

## Large Scale Mapping Northwest of Maitri Station, Antarctica

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### **Abstract**

After providing the Geodetic and Geophysical control in the Schirmucher Oasis, Survey of India has started large scale mapping in the Antarctica. The paper describes how the precise ground control network was formed which is a prerequisite for the desired large scale surveys, and the various steps involved in the detail and contour (i.e. original plane tabling) survey on 1:1,000 scale with 1m contour interval for an area of 400m x 500m located NW of Maitri. This mapping was specially done for extension of our permanent station in the Antarctica. Digital map of this area was made successfully after this fieldwork and given to concerned authorities.

### **Introduction**

The developments due to the scientific activities carried out during the first nine expeditions necessitated the provision of Geographical control and mapping in the surrounding of Indian station Maitri. Survey of India, being the national survey and mapping organization was naturally identified by the Department of Ocean Development for carrying out mapping task and is thus associated with the Indian Antarctic Program since the 10<sup>th</sup> expedition. During the previous expeditions, SOI had provided the Geodetic and Geophysical control in the Schirmucher Oasis by both astronomical and state-of-the-art GPS observations. After that SOI had carried out original plane table Surveys on 1:50,000 scale with 5m contour interval and prepared detailed contoured map of Indian Antarctic station and its surroundings. Indian scientific teams needed still larger scale maps for their various studies, hence during this expedition large scale original plane table survey on 1:1,000 scale with 1 m contour interval for an area of 400m x 500m was done and a digital map was prepared.

### **Objectives**

- 1, To verify and revise the map of Maitri and surrounding area on 1:5,000 scale and 5m C.I. prepared during earlier expedition as per standard departmental practices.

2. To provide control (Planimetric and height) in the proposed area of detail surveying by densifying the network of existing control points by EDM Traverse.
3. To carry out large scale detail and contour survey on 1:1,000 scale with 1 m contour interval for an area of 500m x 400m NW of Maitri and west of the area surveyed during the 18<sup>th</sup> expedition.

### **Methodology**

The methodology consists of selecting suitable existing control points to run the EDM traverse. After verifying them, traverse stations were made and offsets were given at strategic locations to cover the whole area. Then computations and adjustments of the traverse were done for getting the coordinates of the control points, which were plotted, on the P.T. section, and detail survey was carried out as per standard departmental practices. The P.T. section thus prepared was then scanned, screen digitized and edited in MicroStation environment to get digital map of the area. The brief details of the different steps involved are given below.

### **Verification**

The ground control points (*i.e.* Maitri - A and Track - S) already provided in previous expeditions have been verified, found intact and these points were used for the extension of ground control points in the area, after checking their stability.

### **Reconnaissance**

A thorough reconnaissance was carried out for providing ground control points uniformly distributed in the area of work in such a way that detail survey and contour chasing can be done with required accuracy. Cairns were made for correct identification of control points.

### **Traversing**

A main traverse line was run between known points, established during the previous expeditions by SOI by using Wild - T2 Theodolite with EDM instrument DI - 3000S. Six Traverse stations and thirty-two subsidiary ground control points (Offset Points) were provided to density the ground control covering the entire working area.

Known Co-ordinate used for Traverse:

STATIONS	EASTING	NORTHING	' HEIGHTS
MAITRI-S	10,00,000.00	5,00,000.00	117M
TRACK-S	10,00,131.92	4,99,530.64	126.1M

The normal departmental procedures were adopted to carryout the work and maintain the accuracy.

### **Computation**

The computed mutual grid bearing at Maitri Station of Track Station has been taken as initial bearing and computed mutual grid bearing at Track-S of Maitri Station has been taken as closing bearing, Thus the Maitri Station and Track-S were taken as base for the computation of co-ordinates of Traverse Stations. Co-ordinates of offset points were computed using angle and distance measurement during the course of traversing. Heights of the stations have been computed in datum of Maitri-S only.

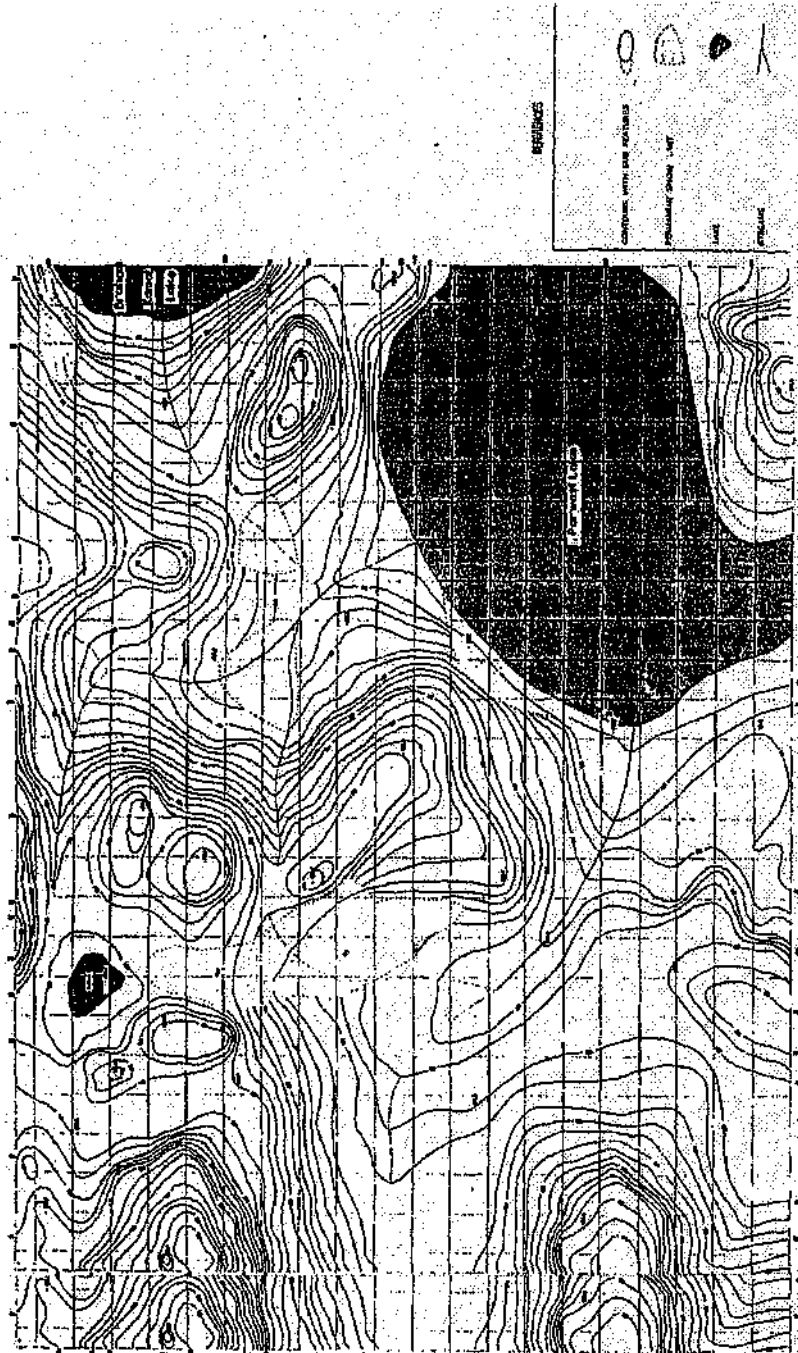
### **Detail and Contour Survey**

The plain table section was divided in regular grids, each grid of size 2cm x 2cm (20m x 20m). The ground control (main station as well as offset points) were plotted on the Plane Table Section.

A mesh of well distributed control points were provided to cover an area of 0.20sq.km. The Plane Table positions (Fixings) were made on control points only and computed heights of these control points were used, no deduced height was used for chasing the contours. This has added the accuracy of contours, and care has been taken to survey the overlap area 1cm for edge matching in future survey. The east edge is adjusted with the already surveyed map of the 18<sup>th</sup> expedition.

### **Scanning, Screen Digitization and Editing**

The **P.T.** section prepared was then scanned by precision scanners. Projection and required corrections were done by the GeoCoordinator module of the MicroStation. After vectorization of the raster file they were screen digitized taking care of all cartographic requirement. Editing for overshoot, undershoot annotation etc. was done to get the final digital map.



Digitized map of Mairi

### **Conclusions**

The project assigned to SOI of detail contour mapping on 1:1,000 scale with 1m contour interval for an area of 400m x 500m located NW of Maitri was successfully completed and state-of-the-art digital map was made for the area (attached). This was made possible by utilizing the days of good weather available to us in the extremely hostile weather of Antarctica.

### **Future Recommendations**

- (a) An Aerial Photography for the whole strip of Schirmacher Oasis area about 4km x 20km on scale 1:10,000 should be flown. Aerial Photography of the whole Schirmacher Oasis is also available with Germany, which can be procured on request for mapping purpose.
- (b) Ground Control Points should be established on the whole Schirmacher range and the post pointing on the aerial photographs should be done.
- (c) Initially actual ground survey should be carried out on scale 1:25,000 with 10m vertical interval on photogrammetrically plotted Air Survey Section and later on in any larger scale as per the requirements.

### **Acknowledgement**

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