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ANTARCTIC COMMUNICATION — AN INSIGHT

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Introduction

An effective communication link between Indian station at Antarctica, Maitri and the mainland is of prime necessity for survival and for keeping the morale of expedition members high. Apart from this, long and short range communication is also required to support communication with expedition field parties, convoys, ship, helicopters, inter-station and intra-station contacts.

Antarctica being the coldest, driest, windiest and the most isolated continent on the planet, needs the excellent connectivity for its scientific population. It is the communication which fills warmth in chilly Antarctic surroundings.

Though satellite and HF communication (the most widely used communication modes) technology is an established and proven technology, yet a communication engineer finds it a challenge to implement it on the Antarctic surface, due to peculiar reasons.

Problems Encountered with Satellite Communication

INMARSAT (INternational MARitime S ATellite Organisation) is providing space segment for maritime communication, thereby assisting in improving the sea communication. INMARSAT system uses satellites to relay communication from ship and coast earth stations. From anywhere in the world, terminal users place direct-dial telephone calls and send telex, fax, electronic mail and digital data.

Satellite communication at Maitri is also possible through INMARSAT satellite only. But Maitri, the Indian station, is at the periphery of the satellite-footprints, demanding very good antenna alignment with the satellite. Quite frequently, the antenna goes out of lock and the place is disconnected with rest of the world. To get satellite antenna again in lock, the operator has to play around lookup angles in manual mode.

Operating temperature for antenna and associated electronics is normally in the range of -25°C to +55°C. So during polar nights when the temperature drops below -25°C, the terminal simply ceases to function, unless some external heating is provided. Heating also has to be automated for round the clock operation. If due to any reason, the relay of automatic heating system fails, causing electrical fire, it would be the nightmare for any expedition, because this oxygen rich and windiest continent could eat away the entire station with the tiniest flame.

Problems Encountered with HF Communication

Antarctic history speaks out loudly of its poor record of HF communication, especially during Antarctic winters. The reason is the remarkable difference in propagation conditions over polar region, as compared to the equatorial regions. Solar radiation enters the polar atmosphere at a more oblique angle and most of these radiations are reflected from the clouds and the ice sheet. Cloudy Antarctic margin is a frequent occurrence due to cyclones that are the result of extreme temperature differences between the continent and its surrounding regions. Though the number of daylight hours over south pole are same as that available in equatorial region, but polar days and nights are different than equatorial days and nights.

During the three months of polar night, ionisation is so poor that even very low frequencies of HF band are not supported for communication. Whereas during the three months of peak polar day it was felt that 8 MHz to 18 MHz frequency band was very good for communication. Here this statement is not a generalised one because range of communication is another important factor in deciding the frequency of operation.

Continuous presence or absence of light affects ionospheric ionisation. This phenomenon becomes more troublesome while communicating between India and Antarctica. This shall require a minimum of 3 radio hops. All the three ionisation zones from where radio waves are getting reflected must have necessarily good ionisation, suitable to the chosen frequency.

On the other hand, ice being a poor conductor hampers ground wave propagation for short distance HF communication. Due to this ice, electrical grounding of equipments is another problem.

Antarctica shows a great variation in earth's magnetic field, causing a setback in radio communication. Also the communication engineers have to be very careful to high static. Apart from this, the extreme low temperature conditions demand military standard robust equipments.

But then ionospheric propagation model over Antarctic region has not reached a stage, where frequency and time of day for better HF communication can toe predicted. To work in the direction of preparing a propagation model of Antarctic region, DEAL team conducted the following experiments.

1) HF packet beacon experiment

The HF packet beacon transmits text packets at various pre-programmed frequencies one at a time in a cyclic order, each for a period of 5 minutes, round-the-clock. The received packet is analysed at the other station. The analysed data provide short term and long term frequency predictions for reliable HF communications in this region.

2) HF data communication experiment

This experiment was conducted to take advantage of the relatively very cheap mode of communication for transferring text files. In this, the data rate of information transmission is optimised as per the channel condition. First channel evaluation is done by automatic transmission of test data and recording the signal to noise ratio (SNR) for each transmission. Then depending upon the available SNR in the previous transmission, data file is transmitted at the supported rate.

Conclusion

The various problems faced by the author in actual field scenario have been discussed. We can safely conclude that providing communication at Antarctica is a challenge in itself and then maintaining a reliable long and short distance communication is all the more difficult. But, the beautiful wild continent of Antarctica acts as the driving force to take up the challenge and at the end of the day, one feels satisfied to provide communication services here.

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