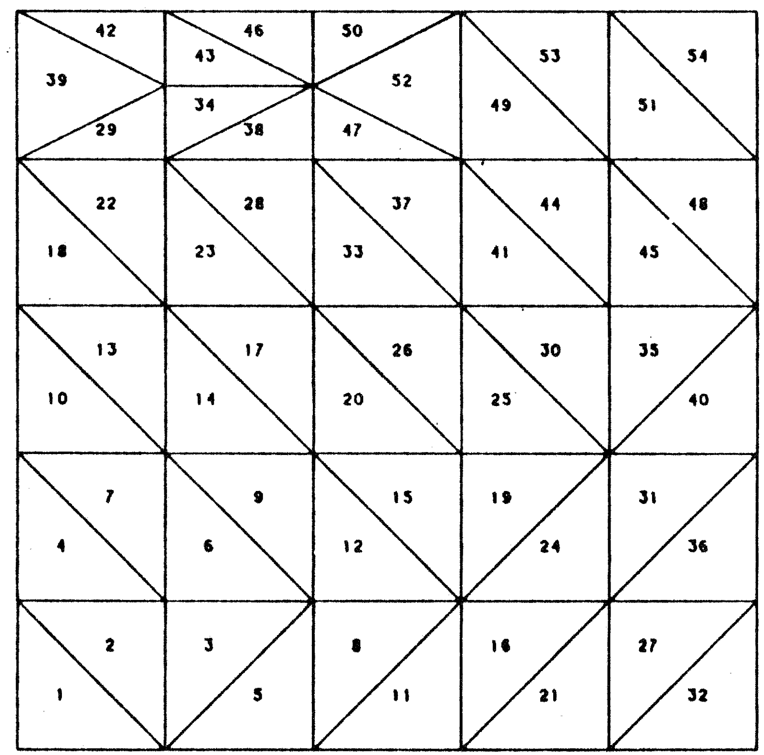
Detail Plot

TEST DATA JAN 1983
SCALE 1: 500



Random

TEST DATA 6 MAY 1982
SCALE 1 : 500



Ordered

Triangular Mesh

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