

SATELLITE COMMUNICATIONS

Satellite links with Antarctica

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A reliable communication facility is a major requirement for the setting up of remote research stations, particularly in Antarctica, where environmental problems are more severe. None of the traditional communication equipments can effectively overcome the distances and elements covered.

The Indian National Institute of Oceanography, working in Antarctica, has found that maritime satellite communication provides a number of advantages over the conventional radio communications. These are privacy of communications, direct dial capability for voice and telex and interconnection of services to the worldwide public telecommunications networks.

The satellite system has three major components: the space segment; the coast earth stations (CES), and the ship earth stations (SES) (Antarctica).

The space segment consists of a number of satellites both operational and spare, in geostationary orbit, 36 000kms above the equator over the world's three main ocean regions — together with the tracking, telemetry, command, monitoring and related facilities and equipment needed to support them. Three types of satellites are used in the first-generation space segment. Marisat, Marecs and Intelsat V (Marecs and Intelsat V are higher capacity systems than Marisat to meet expected continued growth in demand).

Coast earth station

Coast Earth Stations (CES) are located at Southbury and Santa Paula (USA), Naraki and Yamaguchi (Japan), Eirik Norway), Goonhilly (UK), Sentosa (Singapore), Pleumour Bodon (France) and Dham al Arah (Kuwait). These stations have a dish antenna about 13 metres in diameter, transmitting signals to the satellite at 6GHz and receiving signals at 4GHz. The nearest coast earth station to the shore call provides the user SES with the possibility to select the SES station giving the best cost of a particular shore subscriber.

The Ship Earth Station (SES) in Antarctica (at latitude 70°05'37" S longitude 150°05'00" E) works with the Marecs A satellite which is in geostationary orbit over the Antarctic ocean (26 deg W).

Each satellite is under the control of a Network Co-ordinating Station (NCS)

which also controls and monitors the traffic between the SES (Antarctica) and the CES. The system operates in the following frequency bands:

- SES (Antarctica) to satellite : 1636-525MHz - 4200-975MHz
- Satellite to CES/NCS: 4192-525MHz - 4200-975MHz
- Satellite to SES : 1535-025MHz - 1543-475MHz
- CES/NCS : 6417-525MHz - 6425-975MHz

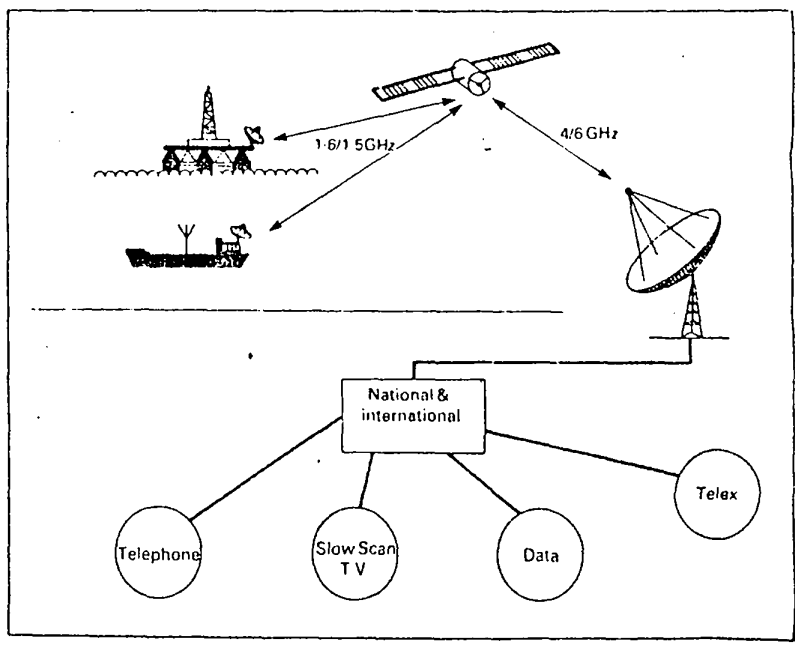
The satellite communication terminal Debeg 3211 (Mx-211) used at the Indian Antarctic Research Station was installed and commissioned on 15th February 1984 and consists of three facilities — voice, telex and slow-scan TV.

The system provides a telephone and telex link from Antarctica to the telephone and telex networks ashore. Once the connection is established, via the

satellite and the coast earth station (CES) the telex and telephone form a part of the network.

In the idle state, the system SES listens for messages or commands from the CES. It can also contact the CES via a common request channel and ask for a communication channel to be established to the terrestrial telephone or telex networks. Similarly, a communication channel is established when a call addressed to the Antarctica Station (SES) reaches the CES from a point in the terrestrial network. Since the CES has full control over the terminal, the operator has only to set up the correct request for connection when an outgoing call is to be made, and to ensure that the connection is disabled after the call.

To get access to a communication channel the SES Antarctica transmits a request to the CES in Southbury (USA) or Goonhilly (UK). The CES responds with an Assignment to the NCS, which



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then transmits an assignment message to the SES, giving details of assigned channel and time slot.

Two channels are reserved for requests from Antarctica to shore, channel 124 Q and channel 402 Q, monitored by the CES. All assignment messages are transmitted on the common channel, (Ch. 156 Q). The common channel is also the channel to which all SES stations are listening when in 'idle state', i.e. no traffic in progress.

When the CES is transmitting telex to SES (Antarctica), a special TDM (Time Division Multiplexing) format is used. In this format, the CES transmits two telex characters every 0.29 seconds in a specific time slot for each SES. Each SES operates on its own fixed TDM channel frequency, and controls the telex traffic to and from the SES.

When an SES is transmitting telex to a CES, the TDMA (Time Division Multiplexing Access) format is used. In this format the SES transmits 12 telex characters every 1.74 seconds in short bursts of 37ms (approx.). The transmission takes place in a specific time slot

and on the SES's assigned TDMA channel frequency.

For telephone communication, FM (Frequency Modulation) is used. The FM signal occupies one pair of communication channel frequencies, one for shore-to-Antarctica and one for Antarctica-to-shore and only one station can communicate at a time on this frequency pair. The telephone channels are controlled by the NCS which assigns a free channel upon request. When a channel has been assigned it is controlled by the CES until end of call.

All SES's are continuously listening to one particular carrier frequency, the common TDM channel at 1537.750MHz.

Call connection

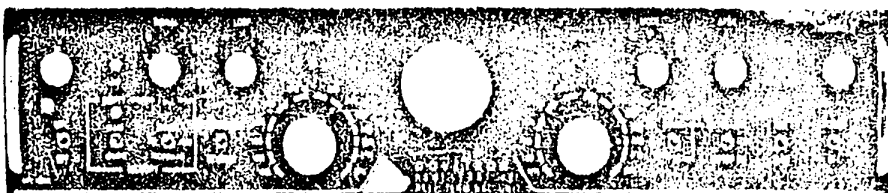
When a CES wants connection to an SES, the co-ordinating station (NCS) makes the SES's identity (ID) number (1640106 INDI X) appear in an assignment message on this carrier. The SES terminal recognises the ID, reads the assignment message and tunes its communication equipment as required.

The SES cannot get access to a communication channel without prior assignment. For the TDM telex channels, such assignment is given by the CES via the NCS. For the telephone channels, such assignment is given by the NCS which also assigns the telephone channel. All SESs share two request frequencies for initiation of station-to-shore calls. The SES will alternate between the two request frequencies. The requests are very short (approximately 36ms) so the probability for two requests interfering is very small. If, however, the request bursts should interfere, the shore station will not respond, and a new request must be initiated. Requests for telex and telephone channels are made from teleprinter and telephone units respectively.

Standard TV video signals are converted to SSVV audio signals which can be transmitted over a voice-grade communication link and standard SSVV audio signals are converted to conventional fast-scan TV, and are capable of being reproduced on any standard CCTV monitor.

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