

## *SUMMARY*

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*Expedition Leader & Station Commander*

The XVIII Indian Antarctic Expedition was flagged off from Marmugao Port, Goa on board ship MV Polar Bird on 14<sup>th</sup> Dec 1998. The ceremony was presided over by the Hon'ble Chief Minister of Goa in the presence of Chief Secretary, Govt, of Goa, Secretary, Department Of Ocean Development, besides various other dignitaries. The team comprising of 56 members, included 39 scientist, 2 doctors from Indian Railways and 15 members from Indian Army and Indo-Tibetan Border Police. Twenty-six members of this team stayed for Polar winters to conduct various scientific experiments and maintain the Station and its life support equipment. The Pawan Hans Helicopters were chartered for the first time to operate with the Indian Antarctic Expedition. The scientists were drawn from 17 Institutions across the country and a participating scientist from Iran, and each organization had a specific program. Three lady scientists were also participating in this expedition, the highest number in any expedition so far. This was the last of the Indian Antarctic Expeditions to be flagged off from Goa, as the subsequent expeditions were flagged off from Cape Town, South Africa.

Immediately after sailing from Goa, heavy rolling/pitching was encountered by the expedition vessel, which kept on increasing day after day. Members were briefed about dos and don'ts during the voyage and expedition. Various committees were formed for smooth functioning during the voyage. Various scientific lectures were arranged for the members every day to discuss the scientific programs of the participating Institutions/members. The ship crossed equator on the morning of 19<sup>th</sup> Dec and the equator crossing ceremony provided a little fun on board. Some problems were detected in the ships engine and air-conditioning system over the next few days. There was some relief from rolling/pitching as the vessel reached Port Louise, Mauritius on the morning of 24<sup>th</sup> Dec. A minor accident took place onboard, when one of the expedition members slipped while walking on ships deck and needed X-ray and medical attention at Mauritius. The staff at Indian High Commission, Port Louise, Mauritius were kind enough to provide all the necessary help during our short stay and arranging for the necessary foodstuff and green vegetables. Some of the clothing items were also received during our stay. The halt at Mauritius was fully utilized to carry out the necessary repairs to Ship's engine and air-conditioning system. The ship sailed from Mauritius on the morning of 26<sup>th</sup> Dec. Immediately after sailing, while taking a stock of the clothing items received at Mauritius, it was noticed that some of the vital clothing items were missing and not delivered at Mauritius. The items included solar/snow

goggles, gloves, polar socks, woolen inners etc. The authorities at N C A O R (DOD) were immediately informed of these lapses and the team members made aware of these shortages and the expected problems to be faced in the absence of such items. A fax was immediately sent to Indian Antarctic Station, Maitri to know the stock position of these items available with them and possible distribution of these items on arrival at Antarctica. The credit goes to all the members who understood the grave situation and continued with their normal work till such items were received from Maitri. The sea continued to be rough after our sailing from Mauritius and members had to bear with heavy rolling/pitching, which became quite unbearable at times. Various programs and indoor games (in addition to the ongoing scientific programs) were started to keep the members busy and occupied. After a few days of sailing, the Captain informed that the repairs carried out to the ships engines at Mauritius proved to be a failure and the ship needs to be stopped in mid-sea for carrying out repairs. The authorities at N C A O R (DOD) were duly informed about these developments and members also taken into confidence at the same time. I must admit that the thought struck me to sail the ship to one of the nearby ports (either South Africa or Mauritius) for carrying out the necessary repairs and not to take the chances in mid-sea. After a dialogue with the Ships Captain, he assured me that it is not going to affect the ships safety and the crew is competent enough to carry out these repairs. The necessary repairs were carried out and the Ship sailed within 24 hours.

The vessel crossed 40° S on 1<sup>st</sup> Jan 1999. New year was celebrated on board. Whales were sighted on 05 Jan 1999 and the first Iceberg also sighted the same day. The vessel entered Antarctic waters on 7<sup>th</sup> Jan 1999 and touched pack ice at 68° 22' S on 9<sup>th</sup> Jan 1999 and finally parked the ship at 69° 41'.7 S, as the pack ice was too thick to penetrate any further. Helicopters were taken out of the hold and made operational.

After the necessary test flights, the first courtesy visit to Maitri station was made on 12<sup>th</sup> Jan 1999. The necessary requirements of the old wintering team and the letters/parcels from their near and dear ones were delivered the same day. After detailed discussions with the Station Commander regarding setting up of summer camp and the various requirements, regular helicopter sorties were started and members shifted to summer camp the same day. The Dakshin Gangotri (DG) field camp was set up the next day and members from SASE and IIG shifted there to start their scientific experiments. The weather however was not on our side and high winds and low visibility caused the helicopter sorties to be suspended for the next three days and cleared only on 16<sup>th</sup> Jan 1999. A close encounter with one of the Helicopters the same day as the Helicopter started dragging the underslung load, without clearing the ships deck. The load hit the safety railing and started swinging dangerously. The load had to be released in the sea for the safety of Helicopter and the passengers inside it. The Helicopter was immediately grounded for necessary checks as the crew had used extra power on the engines to lift off after releasing the underslung load. While some items of this released

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underslung load were lost in the sea, most were picked up by lowering a boat. The flying operations were however continued with one Helicopter in the meanwhile. A fire incident was also reported from Maitri Summer Camp on 17<sup>th</sup> Jan 1999, and one of the toilet modules was totally destroyed. Courtesy visit paid to Russian Antarctic Station, Novolazereskaya and pleasantries and gifts exchanged. The weather however continued to play hide and seek and did not allow more than two days of continuous flying operations. The setting up of mountain camp was being delayed for this reason. The first reconnaissance flight to ZWIESEL Mountains was carried out on 23<sup>rd</sup> Jan 1999, but were unable to find a suitable camping site. Republic Day was celebrated at Maitri in the presence of guests from Russian Antarctic Station, participating member from Iran and Ships Crew.

On the early morning of 28<sup>th</sup> Jan 1999, the ground Engineer from Pawan Hans had a paralytic stroke and Doctors onboard advised immediate evacuation of the patient for better medical facilities. Various contingency plans were drawn for evacuation of patient and authorities at DOD, New Delhi, were duly informed. Contact was also made with various Antarctic stations for necessary help in evacuating the patient. Immediate response was received from McMurdo Station (USA), Sanae IV Station (South Africa), NuMayer Station (Germany) and British Antarctic Centre (UK). McMurdo Station had a plane leaving in two days time for Christ Church, New Zealand and they asked the patient to be shifted to NuMayer Station. Sanae IV station offered help in shifting patient from Sanae IV to NuMayer station by their Helicopter. British Antarctic Survey offered to send a plane in the coming 10 days and evacuate the patient. After thorough discussion with our Doctors and these Stations, it was decided to shift the patient to NuMayer Station via Sanae IV and airlift him to Christ Church, New Zealand with the help of the plane arriving from McMurdo Station. The ship was diverted from 11<sup>0</sup> E towards 2° W longitude to reach within flying distance of Sanae IV station. The remaining distance of nearly 200 km was covered by our Helicopters and the patient safely transferred to Sanae IV station. They in turn had their Helicopters waiting and immediately transferred the patient to NuMayer station and was boarded on the plane. The process was successfully completed in spite of poor weather conditions. However, the patient could not be saved and he breathed his last on 1<sup>st</sup> Feb 1999, after being admitted in a Hospital at Christ Church, New Zealand. The news was shocking for the team as we were quite happy with our efforts and hoped for his early recovery. Condolence meetings were held at Ship and Maitri Station and members paid their homage to the departed soul. Condolence messages were also received from various Antarctic Stations, Heads and members of various Institutions in India.

The bad weather and high winds over the last few days helped in breaking the fast ice and the Ship came alongside in India Bay on 2<sup>nd</sup> Feb 1999. Various task committees set up for unloading of containers and decanting of fuel could start their work on

12<sup>th</sup> Feb 1999 for persisting bad weather. The field camp in the mountains could not be set up and work was carried out by daily sorties. The special boat chartered for NH O coastal survey could be lowered on two occasions only. A windmill was set up at Veteheia Hills for charging of Repeater Station batteries and this proved to be quiet successful.

The necessary training for the new logistic had started in the meanwhile and they were getting familiarized in handling and repairing the life support system and convoy vehicles. The present wintering team had planned to hand over the Station on 4<sup>th</sup> Feb 1999, but persistent bad weather kept on delaying the process. The station was finally handed over to us (new winter team) on 11<sup>th</sup> Feb 1999 and the out going winter team flown to the Ship. Decanting of fuel and unloading of containers was completed on 25<sup>th</sup> Feb 1999. Most of the fuel was shifted to DG and stored in storage tanks there. A reconnaissance of the convoy route was taken up to assess the snow condition and water channels en route. The summer camp was closed on 26<sup>th</sup> Feb 1999 and most of the summer members shifted to Ship. Preparations for the first convoy started and finally took off on 28<sup>th</sup> Feb 1999. The convoy reached the Ship safely. Setting up of Repeater Station at Veteheia Hills made communication possible with convoy vehicles and as such were able to monitor their progress throughout. The convoy returned safely to Maitri on 4th March 1999.

### ***ENVIRONMENTAL CLEANING***

After the shifting of wintering team, it was felt that the surroundings of Maitri needed to be cleaned of all the litter and unwanted material. An environmental cleaning drive was launched on 14<sup>th</sup> Feb 1999 and the garbage collected was loaded into two containers for back loading. A half bin was placed at the garbage-burning site so that the ashes could be easily collected and stored for back loading. This also prevented spreading of ashes and garbage during blizzards. The various tasks taken up were:

1. Cleaning of Maitri Station.
2. Cleaning of area around Maitri Station.
3. Cleaning of area around fuel storage tanks
4. Identification of unwanted and damaged machinery/equipment, vehicle parts and construction material.
5. Shifting of unusable/unserviceable equipment/instruments collected in the loft area to containers placed at strategic points.
6. Shifting of all fire hazardous material from the loft area.
7. Shifting of electric stores and Carpenters workshop to containers outside the Station.
8. Shifting of unwanted stores of IMD, SASE and DEAL kept in the loft area to containers to remove unnecessary load piling up in the loft area.

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9. Cleaning of summer huts and closing them for winter.
10. Identification of an alternate fuel storage dump for distribution and safety purpose.

All the tasks were completed well before the Ship set sailing back to India.

### ***SCIENTIFIC AND LOGISTIC TASKS DURING SUMMER***

All the members could complete their assigned scientific tasks well in time in spite of persistent bad weather and blizzards, except for the mountain camp, which could not be set up. The GSI Scientists completed part of the assigned tasks with daily sorties, whenever possible. The results of the scientific assignments are presented in this report in the form of scientific papers. N H O did not submit any report, as they could not do any work. Some highlights of the work carried out are as follows:

### ***SCIENTIFIC AND LOGISTIC OBJECTIVES OF THE EXPEDITION***

The details of various scientific and logistic tasks and the Institutions participating in this expedition were as follows:

### ***ATMOSPHERIC SCIENCES***

#### ***CLIMATOLOGICAL AND METEOROLOGICAL STUDIES:***

METEOROLOGICAL SCIENCES pursued by *India Meteorological Department (IMD)* This is an ongoing program of IMD with the aim to build up a climatological database. The data will be used to generate meteorological models to understand the patterns of Antarctic circulation in the context of global and Indian weather systems. The studies are as follows:

- a) Periodic measurements of surface met parameters including ozone and radio-sonde ascents.
- b) Measurement of ozone, UV-B radiation and other trace gases in the Antarctic atmosphere using BREWER SPECTROPHOTOMETER.

A state of the art technology, BREWER SPECTROPHOTOMETER will be installed during this expedition to monitor total ozone content, SO<sub>2</sub>, NO<sub>2</sub>, and DU V measurements in the atmosphere.

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#### **LOWER AND MIDDLE ATMOSPHERIC STUDIES:**

This ongoing project to study ozone hole, atmospheric turbidity, UV-B radiation and aerosol loading of the Antarctic Atmosphere, with the aim to understand the overall global change phenomena are pursued by *National Physical Laboratory (NPL)*. UV-Biometer is operated for measuring UV-B radiation in terms of minimum Erythmal Dose. Automatic integrated type Photometer is operated for measuring UV-B radiation at wavelengths of 280-310nm. The atmospheric turbidity at wavelengths of 368-778 nm is measured using Spectrophotometer during suitable intervals.

The operations on Laser Heterodyne System (LHS) and Liquid Nitrogen Plant (LNP) will be stopped and the systems dismantled and back loaded to India for repairs. The LNP had developed leakage in the compressor-cooling coil and needed immediate repairs.

#### **UPPER ATMOSPHERIC STUDIES:**

An ongoing study continued by *Indian Institute of Geomagnetism (IIG)* to understand the dynamics of the mobile auroral current systems. Three Fluxgate magnetometers will be operated at the vertices of a triangle to obtain the velocity of these small-scale auroral current systems. These current systems while flowing over the stations will leave signatures on the ground based magnetometers as pulsations. These studies will give insight in the near and deep space processes.

A Fluxgate magnetometer was continuously operated at Maitri to study a) Quiet time diurnal and seasonal changes in the geomagnetic field, b) Geomagnetic field variations in response to electromagnetic disturbances, and c) Harang Discontinuity features of the auroral oval over Maitri.

A 30 MHz Riometer is continuously operated to monitor the auroral ionosphere and to study the field aligned currents. A Proton Precession Magnetometer (PPM) is operated to record the Total Field (F) variations, to understand the rapid decrease of F in the Southern Hemisphere.

#### **VLF STUDIES:**

The VLF radiowave propagation for mapping of electric fields using whistlers is pursued by Barkatullah University (BU). The Whistler is a cost effective ground based technique widely used to study the upper atmosphere. These low-frequency electromagnetic waves are generated by lightning discharges, which travel along the magnetic field lines from one hemisphere to another. The study will help in long distance communication.

## EARTH SCIENCES

*GEOLOGICAL SCIENCES* are pursued by *Geological Survey of India* (GSI). GSI propose to Geological mapping of Muglik Hoffman Ranges of Orvin Mountains, with an alternate site of Zwiesel Range of Wohlthat Mountains. The Geomorphological studies in the central part of Schirmacher Oasis, delineating of DG snout and monitoring of snow accumulation on ice-shelf will also be taken up during the expedition.

*SEISMOLOGICAL AND APS STUDIES* pursued by *National Geophysical Research Institute* (NGRI). A permanent digital broadband seismographic observatory was established by National Geophysical Research Laboratory (NGRI) in the previous expedition. The objective of the seismic station is to monitor activity in Antarctica and exchange the data with other stations besides participating in the global earthquake epicentral determination. The station will help in monitoring activity in the Indian Ocean as well as in the Antarctic Continent.

The monitoring and recording of frequency and strength of seismic activity in Antarctica will be continued during this expedition. The seismic shocks originating over Southern Ocean and Indian Ocean regions will be recorded and used in delineating the deep crustal structures of the earth. A new software SEISAN and FOXPRO will be installed this year for accurate and advanced analysis of the digital data as well as generation of seismological data base and its management for both local and teleseismic earthquakes.

A permanent GPS Observatory was also set up during the last expedition to carry out high precision geodetic measurements. A Turbo Rogue GPS receiver was installed as a part of International GIANT project (Geodetic Infrastructure in Antarctica) to study a) tectonic movement of the Antarctic plate in relation to other plates, b) to link sea level changes with vertical motion of plates, and c) to generate a data link between India and Antarctica.

## SNOW DRIFT AND ALBEDO STUDIES:

*Snow and Avalanche Study Establishment* (SASE) conducted these studies to understand the net energy exchange between the environment and the snow cover. The studies are aimed to determine the dependence of snow albedo on snow surface parameters like age of snow, grain size and type of snow, cloud cover, solar elevation etc. This will establish the correlation between the energy exchange processes and heat conduction, temperature profiles and snow metamorphism. Automatic Weather Stations (AWS) will be set up at DG and over Polar ice at Sankalp point.

The two AWS consists of Data Collection Platform (DCP) and various snow and meteorological sensors. The DCP acquires data after a pre-defined interval from different sensors. The data is processed every hour and stored locally. All the electronic components of DCP are capable of operating up to -400 C under extreme weather conditions.

The hourly parameters being recorded are:

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- I) Maximum, Minimum and average Ambient Temperature
- ii) Average Wind Speed and Direction
- iii) Average Atmospheric Pressure
- iv) Average Relative Humidity
- v) Average Snow Depth
- vi) Sunshine Duration
- vii) Average Incoming Global radiation
- viii) Average Reflected Global Radiation

The snowdrift from the continent into surrounding oceans resulting from strong winds plays a significant role in the heat balance of Antarctica. The transport of snow under various conditions will be enumerated to understand the drift density profile under various conditions like temperature, snow hardness, free water content and surface features.

*Mapping of Schirmarchar pursued by Survey of India (SOI)* A detailed survey on 1:1000 scale with contour interval of 1m will be carried out in the Maitri region. Precise ground control points for geological and geophysical fieldwork will also be provided. The Geodetic Survey points for the study of Glacial Dynamics requested by Geological Survey of India will also be provided.

*Coastal Hydrography Survey pursued by National Hydrographic Office (NHO).* N H O plans to carry out a detailed survey of the Antarctic Ocean in the vicinity of India Bay. A special boat for survey purpose has been obtained and will be fitted with necessary Hydrographic equipment.

#### **BIOLOGICAL STUDIES:**

*BIO-DIVERSITY STUDIES pursued by Botanical Survey of India (BSI), Zoological Survey of India (ZSI) and Industrial Toxicology Research Centre (ITRC).*

BSI will collect algae samples from different parts of Schirmarchar Oasis for studies of Diatoms.



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ZSI will collect water, Moss and other samples from different lakes in Schirmarchar area for studies of bio-ecology of Nematodes, inhabiting terrestrial moss in this area.

ITRC will collect soil samples from northern and northeastern areas of Ma'im for isolation and enumeration of anaerobes in Schirmarchar Oasis.

*TERRESTRIAL LAKE ECOSYSTEM STUDIES* pursued by Deptt. Of Civil Engineering, University of Roorkee and INCO, IRAN.

They plan to collect the water samples from lakes in Schirmarcher Oasis for studying the following:

- a) Eutrophication of Lakes.
- b) Correlation between phosphorous and morphoedaphic index resulting from natural sources in the cold climate.
- c) Limnological studies of Lakes, and
- d) Accumulation of heavy metals in the sediments of some selected lakes.

*STUDIES OF MARINE MAMMALS* pursued by National Institute of Oceanography (NIO). They propose to carry out a theoretical and experimental study to understand the interaction of random noise fields within scatters of arbitrary shape and size of marine life. The baseline data on Hydrography will be collected using portable CTD / XBT, and will be related to physical origin at selected locations around the Antarctic Polynya. The XBT profiles will be taken every 1° latitude regular intervals from Goa to Antarctica waters. The CTD profiles will be taken every 5° latitude. The sea surface temperature will also be monitored throughout the voyage.

## *HUMAN BIOLOGY AND MEDICINE*

All India Institute of Medical Sciences (AIIMS). plans to conduct a study on significant stress factors and its impact on human relationship and social behaviour. Observations, interviews and some standardized psychological tests will be used for assessment. The physiological parameters of the subjects will also be recorded.

Defence Institute of Physiology & Allied Sciences (DIPAS) will conduct a study to assess the thermoregulatory effect on human subjects by climate variables and cooling power indices. This will be used to predict required clothing insulations with respect to biomedical indices while working in Antarctic conditions.

Indian Railways: The two Doctors from Indian railways will provide the medical cover during the expedition.

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## *ENGINEERING, COMMUNICATION AND LOGISTICS*

*Research & Development Establishment (Engineers) (R&DE)* conducted studies on the condition monitoring of the structural components of the station under low temperature conditions. This will also include the on-line health monitoring of various infrastructural facilities through computer networking. Experiments will be conducted on the performance levels of Polymer Electrolyte Membrane Fuel Cells (PEMFC) to find alternate sources of non-conventional energy.

*National Aerospace Laboratories (NAL)* will set up a small wind battery charger near the automobile workshop. One more wind turbine will be installed at Veteheia Hills, near the communication repeater station for uninterrupted communication between Maitri, Ship, Dakshin Gangotri and convoys at any part of the shelf.

*Defence Electronic & Application Laboratories (DEAL)* will provide the communication in voice and digital mode for the expedition. The communication is a vital lifeline of any expedition and needs proper monitoring. They will also operate the e-mail to receive and send messages and transmit 6 hourly weather data reports to India Meteorological Department, New Delhi.

*Indian Army* provides the logistic support to the expedition. It includes the station and its life support equipment maintenance, repairs and maintenance of convoy vehicles and operating the convoys between shelf and Maitri.

*Ind-Tibetan Border Police (ITBP)* have provided the cooks for the expedition.

## *WINTERING TEAM AND ASSIGNED TASKS*

With the completion of all assigned summer tasks and imparting of necessary training to logistic team and successful completion of a joint convoy, permission was requested from the DOD authorities for sailing the Ship back to India. The departure of Ship on 7<sup>th</sup> Mar 1999 marked the beginning of wintering expedition and impending arrival of polar nights. Stock position of rations, medicines, spares, fuel and other supplies was taken up. Inventory of all the containers in the container yard was taken up for easy identification and accessibility of material inside them. Two containers were found to be full of Rice and Atta, marked for back loading by the previous wintering team. The Doctors were requested for sample testing of the material and they found it to be fit for human consumption. The WOT decided to use this throughout our stay and leave the freshly brought supplies for the coming year.

*Summary:**CONVOYS*

Almost 450 K.L of fuel and 12 container loads of rations, Instruments and other material had to be shifted to Maitri and it was decided to complete as many convoys as possible before the polar winters and complete darkness period. As many as seven convoys were completed and most of the cargo shifted to Maitri. A total of 10 convoys were needed for shifting all the material and fuel. The logistic team under the supervision of Maj. V V Kadam did an exceptional job in maintaining the vehicles and operating convoys. The team also repaired a vehicle engine declared seized by the previous team and replaced it in one of the off road vehicle.

*PROBLEMS AND DIFFICULTIES*

An expedition of this magnitude will always have its share of problems and difficulties and the team which completes all the assigned tasks in spite of all these problems comes out with flying colors. Though we had more than fare share of problems during the summer period, the winter was no less exceptional.

*05<sup>th</sup> April 1999:* Shri R P Lal of IMD sprained his ankle while launching the balloon and was advised complete bed rest for one month. This kept him away from normal activities for the next three months.

*18<sup>th</sup> April 1999:* /PPP: The outlet water pipes of the station got blocked. The pipes had to be replaced and new trace heating attached.

*23<sup>rd</sup> April 1999:* One of the convoy vehicles lost direction during blizzard near Dakshin Gangotri. Maj. Kadam and Capt. Vasant traced the vehicle after 4 hours of dedicated and strenuous search under extreme conditions. It was a heroic effort on their part, which resulted in safe recovery of men and vehicle. The two members inside the vehicle were safe but badly shaken.

*06<sup>th</sup> May 1999:* A fire was detected in Surya generator complex. Immediately controlled without causing much damage.

*07<sup>th</sup> June 1999:* Main water pipe line to station was found to be blocked. It was immediately attended to and rectified.

*10<sup>th</sup> June 1999:* Problems accessing the e-mail encountered. The terminal was not locking on to satellite.

*07<sup>th</sup> July 1999:* Another minor fire was detected in Surya generator complex. It was immediately controlled.

17<sup>th</sup> July 1999: Fire detected in trace heating of outlet water pipes and was immediately controlled. The pipes and the trace heating were replaced.

22<sup>nd</sup> July 1999: Frequent blizzards kept us on our toes. The first severe blizzard struck us with wind speed of more than 120 knots. The satellite dome fitted on top of the station got dismantled and almost blown away during this severe blizzard, disrupting all communication with outside world. Luckily, it got saved by getting entangled in guy wires and connecting cables. The blizzard worsened on 23rd July with wind speed crossing 135 knots. Further damage was caused to station. The duct line carrying power cables from Generator was partly uprooted and blown away, causing a short circuit in the Generator. Most of the communication and scientific antennas were damaged and cables snapped. The spare Brewer Spectrophotometer shelter was blown away. Damage was also caused to two vehicles parked outside by flying objects. The windshield and window glasses were broken.

24<sup>th</sup> July 1999: The dome was restored to its original place after securing the base properly with guy wires and sealing all joints. The communication (the main life line of station) with the outside world got restarted and all of us took a sigh of relief especially since the e-mail was still inaccessible.

25<sup>th</sup> July 1999: The damage caused by severe blizzard assessed. Part of the Brewer Spectrophotometer shelter traced at a distance of more than 1 km. The rest had blown away and could not be traced.

03<sup>rd</sup> Sept 1999: Major breakdown of Bhaskara Generator. Snow leaked into the Dynamo during the blizzard, causing a short circuit.

10<sup>th</sup> Sept 1999: The worst blizzard of the season with wind speed of more than 140 knots. Snow leaked into Maitri station from various places as the fierce wind created cracks and leaks in the side panels, especially in the A and C-Blocks, which were facing the onslaught of winds. Duct line carrying power cables damaged again, causing another short circuit in the generator. The e-mail satellite terminal was damaged due to this short circuit. All members were put on alert throughout the night.

14<sup>th</sup> Sept 1999: The damage caused by the severe blizzard to station and summer huts assessed and immediate repairs started. Two side panels facing the wind in A-block found to have cracked. Window glasses and cabin glasses of two vehicles were found damaged. The container filled with LPG gas cylinders was blown to more than 50 m and was lying toppled on its roof.

15<sup>th</sup> Sept 1999: The snow clearance operation in the station, summer huts, generator complex and workshop started on a war footing.

As the saying goes, a bright day starts after every dark night; we too had a little to cheer during and after these blizzards. The mid-winter day was celebrated on 21 June 1999 amidst another roaring blizzard. Messages of greetings received from The Honble Prime Minister of India, Shri A. B. Bajpai, Honble Minister for Ocean Development and Human Resources and Science & Technology, Dr. Murli Manohar Joshi, President of USA, Mr. Bill Clinton, Dr. John R Dudeney, Deputy Director, British Antarctic Survey, Dr. Valery Lukin, Director Russian Antarctic Expedition, Dr. John Thiede, Director, Alfred Wegener Institute, Mr. Akito Arima, Minister of Education, Science, Sports & Culture, Japan, Heads of various Institutions/Organisations in India, and various other dignitaries. A cultural program was organized on this occasion and a few members from the nearby Russian Station, Novolazarevskaya, joined us.

We missed the first Sunrise on 19<sup>th</sup> July due to blizzard and overcast conditions. We finally had our share of joy to watch the Sun's rim on 26<sup>th</sup> July 1999. This brought in a new dawn and we were all aware that the winter is finally coming to an end and summer can't be far away.

The Independence Day was celebrated with great joy and traditional gaiety on 15<sup>th</sup> Aug, though it happened to be another blizzard day. Tri colour was hoisted at Maitri and members of Russian team joined us in celebrations. Greetings were received from various dignitaries on this occasion.

Deepavali was celebrated on 7<sup>th</sup> Nov and the greetings poured in from N C A O R and Heads of various other participating Organisations.

### *ACHIEVEMENTS OF 16<sup>th</sup> WOT*

1. A state of the art technology, Brewer Spectrophotometer was successfully installed and operated at Maitri. The experiment monitors total ozone content, SO<sub>2</sub>, NO<sub>2</sub> and DUV measurements in the atmosphere.
2. Two automatic weather stations (AWS) were set up at DG and over polar ice at Sankalp point to monitor various meteorological parameters.
3. Seismographic Observatory and a Global Positioning Satellite (GPS) Observatory were operated throughout the year.
4. Portable wind turbine systems operated successfully for battery charging.
5. Experiment on non-conventional energy sources using Fuel Cells operated successfully.
6. Uninterrupted magnetic measurements carried out throughout the year and data collected in digital and analog form.
7. Providing uninterrupted HF communication between Maitri and Ship or any part of ice-shelf by installing a repeater station on top of Veteheia hills.

8. Improvement of road from vehicle garage to Dozer point.
9. Repairing of 2 off road vehicles. ;
10. Completing 10 convoys for shifting of equipment, fuel and other station stores. ;
11. Improving living conditions in summer huts/shelter. ;
12. Repairing the central corridor of Maitri station.
13. Improvement in the C-Block.
14. Erecting new toilet modules in the station and summer shelter.
15. Erecting new bathing modules in the station.
16. Carrying out a successful joint convoy with members of 17<sup>th</sup> W O T to shelf, for the first time carried out in the month of January. This provided the necessary invaluable training to new logistic team.
17. Successfully completing a joint convoy with the members of 17<sup>th</sup> W O T to Polar Plateau. This opened a crevasse free land route and making the distant dream of reaching South Pole a strong possibility in future.

### *LAUNCHING OF XIX EXPEDITION*

The XIX Indian Antarctic Expedition was launched from Cape Town, South Africa for the first time and set sail for Antarctica on 10<sup>th</sup> Dec 2000. The expedition reached Antarctic waters on 22<sup>nd</sup> Dec and Shri Arun Chaturvedi, Leader and a few team members paid a courtesy visit on 23<sup>rd</sup> Dec. The summer camp was started at Maitri on 24<sup>th</sup> Dec and induction of summer team members started.

### *CHRISTMAS CELEBRATION AND ARRIVAL OF DIGNITARIES*

Christmas was celebrated with gaiety and Dr. Valeri Lukin, Director Russian Antarctic Expedition and his team of visiting scientist from Russia joined us in the celebrations. Dr. Lukin and his team of Scientists were visiting all the Russian Antarctic bases and had landed a day earlier at Indian Bay.

### *BACK TO MOTHERLAND*

The arrival of XIX Indian Antarctic team marked the end of prolonged isolation of our wintering team. The new team was accorded a warm welcome at Maitri on 23<sup>rd</sup> Dec 1999. Quite a few changes were brought in the summer camp before the arrival of new team and equipped it with all the necessary supplies for their comfortable stay, though the messing and entertainment facilities were shared in Maitri Station. More than 45 days of overlapping period was spent with the new team to impart the necessary training on handling and maintenance of life support systems and convoy vehicles. The station was finally handed over to the new team on 17<sup>th</sup> Feb 2000 and we moved to ship. The ship sailed for Cape Town on 24<sup>th</sup> Feb 2000 after the convoy reached

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the ship and all the back loaded containers were taken on board. The ship reached Cape Town on the early morning of 3<sup>rd</sup> March 2000, and was dechartered the same evening. The team flew to India on 6<sup>th</sup> March 2000. reaching Mumbai at midnight. On reaching Mumbai, it was detected that our baggage was not loaded at Johannesburg. SA. which finally arrived after two days.

*ACKNOWLEDGMENTS*

The success of any expedition of this magnitude depends on team efforts and I was fortunate enough to have a very balanced, hard working, highly motivated, loving and affectionate team, which stood by me as a pillar of strength throughout the expedition. Every member played his part well, though there are always a few exceptions. I can say wintering was a lifetime experience, watching 25 members of the wintering team. sharing their pleasures and pains, achieving successful completion of all scientific and logistic assignments has been satisfying. I am highly thankful to all the members of XVIII expedition and XVI wintering team for their cohesive efforts and dedication to the tasks. Dr. Kusum (Capita, Shri Narendra Angal Maj. V. V. Kadam. Capt. R. V. Vasant Shri Praveen Srivastava. Dr. U. S. Nag and Shri R. K. Pandkar to name a few. voluntarily shouldered greater burden during the expedition. I am personally grateful to all of them.

We are thankful to Dr. Harsh K. Gupta, Secretary, DOD, Dr. A. E Muthunayagam, former Secretary, DOD for their constant encouragement. Dr. P. C Pandey, Centre Director, NCAOR and Shri T. V. P Bhaskara Rao, Director (Logistics), NCAOR, maintained an invisible presence during the wintering and were always available with their guidance and words of encouragement, which raised the morale of the team. We thank both of them for their kind words of praises for the team. The cooperation extended by DOD Observer, Dr. N Khare throughout the expedition is greatly acknowledged. I am also thankful to Heads of various participating Organisations for enquiring about the welfare of the team members from time to time and helping us in completing the assigned tasks. We are also thankful to the Head and staff at Indian High Commissioners Office at Mauritius and Cape Town, South Africa for their hospitality.

The team is thankful to Head, British Antarctic Survey, Leaders/Station Commanders/Scientist In-charge of McMurdo Station, Sanae IV Station and Numayer Station for offering help for evacuation of the patient late Shri Verma. We thank them and various other Antarctic Stations for the condolence messages sent after this fateful event. Our sincere thanks go to the Heads of various participating organizations, former expedition Leaders and members etc. for their condolence messages and words of encouragement. The team sends their heartfelt condolences to the bereaved family members.

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*Ajay Dhar.*

I am personally indebted to Prof. B. P Singh, former Director, IIG, Shri M. R Joshi, Former Director R&DE (Engrs), Pune and Shri M.K. Kaul, former Director, Antarctic Division. GSI. for their kind advice and blessings. Prof. Singh for long wanted an IIG member to lead the expedition, though it did not materialise during his tenure as Director, IIG. Prof. G.S Lakhina, Director IIG. was very helpful with his encouraging words during the post-expedition tasks. Words of advice received from Shri R Ravindra, Director. Antarctica Division. GSI, Shri Arun Charurvedi. Leader 15<sup>th</sup> IAE and Dr. Vinod Dhargalkar, Leader 13<sup>th</sup> IAE and the help from Dr. Arun Hanchinal and Shri T Arun of IIG is gratefully acknowledged. I express my sincere thanks to Prof. R. V lyenger of IIG for the help received during the compilation of this report. I am also thankful to all my colleagues, friends and well-wishers, who remained in touch with us throughout the winter and raised our morale.

(Ajay Dhar)



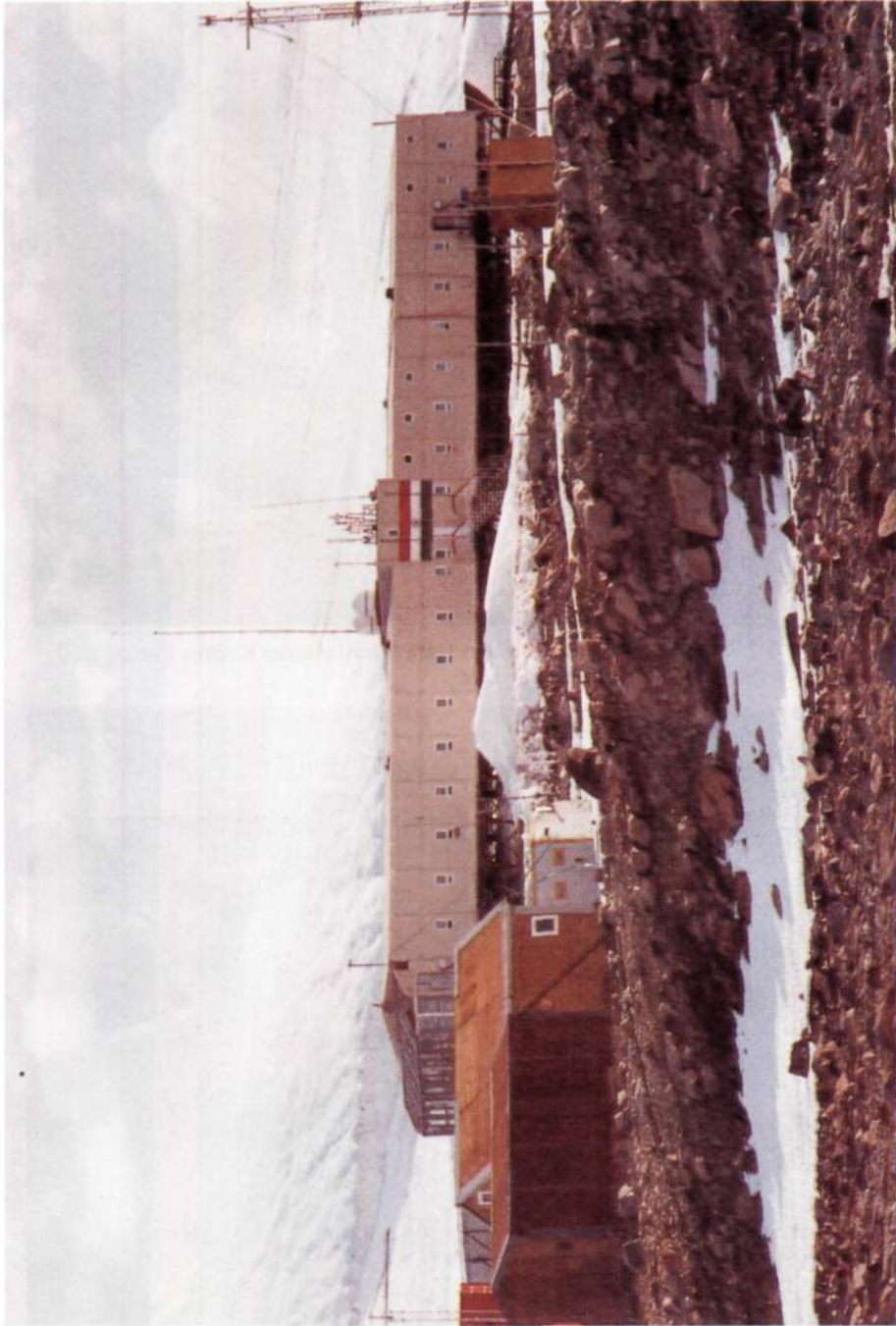


The Leader of 43<sup>rd</sup> Russian Antarctic Expedition Team Mr. Alexander Kochin, Cutting a cake to mark the celebration of our Republic Day.



The Leader & Station Commander of XVIII expedition taking over the Station from predecessor Shri. K. R. Sivan, Station Commander XVII expedition.

XXXXII



A View of Maitri Station after Polar Winter



XXXXIII

An aerial view of Schimarcher Oasis, the Maitri Station and the Priyadarshani Lake.



XXXXIV



Flag hoisting on Republic Day.

XXXXV



Aurora Australis seen over Maitri.



XXXXVI



↑ a

Dr. Arnold Budretsky, Leader, Seasonal team 45 RAE, Dr. Valery N. Masolov, Head Antarctic Division, Ministry of Nature Resources of Russian Federation, Dr. Ivan Frolov, Director, The Arctic and Antarctic Research Institute, Russia and their team of Scientist were visiting all the Russian Antarctic Stations, The team visited Maitri on 25<sup>th</sup> Dec. 1999 (a,b,c,d)

↓ b





XXXXXVII

