

RADIO COMMUNICATION SERVICE IN ANTARCTICA

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Abstract

Defence Electronic Applications Laboratory, Dehradun, of DRDO provided real time communication to the 18th Indian Scientific Expedition to Antarctica. The continuous communication with the rest of the world has been extended in the form of Voice as well as Data communication. An excellent feat was achieved in VHF communication throughout the expedition by installing repeater station at Veteheia Hill. This paper describes the details of communications and the facilities available at Maitri, Indian permanent scientific base at Antarctica.

Introduction

The real time communication is considered as the backbone of any mission be it in war or an expedition. Nowadays communication can be provided to any remote corner of the world. But providing communication to the Antarctic environment is a challenge because of the windiest and coldest working conditions as well as magnetic storms, static electric charge and high magnetic field. DEAL, Dehradun has been entrusted the responsibility to carry out the communication requirements of the team.

The XVIII Indian Scientific expedition to Antarctica, under the Leadership of Shri Ajay Dhar sailed off Goa on 14th Dec 1998. The team comprised of 60 members from various organisation of India and a member from Iranian National Centre for Oceanography (INCO), Iran.

Since 1995 (XV Expedition), DEAL, Dehradun, was entrusted with the responsibility of total communication support for the Indian Antarctic Expedition along with SCIENTIFIC STUDIES and the DEAL team took over the responsibility from Indian Navy. DEAL'S participation in the Indian Antarctic Scientific Programme started in 1991 with a summer member to carry out experiments in HF propagation & DATA transmission.

The main objectives of the DEAL team during 18th ISEA were:

1. Installation of VHF repeater station

2. VHF/HF communication and propagation studies.
3. Reception of Contour weather chart from Pretoria on HF.
4. Scientific data transmission
5. Communication support to convoys and field camp.
6. Aviation band communication
7. Phone, Fax and Telex service through Satcom Terminal
8. Operation of E-Mail, picture transmission and Internet.

Activities

The expedition touched the Indian Antarctic coast on 10th of Jan 1999 by the chartered vessel MV Polar bird.

During sea voyage phone/fax facility was provided to the members by DEAL team using the system available on board ship. We were also maintaining regular HF contact with India and Maitri during voyage. Messages for logistic support and other information were regularly exchanged between ship and Maitri. There was severe technical fault in the aviation band radio set of the Ship. The communication facilities were provided through our own new set from the Ship for two days. Later the DEAL team rectified the fault.

V H F Repeater Station

The primary task on our arrival at Maitri, the Indian Antarctic Station, was to install a V H F repeater station at Veteheia Hill, 8 km away from Maitri. The team visited Veteheia Hill to install the same on 18th January 1999. The repeater station was successfully installed with the erection of ground plain antenna tied by guy ropes in order to protect it from the heavy wind at the Hill. The repeater module was powered by 12-volt lead acid battery charged through two solar panels. The communication was sustained for only 6 to 7 days at the maximum due to lack of power, as the two solar panels were not sufficient enough to charge the battery for continuous power supply to the system while 24 hours sunlight was available during summer period. So, an alternative source for charging the battery was thought of and as a result, a windmill from National Aerospace Laboratory, Bangalore was commissioned to charge the battery on 24th February 1999. This time the windmill charger charged two 12 volts batteries, connected in parallel. As the Veteheia Hill is an isolated place without any shelter so the repeater and all other accessories were put in two wooden boxes sealed properly. Although communication was proper but during heavy blizzard it was found that the wooden boxes were filled with snow through newly developed leakages. The snow accumulation inside the wooden boxes might have caused severe damage to the equipment but regular clearing of snow and maintenance made the system operational successfully. After the completion of first phase of convoy the repeater station was removed from Veteheia peak in the

last week of May 1999. The repeater station was closed in order to avoid the damage caused by high wind, blizzards and cold during peak winters.

During the summer time continuous VHP communication was provided from 18/1/99 to 4/3/99. The VHP set was uninstalled from the ship before it sailed back from Indian bay on 5 ' March 99 early morning. The VHP set extended communication during the above-mentioned period.

VHF / HF Communication

The VHF communication was provided to the summer huts and for daily operation of the pump house. During Generator operation and changeover, the VHF

communication was only means of communication to the maintenance personnel. Moreover all the galley duty persons were communicating to Maitri through VHF walky-talky only. The leading and lagging convoy vehicles were connected through VHF to Maitri while the rest of the vehicles were locally connected by VHF. It has been observed that during peak winter season and blizzards the Motorola GP300 walky-talky set was more useful in comparison with the Punwire walky-talky.

The HF communication facility was started since the beginning of the voyage from Goa and it was communicating with Maitri as well as DEAL, Dehradun, India.

At Maitri, two 14-30 MHz and one 6.2-30 MHz LPA for long haul communication were available and communication setup was furnished with one FT-767 with a linear amplifier FL-7000 for communication round the clock. The HF communication was available with India up to 18 May 1999 and again started on 18' August 1999. During peak winter time the HF communication was not possible because of perturbed ionospheric propagation condition.

Three LPA were destroyed during a severe Blizzard. One of them was repaired and erected.

Reception of Contour weather chart from Pretoria on HF

Antarctic weather is most unpredictable phenomenon and it is to be observed very carefully before any outside activities to avoid obstruction in the work. HF weather fax was received whenever the propagation conditions were suitable. The weather chart was handed over daily to IMD team for further processing. This weather fax is being transmitted from Pretoria on 13540 Khz, 18240 KHz at 04.45, 08.00, 10.00, and 15.00 and

22.00 UTC . The quality of the weather chart depends on propagation conditions. This weather charts also helped the communication team in various ways. During this expedition the contour weather chart was received regularly up to 31st August 1999. Later it was confirmed on 21st October through E-mail from Sanae IV (South African Base) about the non-availability of the contour chart due to malfunctioning of the equipment in South Africa. The weather chart transmission started again from 05 January 2000 and we are receiving the charts.

Scientific Data Transmission

Scientific data of the following participating organisations were regularly transmitted in compressed form using the E-mail attach file option

- a) Phase Data of three components Digital Seismic Acquisition System to NGR I , HYDERABAD .
- b) Data on health monitoring of GENERATORS to R & DE (Engrs) , PUNE .
- c) Data for geomagnetic field variation to IIG, Mumbai .
- d) Monthly weather summary, Brewer data of IMD New Delhi and daily IMD data transmission on Telex.

We had also received the scientific data from United States Geological Society, America through E-mail.

Communication support to convoys and field camp

During expedition total communication for DG and Ship was provided with the help of V H P repeater on scheduled time. In spite of this we extended successful communication to 10 convoys round the clock. We were always in touch with the convoy on their way to the destination i.e. DG, Indian Bay and Russian Bay. All the convoy vehicles were interconnected through Motorola GP300, GM 300 and YAESU 25watts set. Only two YAESU 25watts V H P set and one GP300 battery charger were damaged in the eighth convoy. Later 2 Watts Punwire Walkie-Talkies were provided to the convoys for inter communication. It has been observed that these Punwire sets were not so reliable in these Anatarctic condition. These Punwire sets were also not compatible with other sets like Motorola GM300 and YAESU 25 watts V H P sets. That is why both types of sets were being kept in the last vehicle of the convoy. As we were in touch with the convoy round the clock, all the messages from India either individual phone calls or other news was conveyed immediately to the Convoy members.

Radio communication service in Antarctica

Besides the above communication facility, one more reliable standby communication facility was available with convoys through Inmarsat M terminal to contact with Maitri. This facility is to be used in emergency conditions only. This is a very compact unit, can be kept in co-drivers seat. Inmarsat M terminal is a very sophisticated unit, which can provide communication throughout the Globe.

Aviation band communication

In summer period, the aviation band communication was provided to the Helicopters, During takeoff or landing with underslung loads, the instructions were given to the pilot through aviation band only. Throughout the expedition we were in touch with the neighboring Russian Station NOVO LAZAREVSKAYA on 126 MHz .

Phone, Fax and Telex service through Satcom Terminal

Telephone/fax and telex facility were provided through Inmarsat- A-terminal. Throughout the expedition, we could provide uninterrupted and the round the clock phone/fax and telex facility to the expedition members . Telex was generally used only for sending the six hourly IMD data.

In the month of July during heavy blizzard the RADOME of main Inmarsat A terminal was blown off from the base disrupting the communication. The RADOME was properly reinstalled within 24 hours. Again on 5 and 6 November 1999, the Inmarsat A terminal was receiving the incoming messages only and no outgoing call could mature. Later the problem was rectified.

During this expedition, one Fax (Panasonic) machine was installed which is connected to the Inmarsat A terminal

Total 1386 numbers of phone and fax call were matured during this expedition.

Operation of e-mail, Picture transmission and Internet

Inmarsat-A satellite terminal Magnavox MX2400 was used during summer exclusively for e-mail and Internet access. The complete system is installed in one of the modified summer huts. Eudora pro-software was used for e-mail upto 11 June '99. Due to VSNL's up gradation programme, a new software, Trumpet Winsock was installed for the smooth operation of the e-mail facility.

It has been observed that in peak winter when the temperature goes below -23.5 degree Celsius, the Magnavox MX2400 satellite terminal does not work.

During the severe blizzard of 10 September 99, the Magnavox 2400 satellite terminal became permanently unoperational. With permission from NCAOR, GOA, the e-mail communication was being conducted through main Inmarsat A terminal from 24 Sep 99.

Due to limitation in allocation of time, real time picture transmission and Internet were not tried regularly but the still picture on compressed file were successfully transmitted. More than 8000 mails were sent/downloaded during our expedition.

Social Assistance

During the earthquake in Chamoli district of UP, one of our expedition members was out of communication with his family for a long period. He was not getting any information about his family. With request from Maitri, DEAL, Dehradun deputed one team to know the whereabouts of his family and all the information was provided to Maitri.

Throughout the expedition DEAL Dehradun posted all the messages sent by the respective members to the respective addresses.

Conclusion

- I. The DEAL has provided effective communication through out the period of expedition with the resources available.
2. For the first time a total uninterrupted VHF communication was provided to all the 11 convoys all over the Shelf as well as Russian bay. Not for a single moment the Convoy was out of communication with Maitri base.
3. Properly designed cabin should be provided to the Repeater module as well as the Power Supply system at Veteheia Peak in order to protect from wind and snow accumulation.
4. For Inmarsat M terminal operation, clear weather condition is required.
5. The E-mail terminal should not be operated during moderate to heavy blizzard to protect the module from the damage caused by the Static Charge and when the ambient temperature is below -23.5 degree Celsius.

Aknowledgement

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