

Report of Communication Activities in Maitri, Antarctica during 21st ISAE in the Year 2002

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Abstract

Defence Electronics Applications Laboratory (DEAL), Dehradun is playing a vital role in the field of communication. This is the prestigious communication laboratory of DRDO, to provide adaptive HF Voice and Data communication to the XXIst ISAE. To improve the convoy communication, we had made an extra effort by adding HF communication for the first time in convoy with VHF and mobile terminal like other neighboring station. It was our trial bases efforts, station commander and convoy chief are also satisfied with it, and we feel that HF mobile antenna with proper specification is necessary. After specific modification of the adoption of HF communication in convoy, it will boost the morals of our convoy team. This report briefs the achievement of communication team to provide the lifeline communication at Antarctica scenario, details of communication facility available at Maitri and some suggestions for enhancing the total communication support for future.

Introduction

For long distance communication, HF will continue to remain the primary means of beyond line-of-sight communication, mainly as a result of its lower cost and free provision by nature in the upper atmosphere of a reflecting region, albeit an imperfect one. But satellite communication emerge as an alternative to HF communicators weary of the endless pursuit of the HF channels in the face of diurnal, seasonal and sun point change, eagerly boarded the satellite band wagon. Suddenly HF seemed obsolete. Many military and other organizations switched to satellite as their primary communication medium, usually preserving the old HF equipments as a back up.

Progress in anti-satellite activity had been such as to make many experts believe that enemy action could put satellite links out of service very soon after the outbreak of hostilities. This could be achieved in a number of ways, for example by the destruction of the satellite itself with a missile, by electronic jamming, or by damage to the satellite or its

antennas by electromagnetic pulse (EMP) interference with the electronic circuits. Realization of the fact that satellite link, once considered to be inviolable, could be vulnerable, throughout the world, to reappraise its means of long-range communications.

Satellite vulnerability was acknowledged, military strategic and tactical studies pointed to the communication scenario in force that no long-range communication medium is suitable for all requirements. Rather successful command control communication (C³) require a well- conceived mix of alternative communication links, one of which is HF.

Although Satellite communication is more reliable than HF Communication but could not be ignored to it. In modern HF era, compact Codan Transceiver with built in Fax data interface unit is very useful and reliable for long distance and in emergency it might be substitute of satellite communication for voice and data communication in windiest and coldest working condition of Antarctic. On the bases of such vision 21st ISAE communication team, inspite of total communication support to expedition took the extra responsibility to study the advanced features of CODAN transceiver and HF/VHF antennas. This report briefs about communication facilities at Maitri and advanced steps taken by our institute for better communication to the expedition.

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

Objectives

1. Installation of wind mill and activate the repeater station.
2. Installation of HF CODAN Transceiver for Voice and Data communication.
3. Work for the enhancement of mobile communication.
4. To improve the convoy communication by trying to add HF communication in convoy like Russians.
5. Communication service through SATCOM terminals for the Expedition members.
6. General daily routine works.
7. To maintain the best interpersonal relationship among Maitrians by providing the 24 hours communication service.

Achieved Tasks

The main objective of DEAL team during this expedition was to achieve all tasks according to priority of work.

Repeater Station

The repeater station plays a very important role for overall activity of expedition as aviation communication, convoy and field camp. All expedition activities depend upon repeater station. So VHF communication between ship to Maitri was very essential to pass weather information for chopper operations and to transmit leader's necessary instructions for the smooth functioning of expedition activities. It is possible only when repeater station functions properly. So first of all we installed the windmill which was broken in the previous expedition by new one. Also replaced the YAESU repeater unit on Vethia hill in 40-45 knot wind. It was very fatigue work, but we had done it with our full efficacy and capability.

HF Communication

The frequency spectrum occupied by 3 to 30 MHz constitutes the HF band. We brought with us a very advanced HF COD AN Transceiver of 125 Watt and 100 channel storing capacity, which can be used, for Fixed Base station and Mobile station. We have provided HF adaptive communication in this expedition successfully.

We have another HF transceiver (FT-900) of 100 Watt made of YAESU. Which is also installed in radio room as standby unit.

At Maitri, we have three HF links.

- (a.) HF link for voice and data communication with DEAL Dehradun around 12,340 Km from Maitri station, at fixed time schedule on various frequencies like 18.400, 18.420, 18.450, 18.500, 18.600MHz, 17.400, 17.420, 17.450, 17.500, 17.600MHz, we observed 18.450 is the best frequency.
- (b) HF network among Novolazarevskaya Station (Russian), Neumayer (German), SANAE (South Africa), Halley (UK), Rothra (UK), Mirny (Russian) and Ships for necessary information interchanging the weather reports for flight operation.
- (c) HF link for receiving the weather faxes/ chart form Pretoria South Africa for scientific analysis.

We have maintained the logbook of received and transmitted signal strength according to frequencies and time. We have faced some problem

in HF communication during Magnetic Storms, bad weather and poor HF condition. All through the year, we observed that Alpha (Maitri station) received better signal strength than Delta (DEAL Dehradun). During poor HF condition in winter period one-way communication phenomena was observed.

We have Installed H.F CODAN Transceiver for adaptive communication in the radio room and used wide band antenna. We have tested all features of this transceiver in Antarctica scenario. Through out the year we have maintained Voice and Data link between Maitri to DEAL Dehradun. We have received and transmitted the error free file and done interactive 'chat types' communication. H.F.CODAN transceiver has various features like file transmission in selective, broad cast and group mode, Phone patch facilities, Emergency call establishment, GPS positioning transmission, Remote Control Station etc. we have tested some of the feasible features in extreme cold conditions.

Radio-Facsimile Receiver (FX-220)

We are using this machine for receiving weather chart, which broadcasts from Pretoria (S.A), for scientific analysis of metrology scientist. We receives weather chart once in a day either at 10:30 or 15:30 UTC. The broadcast frequencies of HF weather fax are 13,538.0 & 18,238.0 and call sign ZRO-3&ZRO-4. We observed that the clarity of receiving fax depends upon HF conditions.

Mobile Communication (VHF communication)

- (i) Convoy & Aviation communication
- (ii) Local communication

(i) Convoy and Aviation Communication:

First priority task of communication team at Maitri was to reactivate the VHF repeater station at Veteiah Peak 8Km away from Maitri. So we visited Veteiah and replaced the lead acid battery and came to the conclusion that windmill should be installed as soon as possible to restore the mobile communication. The communication sustained for 6-7 days only, because the windmill was broken, there was no alternative to charge the lead acid batteries.

Just after first sortie, 25 watt VHF radio was installed in the ship to provide VHF communication from ship to Maitri, DG, and shelf and for

chopper operations. Before 4th convey we had visited Veteiah hill and found windmill was not functioning properly because of wind-chill effect. It's bearing was jammed. So we replaced the battery only. Every fifteen days we checked repeater station and distilled water was filled in batteries.

Since June 02 windmill was broken completely, so there was no alternative for battery charging at Veteiah. To provide long distance communication without repeater, we arranged HF communication for convoy, using available wideband antenna and advised the convoy chief accordingly to use this facilities to communicate with Maitri in long convoy. This was quite useful.

Our expedition has done 6 big convoys (7-vehicle) and 5 mini convoys (two vehicle). For shifting total items from shelf to DG, we had done the longest convoy of 21 days with 7 vehicles. So, as far our motto to provide the best communication facilities, we have installed three 25W radio sets in three vehicles and Banjara (command, middle and last vehicle) and 5Watt walki talki in the rest of the vehicles for inter communication. To over come the problem of "shadow zone, we had increased the height of antenna in command vehicle". In last convoy our all inverted antennas were broken during convoy operation, we managed it through old dumped antennas. We remained in communication with convoy round the clock during convoy period. In mini convoy we have tested the performance of new supplied antennas (similar to X/5 antenna) and old antennas. Since our all inverted antenna for 25-Watt radio was damaged, before last convoy, so we managed it through old dumped antennas.

Repeater is uninstalled after the pre winter convoy and reinstalled before convoy started again.

(ii) Aviation communication:

Aviation communication is the backbone of summer activities. Tasks involved during summer period are shifting of expedition members, necessary equipments and food items and field camps activities., This work totally depend upon chopper operation. So, for better flight operation, we collected the current Mat report from IMD people and passed through Dittel set (VHF aviation radio) to ship and helicopter pilot). The weather report contains the following parameters. We have to provide weather report/ forecast for every helicopter flight.

At Maitri, we use 6W Dittel sets for aviation communication (aviation band) with helicopters. The frequency range is 118 to 136.975 MHz with channel spacing 25 KHz.

(iii) Local communication:

We have maintained a good quality internal communication among Lounge, Pump House, Boiler Room, Generator Complex and Workshop, by installing 5 watt walky talky in those places and controlled all activities through radio room. We have installed a battery operated PA system in radio room for emergency announcements, in case of station power failure. We have installed 5 Watt radio sets in the living rooms of Leader and all station OIC. For the purpose of 24 hours monitoring the radio room, we have connected our living rooms through the output of PA system.

Trial of HF communications for convoy

For the betterment of convoy communication inclusive of VHF and mobile terminal, we have tried HF communication also and came to the conclusion that a HF mobile antenna (914 series manual tap whip antenna, Ref. BARRETT 950 HF Transceiver manual) with proper specification is necessary. We had no HF mobile antenna at Maitri station. So we made an arrangement to mount the wide band antenna between two vehicles for trial purpose. We found that shadow zone also covered by this effort. It is a fact that wide band antenna is not suitable in any aspect for mobile communication, so we have recommended HF mobile antenna with proper specifications to NCAOR, Goa.

Global Position System

Global position system is a satellite based navigation system developed and maintained by USA defense. The GPS constellation consists of 24 satellites in 6 orbits. The altitudes of the satellites are 20,000 km and about 12 hours-cycles in elliptical orbit. The frequency is 1575.42 MHz and the signal strength is -160 dBW.

GPS indicate the true bearing, not the compass (magnetic) bearing. The GPS receiver determines your precious latitude, longitude and altitude (Anywhere in the world, at any time and in any kind of weather) with the position accuracy of 30-100 meters, bur fixed antennas GPS are more accurate for precision measurement. At Maitri we have total 5 GPS. Three SONY, one Garmin and one Trimble made.

INMARSAT-A

It is an oldest but very reliable terminal at Maitri, during winter session we faced some problem. We had to go through the manuals and

sort out that problem immediately. It is functioning in all modes like, phone, fax and telex.

INMARSAT-B

All satellite terminals are very delicate and so for switching ON / OFF we should follow the right procedures. This terminal is not working in fax mode from 20th IASE due to problem in PAX card. We are using this terminal for phone and telex only. Switching ON/OFF, settings of position, time, volume and call procedures are given below.

INMARSAT-C (Sailor)

Basically it is a stand by terminal at Maitri for data communication only to receive forecast of Met report & ECG mails and sending telex and fax message. This terminal is working in all mode, for checking the status of this terminal we make a telex, fax and data call in fixed schedule. The **system ID No is 441900167**. A DOS based software system "CAPSAT" was provided for its computer interfacing. It is a Menu driven program and is used for sending telex, fax and data. We have not faced any problem with this system during the XXI Expedition.

INMARSAT-M Terminal

During 5th convoy SMPS of this terminal became faulty. We have gone through the manual, rectified the fault and repaired it. In our expedition, we have used this terminal only for convoy, but in XXII IASE, summer field party may use it. Before convoy starts we hand over it to convoy chief and advice to use it in emergencies. In order to remain operational the terminal; a call has to be placed every 25 days. Following are the IDs for INMARSAT-M terminal.

TEL: 684040246 FAX: 684040247 DATA: 684040248 PABX: 684040249

Role of Interpersonal Relationship in Expedition

Maintaining good interpersonal relationship among the expedition members is a part of healthy and successful communication. We always kept in mind this thing and provided 24 hours Phone/ Fax/ telex service to Matrians and this proved great success in our expedition.

Suggestions

1. It should be the MOTO of communication persons, to try to satisfy expedition members by providing nice and transparent communication service.
2. It should be ensured to carry VHF radio, all of those who are going out of station either for working or walking to surrounding station more than 300 meter, as a safety precaution.
3. Radio room is very congested, so it is very essential, either to increase the area of radio room or to provide vertical racks for managing the radio sets and terminals properly, for safety purpose.
4. Uninterrupted power supply (UPS) with 4.5 KVA is very essential for radio room.
5. Proper training about Marconi Mobile terminal should be provided, to convoy chief and deputy convoy chief.
6. Anti -static pads and bands should be replaced by new, to reduce static charges.

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