

Report on the Communication Tasks carried out During the 24th Indian Antarctic Expedition (2004 – 2006)

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INTRODUCTION

Effective communication is an essential and vital need for successfully carrying out various day-to-day activities in modern life. It is very crucial during any expedition, especially for a remote place like Antarctica, providing link with motherland and rest of the world. Communication not only keeps the morale of expedition members high in this hazardous and coldest working conditions but is also instrumental in passing the scientific data to the parent organizations in time.

DEAL, Dehradun, one of the DRDO laboratories, has been involved in the total communication support for the Indian Antarctica Expedition besides carrying out some technical studies since 1995-96.

Honorable Minister of Science & Technology Shri Kapil Sibal along with seven member delegation visited Maitri in February 2005 (**Fig.1**).

Shri Sibal was appraised about the existing communication facilities available at Maitri and the constraints. He appreciated the problems and promised up-gradation in high speed data link from Maitri to Mainland. It was during this ministerial visit that Shri Sibal kindly approved and announced the increase in permitted telephone time to 20 minutes from 12 minutes for wintering team members.

Tasks Assigned to DEAL Team

Following communication related tasks along with some additional work were assigned to the 24th Indian Antarctic Expedition's DEAL team. One of the DEAL's team members, Rajesh Dabral, also performed the duties of the official Post Master for the expedition as designated by the Leader of the expedition.



Fig.1 : Honorable Minister of Science & Technology, Shri Kapil Sibal in the Radio Room at Maitri along with the communication officers S/ Shri Bhagwati Prasad and Rajesh Dabral

- (a) INMARSAT based Telex, fax and telephone (round the clock).
- (b) INMARSAT based emails service.
- (c) INMARSAT based mobile communication around Maitri, India and world.
- (d) Video conferencing from Maitri to India with High Speed Data option of 56/64Kbps using ISDN through INMARSAT.
- (e) HF fixed and mobile services around Maitri and with India.
- (f) HF Weather fax reception.
- (g) Collection of data on HF propagation condition.

- (h) Experiments related to adaptive HF communication for improving the present HF communication.
- (i) Ham radio contact in 20 M, 15 M and 40 Meter Band around the globe to world familiarity from Maîtri Station, Maritime Mobile and cooperation through Amateur Radio.
- (j) Installation of G P antenna in vehicles and field stations.
- (k) Installation of HF Log periodic wide band 14-30 MHz array antenna

Work Done by DEAL Team During 24th IAE

1. Provided HF and VHF Communication to field parties, ship, convoys and helicopters.
2. Regular VHF / HF communication with Russian, German, South African stations along with all nearby field camps / stations of other countries.
3. Maintained the Logs of telephone / fax / email / Telex / HAM radio contacts.
4. Round the clock operation of satellite based (INAMRSAT A, B, C, M, Mini) Telex, Fax, Telephone and E-mail services (2 times in a day).
5. Six Hourly synoptic data transmission to IMD Delhi using Telex through INMARSAT – A & C.
6. Regularly received (4 times in a day) the HF data Weather Fax broadcast from Pretoria, South Africa.
7. Installed the Ground Plan / Whip antenna.
8. Installation of HF Log periodic wide band 14-30 MHz array antenna.
9. Conducted experiments related to adaptive HF communication for improving the present HF communication (an important Regular / Stand by system) and to provide HF data service.
10. Assisted concerned expedition members to acquire scientific data and related information from other Antarctic stations.
11. Routine Station duties besides active participation in environmental cleaning.

The Communication Systems

The communication systems at Indian Antarctic Base, MAITRI (70° 045'99" S - 011° 043' 89" E) can be broadly classified into following two categories:

(a) Long Distance Communication Systems

It is supported by the following means:

- i. INMARSAT – A
- ii. INMARSAT – B
- iii. INMARSAT – C
- iv. INMARSAT – M, Mini M
- v. HF Communication System

(b) Short Distance Communication Systems

The short distance communication support is by VHF /HF / Mobile radio Communication.

The long distance communication systems include following satellite communication systems.

INMARSAT System

The Indian Antarctic Base, MAITRI (70° 045'99" South & 011° 043' 89" East) is close to the South Pole hence can not see the geostationary satellite in equatorial orbit. The look up angles for geo-stationary satellite from Maitri are very low. INMARSAT terminals with antenna sizes of 1.2 M and 0.5 M need to be aligned accurately for achieving just sufficient signal strength to provide communication support. The Inmarsat consists of 3 components - Space segment, the satellite link and their ground support facilities. The land earth station provides an interface between the space segment and national PSTN & International telecom lines. The Maritime satellite service is available through out Atlantic, Pacific & Indian oceans but not in certain part of Polar Regions. The mobile earth station at Maitri, Antarctica falls at the fringe of geostationary footprint of Inmarsat Satellite. Coastal Earth Segment (CES) is the interface between satellite & PSTN lines with computer network. The Inmarsat satellite is positioned in 64 East for Indian Ocean region (873) & 15.5w Atlantic Ocean region (871) in the equator.

To operate INMARSAT equipment, it is essential to acquire the satellite signal (common signaling Channel), and “lock” on to that signal

before the actual operation of the equipment. To achieve this, first the satellite has to be “acquired” either manually or automatically by positioning the antenna accurately towards the satellite for the chosen oceans IOR, AOR-E and then feed the co-ordinates (lat, long) of our Base Station, Maitri to the system. The video conferencing could not be implemented as the Nera Video communicator (NVC) equipment for video conferencing was not sent with the expedition stores.

Maitri is equipped with different types of INMARSAT terminals having different capabilities. These can be described below:

INMARSAT –A

Indian Antarctic base Maitri is connected with the rest of world through Satellite phone, fax & telex. INMARSAT-A satellite terminal supports high quality analog voice, fax and telex. This system had been operational with IOR INMARSAT satellite & was registered with Arvi LES till 20 feb 2005, 20:00 UTC. Later, the terminal was aligned to AOR-E at 120° E and Perth, Australia as LES. We were able to receive Search & Rescue (SAR), distress messages / urgency messages through this terminal till the end of 24 IAE.

The IDs were as follows:

Voice Phone No.	:	00 873 1640522
Fax No.	:	00 873 1640523
Telex No.	:	00 583 1640522

INMARSAT –M

This is a suitcase type Satellite terminal used by field parties or during the convoy operations. It can be operated in data mode @ 4.8 Kbps.

The IDs were as follows:

Voice Phone No.	:	00 871 684040246
Fax No.	:	00 871 684040247
Data	:	00 871 684040248
Pbx	:	00 871 684040249

INMARSAT –B (SKANTI)

INMARSAT–B is a digital satellite terminal for maritime and land mobile communications providing direct dial, high quality telephone, groups 3 fax, telex and data from 9.6kbps to high speed connections up to

64kbps, both on land & sea. This terminal was dedicated for Emails & Internet using special email packages, namely, Ammosconnect & Microsoft outlook express for easy editing & composing in off line. Maitri station has been provided a special ID, maitri@ncaor.amosconnect.com which is shared amongst all the expedition members. DEAL team downloads the emails twice a day at 10:00UTC & 22:00UTC. Though heavy downloads are feasible, but these are avoided as usage of this terminal is quite expensive. Expedition members were allowed to send email attachments of the order of 100 KB only. Through out the year, downloading / sending of mails with attachments not exceeding 100 kb was observed to save the satellite usage time.

ID numbers of the system are as follows:

Voice mail	+ 873 331900348	@16kbps
Fax Ids	+ 873 331900349	@ 9.6 kbps
Data	+ 873 331900350	@ 9.6 kbps
Telex	+ 583 331900351	@ 50baud

INMASAT Mini M (NERA)

This system was used for Voice, fax & emails @ 4.8kbps. The call charges with this terminal are @1.8 \$ per minute round the clock in AOR region.

The ID numbers of the system are as follows:

Voice mail	+ 873 64102726
Fax Ids	+ 873 64102727

The email id 64102726@inmasat.vsnl.com was also available to us. Internet Email browsing on M mini was registered with ARVI (VSNL). One more Nera Inmasart M Mini terminal is installed in Nandadevi Hut as standby terminal. The ID number of the system is:

Voice mail Ids	+ 873 64102723
Fax Ids	+ 873 64102724

INMARSAT-C (SAILOR)

This is a text only satellite terminal. This terminal is available with an integrated Global Positioning System (GPS) approved for under Global Marine Distress Safety System (GMDSS) and is ideal for distributing and collecting information from fleets of commercial vessels or vehicle. This

terminal had been primarily used to send the IMD synoptic data 4 times in a day at 00:00UTC, 06:00UTC,12:00UTC & 18:00UTC to IMD Delhi. The ID No. of system was 441900167. We can use the SMS service by this terminal.

HF Communication

The HF communication facility was used throughout the year in voice/data modes using Codan (125 Watt) to provide HF data service, Automatic Link Establishment (ALE), Monitoring Channel Quality, Selection of Right frequencies throughout the year, Beacon strength measurement, Packet Data service, HF data Interface Selective call, Group & Broadcast call and Yaesu Radios (FT-100 of 100 W) for long & short distance communication. HF communication depends upon weather conditions, solar activities & ionosphere. HF was primarily used for following applications:

1. Linking neighboring station in Antarctica.
2. Point to Point communication between Maitri & DEAL, India at the pre-decided time.
3. Weather fax reception.
4. HAM Radio contact.

For this, a Log periodic antenna in 14 to 30 MHz band was used. Our daily official contact was made with Russian (Novolazarckaza) station; weekly contacts with SANAE station of South Africa and Neumayer Station of Germany.

We also provided the regular HF news to our expedition members at 20:45hrs IST from All India radio (AIR) / Vividh Bharti (@ 10.330 MHz) and BBC at 10:30AM (@ 9 MHz AM band) & Voice of America.

HF was also used to receive weather chart through HF once in a day at 10:30 UTC. This helped MET scientist to read the chart & forecast the Antarctic weather. It was especially useful during local /Heli / convoy operations outside the station. During the convoys, we received faxes twice in a day. When the signal propagation condition was poor due to magnetic storm, the chart quality was also poor. The broadcast from Cape Noval (ZSJ) FROM Pretoria (SA) was at 13,538 kHz & 18238.0 kHz.

The Log Periodic Array LPA (14-30MHz)

The LPA was laid down near Satpura hut for the last three expeditions. It was installed on the ground by 24th and 25th IAE teams in joint efforts.

HAM Radio Contact with Call Sign VU3BPZ & VU3BPZ/MM

DEAL could not receive special event call sign AT5BPZ from WPC New Delhi for the expedition. So, we used personal Amateur Radio home call sign VU3BPZ & VU3BPZ/MM with QSL manager VU3MKE i.e. Sh Manoj Kumar Dhaka and made 2500 contact round the globe and with 12 Antarctic bases. The log was maintained during 13 months of the usage of HAM radio & received an Award i.e. W.A.C.A. award (Worked Antarctic call signs Award) issued by World Antarctic Program (WAP) from Mondovi, Italy.

During the visit of Honorable Minister Kapil Sibal along with delegates in February 2005 Air Net India, Bombay and Kolkata could listen about their visit to Maitri station through ham radio. Unfortunately, the HF conditions were not favorable during that time due to the disturbances. The HAM Radio station is stand-by system for emergency contact if satellite terminal fails.

The short distance communication systems include VHF communication.

The VHF communication was very important for local field parties like SOI, GSI, NGRI, convoy, chopper's operation, station power change, communication with pump house etc. Its usage becomes more crucial during blizzard conditions. In house Maitri communication using VHF was made operational round the clock. During the Convoy operations, radio room remained continuously in touch with the convoy party through 25 Watt Motorola radio set. Around 90% convoy route was covered using this kind of communication. The VHF repeater equipment (YASUE make) was not working properly during this expedition. Only one way communication with delay could be made operational between the convoy party and the new site.

The aviation band of 119 MHz to 139 MHz was used during the flight operations. Dittel make (7-watt radio) was used at 126 MHz.

PROBLEMS AND SUGGESTIONS

1. *Static Charge* : High static charges during the strong wind and at the time of snowing generally cause damages to the Electronic equipments. Therefore it is necessary for all members to touch the metallic earth while entering radio room and before touching any equipment.



Fig. 2: Repositioning and erection of HF communication antenna

2. *Shortage of Ground Plane Antenna's /connectors* : Shortage of GP antenna especially VHF vehicles mounted, Whip antenna & inverted V antenna was faced. In strong blizzard conditions during convoy operations, vehicle mounted antennas gets tilted or broken which needs to be replaced. Such replacements require spare antenna and connectors.

3. *HF connectors* : Shortage of HF connectors was also felt. Accordingly, demand was placed for the ensuing expedition.
4. *Space and Interference problem* : The space in the radio room is very much congested due to number of communication equipments maintained there. All sorts of equipments and stores related to communications like VHF / HF 100W /Aviations / Inmarsat etc are kept in the radio room. Sometimes various types of communications sets using high power create interferences that cause disturbance or improper communications. Sufficiently bigger space for the radio room would be more users friendly.
5. High Speed Data communication system capable of sending the massive amount of scientific data is recommended.

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