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Naval Hydrographic Survey in XXII Indian Antarctic Expedition, Work and Achievements

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INTRODUCTION

The Hydrographic survey of India Bay, Antarctica was undertaken from 01 Jan 03 to 31 Mar 03 by a Hydrographic Survey Team embarked as the part of XXII Antarctica Expedition, in accordance with the detailed guidelines issued by National Hydrographic Office.

PASSAGE FROM CAPETOWN TO ANTARCTICA

The survey team commenced passage sounding at 69° 24' S as the depth were below 500 meters. As the ship was maneuvering through thick pack ice causing it to continuously alter course and speed, spot soundings were also recorded. Although ice free waters were expected much earlier but, the ship finally cleared the pack ice, at about 1800 hrs at 69° 40' S latitude. With the clearing of pack ice the first snowfall was encountered with a drastic fall in the visibility.

SURVEY

On 29 Jan 2003 the ship was found to be drifting due to the breaking of fast ice on. The ship was made available to the survey team for sounding operations. The Sounding was progressed as the ship maneuvered in the vicinity of the survey area for confirmation of XXI IAE data. The ship returned to fast ice on 30 Jan 03, about 08 Nm from the ice shelf. Aerial recce of the survey area and Dakshin Gangotri station was also carried out on 30 Jan 03. The ship adrifted again with the breaking up of fast ice on 23 Feb 03. She proceeded further into broken ice and attempted to make fast on ice edge. The ship was made available for sounding tasks again on 23 Feb 03. The sounding was progressed in Area 'C and 'B'. The ship returned back on fast ice on 24 Feb 03 to undertake flying operations. On completion

of flying operations the ship proceeded to progress sounding in Area 'C\ The ship returned to fast ice at 70° 02'.43 S 12° 40' E on 25 Feb 03 awaiting for the load disembarkation area to be ice free.

The survey team carried out simultaneous GPS observations at Maitri and Dakshin Gangotri on 08 Mar 03. Ice shelf delineation was progressed on 11 Mar 03 using the expedition's integral helo. Data was logged using Leica GPS 200 in KOF mode.

The specific Survey tasks progressed during the expedition are enumerated in the succeeding paragraphs.

GEODETIC CONTROL

Horizontal control for the entire survey was established in WGS 84 Datum and plotted on Mercator Projection with scale true at 66° S.

GPS coordinates were directly obtained from the ship fitted GPS "Trimble Navtrac XL" were used for sounding. No control was established for this purpose. However, the GPS set was compared with the Leica GPS 200, which was available with the survey team and was found to be acceptable.

The following existing stations was recovered and used for extension of Geodetic Control to carry out Ice Shelf delineation:

Stn.Id	Station Name	Latitude (N) Longitude (E)	Height (in M)
A	Maitri S	70° 45'51 ".730 S 11°44'02".570E	117.068

DIGITAL SURVEY SYSTEM

Data was recorded manually as the ships echo sounder did not have any digital output. This data after extraction and application of corrections was manually ported into the DSPS. The data was rendered in the form of fair sheet and report of survey.

NAVAIDS

Leica GPS 200, Trimble Navtrac XL and EG&G Smart Acoustic Currentmeter were the digital systems successfully deployed in the field. KDS Valiant Laptop computer and the DSPS comprising of CARISAH menu driven software from M/s QTC ported onto a Sun Sparc Work Station

under Sun OS 4.1.3 UNIX operating system was used for processing the digital and the manual data.The GPS positions obtained at the ship fitted Navtrac were manually recorded. Although there exists a provision of digital output, but the system is interfaced with the ships radar.

BATHEMETRY

Two Russian made echo sounders were available on board, model M4, designed for measuring up to a depth of 50 meters and model NEL M3B designed to measure up to a depth of 500 meters. With an average depth of 100 to 200 meters at Antarctica near India Bay, the only option was to use the echo sounder model NEL M3B. The echo sounder was crude mechanical type with very limited options and no digital output. Also the echo rolls do not have any graduations; the scale is fixed on the echo sounder. The data was manually extracted and corrected for draught and calibration. The scale was manually traced on paper and used for data extraction. Copy of the scale is placed as an accompanying document to this report. Moreover, the manuals available were all written in Russian language and not many details could be found out.

The details of the echo sounder which could be inferred is placed below :-

Model	NEL M3B
Velocity of sound used	1500 m/s fixed
Frequency of transmission	169 kHz +/- 3.4
Scales of operation	0 to 50,40 to 90, and 0 to 500
Phasing of scales	Not present
Recording paper speed	Fixed speed as per scale (details could not be found out).

The sound velocity was fixed 1500m/s on the echo sounder. Sound velocity was observed using the EG&G smart acoustic current meter. The sounding lines were run at approximately 1 cm apart on the scale of survey perpendicular to the depth contours. The sounding density was not changed for delineation of the shoals, which was considered adequate to meet the desired standards of accuracy and thoroughness on scale of the survey. When the ship was not following any particular course, especially whilst negotiating through pack ice, spot soundings were taken.The observed soundings were corrected for index error of the echo sounder, ship's draught and sound velocity.The accuracy of sounding was within stipulated 2c level. No cross lines were run owing to bad ice conditions.

SEABED TOPOGRAPHY AND TEXTURES

The seabed in the general area was found to be of extremely gradual slope. The result of the survey did not indicate any major undulations. Whilst the ship was alongside the ice shelf the depths observed to vary to a large extent even with minor position changes. It was inferred that the ice shelf extends into the sea beyond the visually prominent boundary.

TIDES AND SOUNDING DATUM

It was not feasible to erect a tide pole at the India bay as it has only the ice shelf, which rises and falls with the tide. Depth observations were carried out on board whist the ship was stuck on fast ice and alongside India Bay.

TIDAL STREAMS

Tidal stream observations were carried out were carried out on 08 Mar 03 whilst the ship was alongside at the disembarkation point at India **Bay.**

COASTLINE, TOPOGRAPHY, CONSPICUOUS OBJECTS AND MARKS

Delineation of ice shelf was progressed on 11 Mar 03. Data was logged using Leica GPS 200 in Kinamatic on the Fly mode.The coast was found to be barren and devoid of any marks or objects. Barrels and containers were placed by various expeditions in the area mainly as route markers.

MISCELLANEOUS

The expedition was fortunate to have had a prolonged duration of clear weather. But this resulted in the longer duration of ice presence in the area. Thus reducing the period of progress of sounding tasks. Also in view of fuel restrictions the ship carried out all survey tasks at low speeds. With poor machinery state the master of the ship was hesitant to progress the task even in clear waters.

ACHIEVEMENTS

(A) During the Expedition 200 Nautical Miles of sounding was completed.

(B) During the Expedition 120 Nautical Miles of ice shelf was delineated.

(C) Oceanographic and Meteorological data was collected.

(D) Sound Velocity and Current observation were undertaken at various locations.

(E) About 600 Nautical Miles of Passage Sounding was undertaken.

(F) The valuable data of Antarctica Region was collected for inclusion in sailing direction.

(G) The team gained valuable experience in operation of various survey equipments/systems in Polar Areas.

(H) Data collected during previous expeditions was validated by the data collected during this expedition.