

Fourteenth Indian Scientific Expedition to Antarctica — A Review

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Leader

The expedition carrying sixty three members belonging to different components like scientists from various scientific organisations (32), Army (16), Navy (13) and AFMS (2) — was flagged off in an impressive ceremony at Marmagao port on 15th of December, 1994 with blessings of Sh. Prasada Rao (Joint Secretary, DOD), Dr. E. Desa (Director, NIO), Sh. H.P. Rajan (Director, DOD), Leaders of the previous expeditions and heads of a numbers of participating organisations. The ship M V Polar Bird sailed off on 17th December and after that there was no looking back.

Notwithstanding the roughness of the sea from the word go, scientists from a number of Institutions like NPL, IMD, Wildlife Institute of India, AIIMS and others started taking observations. Sensors were installed on top of the bridge to record erythemal dose of UVB and Sunphotometer to monitor different wavelengths of radiations. The ship halted at Mauritius to the respite of the expedition members for replenishing the spoiled food articles, to pickup cargo and ship bow- thruster repairs.

The first Iceberg was sighted at 57° 44' S; 28° E at 0115 on 7th January. The event was a long awaited scenic attraction for a few but was a beginning of scientific activity of Iceberg monitoring for GSI team. Packice appeared around midnight of 10th Jan. and was cleared after a journey of about five hours and the ship entered Polynya on the early hours of 10th January. Due to packed up weather, the flying operations could not be started before 13th January, 1995.

Within the following week, the summer camp was established and all the scientific groups were inducted. The Army team took over the repairs of the vehicles and made a few preliminary convoys to DG. Later the personnel specialized for essential services started taking over from their counterparts of the previous wintering team. Meanwhile flights were arranged to take observations in the southern hills by the teams of GSI, Osmania University, IIG etc. Flights were also arranged for WSI, ZSI and Naval hydrography teams for

wildlife monitoring and survey work. The Republic Day was celebrated with traditional hoising of the National Flag followed by National Anthem in the presence of both the teams, Russian guests and ship's crew.

On 2nd Feb., 1995 the members of the 14th expedition took over the charge of the Maitri Station after the traditional handing-taking over ceremony. Sh. Sudhakar Rao, the leader XIII IAE and his team was given a hearty send off. The ship sailed off to India on evening hours of 6th March, 1995.

Scientific Objectives

A. Atmospheric Sciences

To establish Laser Heterodyne Experiment to study ozone profile (NPL), A shipborne system to study PBL(NPL), mm- wave experiment to study ozone profile (NPL), daytime auroral emissions study using a special photometer (PRL), fluxgate magnetometer studies (IIG) and climatological and meteorological studies (IMD).

B. Earth Sciences

Geological mapping in the Orvin II mountains and Glaciological Studies (GSI), Petrophysical, VLF-EM and Geothermal Studies (Osmania University), Topographical mapping of the Schirmacher oasis to 1: 500 scale and ground control points (SOI). Bathymetric studies around Indian Bay (Naval hydrography).

C. Environment Sciences

Environment impact assessment studies (NEERI)

D. Medical Sciences

Studies on human physiology (AIIMS)

E. Biological Sciences

Algal colonisation in Schirmacher oasis (BHU), Microbic Studies for Biodegradation (DRDE). Studies on phylum Tardigrada (ZSI) and long term monitoring of mammals and birds (WLI).

F. Engineering

Structural studies (R & D E) and establishment of e-mail facility (R&DE)

Logistic Tasks

- a. Completion and erection of garage-cum-workshop for vehicle maintenance
- b. Routine maintenance and repair of the station
- c. Upkeep of electrical and structural aspects of the station and also fire fighting equipments
- d. Proper earthing of Maitri Complex
- e. Overhauling of the cold room
- f. Upgradation of communication link and establish e-mail facility

Summer Achievements

The achievements of the various scientific and logistic groups during the brief period of austral summer are described in brief:

A. Atmospheric Sciences

a. *National Physical Laboratory:* UV Biometer and aerosol studies were started just after starting from Goa. The sensors were mounted on the bridge-roof for recording data on automatic datalogger. Four wavelength Sunphotometer was used for studying aerosols.

Laser heterodyne system of studying total ozone and ozone profile was established in Laser hut and data recorded for all sunny days.

PBL studies using an acoustic sounder and sensors fitted on 28 M tower were undertaken. It was concluded that at Maitri a diurnal variation is stable during hours of minimum insolation. Day time boundary layer remains convective with thermal plumes reaching upto 30 M.

b. *Physical Research Laboratory:* A group of two scientists studied auroral emissions excited by high energy ions and high/low energy electrons during sunlit hours (daytime aurora). Data on wavelengths 3914 Å, 5577 Å, 4861 Å and 6300 Å were monitored during magnetic storms and normal days. Distinct difference was observed from the last year observations.

c. *India Meteorological Department:* Three hourly monitoring of weather parameters started from Goa itself but ozonesonde flights could not be successfully taken on board because of wind and antenna problems. At Maitri, continuous automatic recording of weather parameters, three hourly recordings, six hourly transmissions and ozone studies were taken. Solar radiation and turbidity studies were also undertaken.

d. *Indian Institute of Geomagnetism*: A three component fluxgate magnetometer oriented to respond to horizontal, vertical and declination components was installed to study the earth's magnetic field variations. Three stations viz Maitri, DG and Conrad (Orvin II) at the vertices of a triangle were operated simultaneously. The data so collected would be used to study the velocity and amplitude of mobile current system in the auroral region and dynamics of coupling between interplanetary regions and earth's near environment.

B. Earth Sciences

a. *Geological Survey of India* : The shape and size of icebergs were monitored as per the format. Old icebergs were found to be of pyramidal and sculptured forms whereas those close to shelf were regular shaped. Snow accumulation and ablation studies also made at the previously fixed nine stakes near DG.

b. *Osmania University*: Insitu measurements of physical properties (density, gamma radiations, magnetic susceptibility and vertical component of magnetic field) of rocks in Schirmacher region were undertaken along five traverses laid for the purpose. The samples were collected for laboratory investigations from these sites and from Orvin mountains in a single drop.

c. *Survey of India*: Completed the mapping of 0.5 x 0.5 Km² area west of Maitri on a scale of 1:1000. For the first time took measurements of astronomical coordinates of Maitri from the transit of stars. Helped GSI in the movement studies of DG Glacier. Help extended to Osmania University Scientists in laying down three profiles. Also helped fixing antenna orientation for SATCOM required for e-mail establishment in Maitri.

d. *Naval Hydrography*: The ground station established by Survey of India in 1991 was used to extend ground control to the shelf. A three Km traverse was carried out by walking along the edge of the shelf to establish coastlining. Bathymetric studies carried in an area of 5 x 4 miles. The average depth of India Bay was found to be 220M.

C. Biological and Medical Sciences

a. *Banaras Hindu University*: Most of the algae identified here belongs to Cynophyceae class. The presence of exogenous algae is ruled out on the basis of studies in the vicinity of Maitri Station. Detailed studies at the species and intra-specific level would be carried out at BHU. Despite using a large number of sticky slides for air borne diaspores, only three have been recorded in Maitri region viz. *cosmarium*, *oscillatoria* and *phormidium*.

b. *Wildlife Institute of India, Dehradun*: Birds and mammals in the Indian ocean enroute Antarctica were monitored and the location (using GPS) and numbers were recorded. Ten species of birds and two species of mammals were sighted. Similarly the status of wildlife in Antarctic waters, shelf area, DG area and Maitri region was also monitored by walking, boating and aerial surveys. The objective is to develop monitoring protocol for identifying species / fauna and to maintain a data base to apply GIS technology.

c. *Zoological Survey of India, Calcutta*: Micro-organisms like Tardigrades, Rotifers and Nematodes have been studied in habitats like moss, soil and water in the lakes around Maitri. Physico-chemical parameters like Ph, DO, conductivity and light penetration were also studied. Data on Polar Skua also collected and ringing undertaken. Two species of Tardigrades, two of Rotifers and five of Nematodes were identified. Their presence, number and diversity indicate the nutrient level of the ecosystem.

d. *Defence Research and Development Establishment, Gwalior*: The study was aimed to search for bacteria active at low temperature and suitable for biodegradation of organic waste. Bacteria, yeast and mould samples had been collected for further studies at DRDE. Some samples showed the presence anaerobic bacteria which could grow at 5°C in balch medium. The water samples from Priyadarshini lake was found free from faecal pollution but the presence of H₂S producing bacteria was found near convoy route down Klargestep point.

e. *National Environment Engineering Research Institute, Nagpur*: Environment pollution with regards to air, water, noise was studied in a systematic manner by taking samples from predetermined points. For air, samples were collected from Genset exhausts, boiler room, incinerators and aircraft exhausts. Fresh water/waste water samples were analysed for hydrocarbon and oil-grease extraction. Noise level monitoring, soil sampling from spillage areas etc. also undertaken. Results in detail are published in this report.

f. *All India Institute of Medical Sciences, New Delhi*: The study of interaction of opioids and altered photoperiod stress on the immune status was undertaken on 12 volunteers. Cold adaptation test and autonomic status was monitored. The physical parameters like weight, skin-fold thickness, abdominal girth etc. were measured before and after Antarctic stay. The effect of Geomagnetic field on ECG was also observed on 20 summer subjects. A battery of neurobehavioural tests were undertaken on 12 subjects.

D. R & D E (ENGRS) PUNE

a. *E-mail*: Installation of e-mail facility at Maitri was an important task to be completed during the summer. Girnar hut in summer camp was chosen as the appropriate site. The Satcom dome and computer was installed there. Later, e-mail facility proved a boon for overwintering members of the expedition. The user-friendly software could be operated even by the beginners.

b. *Refrigeration*: One walk-in freezer and five reach-in freezers were made operative. One BOD from NPL was converted to work as a refrigerator in the absence of a working fridge.

c. Work on workshop flooring started, site for balloon launching hut for IMD finalized and responsibility for carrying out data collection for IIG was also accepted .

Winter Activity

During winter the following scientific activity was carried out in Maitri:

- a. UV Biometric study to monitor erythemal dose in Maitri region was carried out after Polar nights, during ozone hole period and subsequent summer. Similarly aerosol observations were taken on all sunny days available during the stay. All these observations would establish a baseline in this important aspect of Maitri region. Spectral measurements were also taken for all the available period.
- b. mm-wave Radiospectrometer was established and ozone was observed from Feb.95 to Dec.95 on an average for 18-20 days per month and more during ozone hole period. Also observations on atmospheric opacity variation at ~ 100 GHz were undertaken during this period.
- c. Acoustic sounder and Geomagnetic observations were also continuously monitored during the winter and important data recorded by the expedition members in the absence of trained scientific workers.
- d. In addition to the normal IMD activity, APT receiver was made operational and APT pictures were received from NOAA satellite throughout the year. Facsimile charts were received from Pretoria and were analysed for weather prediction.

A record number of 55 ozonesonde flights were undertaken, more during ozone depletion period and a new method to process the balloons were devised. Similarly 14 radiometer sonde (RMS) flights were attempted to study radiation budget. Data collection platform (DCP) was made operational and hourly data was received and transmitted to IMD, HQ, New Delhi through INSAT. Mete-

orological data was also exchanged with neighbouring stations like Novo (Russia), Syowa (Japan) and Neuemayar (Germany).

Logistic Tasks

Logistic work undertaken during the expedition was as follows:

- a. Mammoth work of workshop shelter, the second biggest structure after the station was undertaken and completed
- b. Electrical Earthing of the station was undertaken and almost completed
- c. The interior of the whole station was painted afresh. Lab space was created in A - Block, insulation and heating provided. An old 50 KL fuel tank was also painted.
- d. Hindi signboard of Maitri made and installed, 30 KVA genset overhauled, Power line from A - Block to Girnar hut laid.
- e. Zenotti changed and the cold room made operational after closing the leakages.
- f. Proper sitting arrangement for summer scientists made in Tirumala and Nanda Devi huts and heating provided. An abandoned hut was converted into a useful sitting and entertainment hall.
- g. Eleven ton Dozer backloaded with available means. Similarly Godrej forklift at Maitri and Snowcutter lying unused at shelf were backloaded.
- h. Summer road broadened, east-west roads improved and named, automatic temperature control for duct installed, fire fighting / alarm system augmented, twelve penguins rescued, automatic temperature controllers installed in Nanda Devi and Girnar for temperature maintenance, automatic water boiler designed and developed for tea / coffee and extensive ecological work undertaken around the station / lake and 5 Kw HF communication system was removed .

Accidents

Accidents are great teachers and one can learn a lot from them to avoid future happenings. Although 14th IAE was fortunate to have no major accident but the same was not true with the previous and the following expeditions and our medical officers and expedition members shared their problems. One member of the Russian team at Novo died after drinking a spurious liquid.

*At the end of our expedition after boarding the ship, one day a portion of the shelf just gave way and a senior Army Officer waiting to board the cage fell into the sea. Fortunately another officer was in the cage and the crane operator

was in the scat. Everything went well and the gentleman was saved. Appreciation letters were given to both saviours which culminated into an award for the Army Officer.

* * Since our return cruise was to carry an accident victim, the idea was to finish the joint convoys as early as possible. During the first such convoy a couple of vehicles carrying backload items got immersed into water channels which were covered by only thin sheets of ice and gave way under the load. At the same time weather deteriorated and no flying operation possible. Large scale operations with Russian help were carried out and all the vehicles retrieved safe and sound.

Important Dates

- 15-12- 94 Flag off ceremony at Goa
- 17-12-94 MV Polar Bird leaves Goa
- 21-12-94 Equator crossing ceremony on board
- 25-12-94 Ship reach Mauritius (replenished the spoiled food items)
- 29-12-94 Ship left Mauritius
- 02-01-95 Ship crosses 40° S
- 10-01-95 Ship reached Polynya/icc front (69° 57' S, 11° 53' E)
- 13-01 -95 First sortie to Maitri and ship berthed
- 18-01 -95 First convoy from Maitri
- 06-03-95 Ship sails back and wintering period starts
- 12-04-95 Russian ship /chopper brings our 25th member
- 21 -04-95 12th Engrs raising day celebrated
- 23-05-95 Sun sets for long polar night
- 21-06-95 Midwinter day/night
- 30-06-95 Beautiful aurora observed
- 19-07-95 Funeral rites of Sergey at Novo (died on 25.6.95)
- 21 -07-95 Solar disc comes above horizon (polar night of 58 days)
- 14-09-95 Ozone hole starts
- 18-09-95 Coldest temperature observed (-32.6° C)
- 28-09-95 Auroral night at Maitri
- 08-10-95 Firstever IAF day at Maitri
- 13-10-95 Flock of snow petrels observed over Maitri
- 15-10-95 15th and the last convoy started .

- 18-10-95 First skua (dark brown) noticed at 1540 Hrs
- 27-10-95 EME day celebrations
- 05-11-95 Three penguins stranded in Maitri
- 05-11-95 Ozone hole ends
- 13-11-95 Firstever telephonic viva-voce for Ph.D undertaken at Maitri
- 18-11-95 Engrs day (215th) celebrated
- 19-11-95 German Expedition 'Geomaud' arrives
- 26-11-95 Lakes around Maitri seen melting
- 29-11-95 German hut west of Maitri removed
- 04-12-95 Navy day celebration with record no.of foreign guests
- 07-12-95 MV Brinkness sails off from Goa
- 31-12-95 Brinkness reaches polynya
- 01-01-96 15th expedition arrives in Maitri (70° 46' S; 11° 44')
- 04-02-96 Handing - taking over ceremony
- 27-02-96 Ship sails back to Goa
- 05-03-96 Ship crosses 40° S
- 20-03-96 Ship reaches Goa



1. Hon'able Prime Minister Sh. H.D. Devegauda, Sh. A.E. Muthunayagam (Sec., DOD) and other senior officials seen with the overwintered members of 14th IAE



2. Laser heterodyne system (NPL) installed in Maitri



3. Sun tracker installed outside the Laser hut in Maitri



4. Common-room facility created in the summer huts



5. Maitri building during a winter night



6. A good weather day being harnessed to the end



7. A tabular iceberg in the Antarctic circle



8. Maitri (with Hindi signboard) braced for National day celebration



9. A panoramic view of the summer huts



10. Expedition ship 'Polar bird' in the Indian Bay region



11. Handing-taking ceremony in Maitri lounge



12. Cap ice near Shivling area



13. Adelie penguins in a small rookery



14. Friends in need are friends indeed (L to R: Sh. A. Chaturvedi, Ldr 15th IAE, Mr. Victor Venderovich Ldr, 40 RAE, Dr. S.D. Sharma Ldr 14th IAE)