

**SATELLITE BASED
INTER-ACTIVE COMMUNICATION SYSTEM
FOR
DEVELOPMENT, EDUCATION AND TRAINING**

INDIAN SPACE RESEARCH ORGANISATION

DEPARTMENT OF SPACE

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SATELLITE BASED INTER-ACTIVE COMMUNICATION SYSTEM FOR DEVELOPMENT, EDUCATION AND TRAINING

It has been the constant endeavour of the Indian Space Research Organisation to use Space Technology in assisting the process of development in the country. Several experiments and demonstrations have been conducted to this end. As part of New SATCOM applications, experiments and demonstrations using **satellite based inter-active communication system** for development, training and continuing education have been conducted in collaboration with user agencies.

The major emphasis is in using `one-way video and two-way audio system with talk-back' facility through INSAT satellites. In this interactive system, the `teaching end' comprises of a studio where the experts deliver, either live or through pre-recorded tapes, the lectures on the subject. These lectures in TV form (video and audio) are transmitted to the satellite through a large earth stations which is linked or collocated with the studio. The satellite relays back the TV signals for reception directly by small satellite terminals and TV sets at `class-rooms' which are distant and widely spread. The participants at the `class-room' can ask questions to the experts present at the `teaching-end' on an audio channel through the satellite terminals located at the class rooms via satellite. At the `teaching-end' the questions received from a `class-room' are looped back on the audio channel of the TV signal emanating from the teaching-end so that the questions can be heard at all `class rooms'. The response to the question by the expert goes on the TV signal and is received by all the class rooms. This mode of interaction essentially simulates an environment as if the entire learning process is being carried out in a conventional class-room. Some of the `class-rooms' which are not equipped with satellite talk-back terminals can ask the questions to the teaching-end on normal STD lines. A more detailed description of the system is given in **Appendix-1**.

Details of some of the Application Demonstrations/Experiments that have been conducted since 1991 are given in **Appendix-2**.

SATELLITE BASED INTER-ACTIVE COMMUNICATION SYSTEM: DESCRIPTION OF BASIC ELEMENTS

A diagram of the configuration of the system is given in Fig. 1. Elements of the system and their functions are briefly described below:

Also known as a "one-way video, two-way audio" system or the "Talk-Back" system, this network consists of a **teaching end** which originates the training material either in the form of "live" lectures or recorded video programmes and uplinks these television signals to a geostationary communication satellite by means of an **"uplink" earth station** which is located at the teaching end.

The **satellite** receives, amplifies and retransmits these signals over a wide coverage area, which can theoretically be as large as one-third of the earth's surface. These signals can be received at any location within the coverage area by means of a **Direct Reception System (DRS)** - a low-cost dish antenna of 8-12' diameter, front-end electronics and an ordinary television receiver.

The **classrooms for the learners** can be located anywhere within India (say) if a satellite of the INSAT system is used. A certain number of these classrooms can be provided with **the capability to interact with the teaching end** by means of a voice link. This voice link can be implemented in two ways. One, through the Public Switched Telephone Network by means of **dial-up long-distance telephone** to specific telephone numbers at the teaching end. These calls are received by a **small EPABX** located at the teaching end. These calls are received by a **small EPABX** located at the teaching end. Two, through a **small satellite communication terminal** located in the classroom which transmits the processed audio signal via satellite to the teaching end where they are received and processed. Facilities for reception of such satcom signals are provided at the teaching end. Classrooms where such interactive (telephone or satcom) capabilities are provided are known as **"talkback" locations**. Other classrooms are known as **"receive-only" locations**. The number of talkback locations in a system are limited by the system's capacity to receive simultaneously, and process questions

from various talkback locations. The number of receive-only classrooms are not limited by any such considerations.

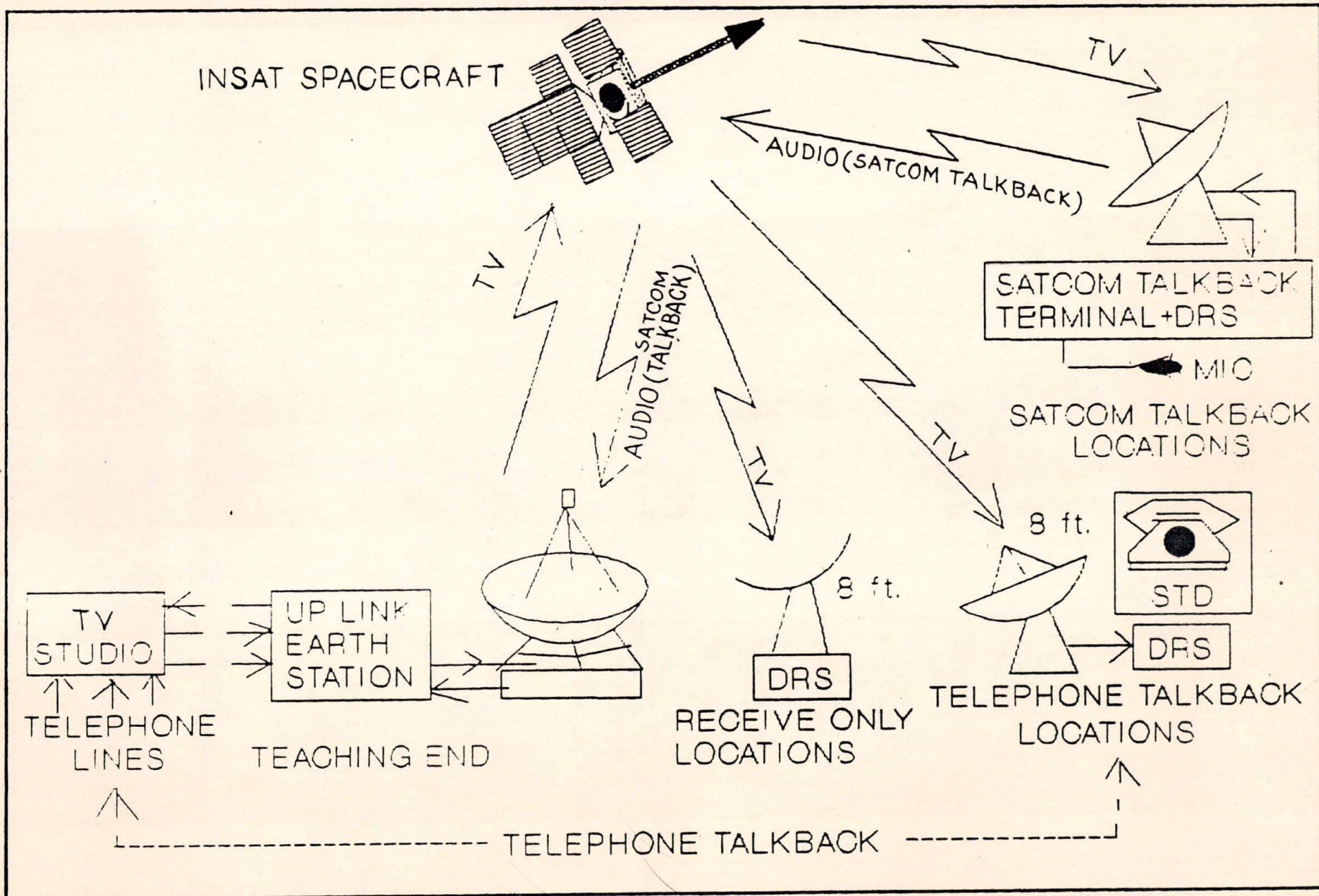
A talkback or discussion session normally follows delivery of training material from the teaching end.

A small studio setup at the teaching end serves two purposes: to originate "live" or recorded lectures and to accommodate the panel of experts who will participate in the talkback sessions. The studio is linked to the uplink earth station in the forward direction for transmission and in the reverse direction for routing calls received from satcom talkback locations to the studio.

Calls received via telephone and satcom are fed to the expert panel at the studio classroom. They are simultaneously fed to the transmit chain at the teaching end earth station. Questions are heard "live" by the experts as well as participants at all locations (talkback and receive-only). Specially devised procedures for putting telephone calls on "hold" and feeding them sequentially to the expert panel (one at a time) have been developed. Participation from satcom terminals is invited by visual cuing. An anchorperson in the teaching end classroom conducts the talkback sessions and implements the procedures devised for the talkback sessions.

Visual image of the classroom at the teaching end and the audio signal generated by the experts are transmitted by the uplink earth station and received by **all** classrooms which are equipped with a DRS. Thus even receive-only locations which are not equipped with talkback facilities can receive the training material as well as the entire talkback session.

FIG-1.NETWORK CONFIGURATION FOR SATELLITE-BASED INTERACTIVE BROADCASTING NETWORK FOR TRAINING.



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**SUMMARY OF
APPLICATION DEMONSTRATIONS/EXPERIMENTS CONDUCTED**

A total of seven collaborative experiments/demonstrations have been conducted between 1991-93 using the satellite based inter-active communication system configuration. The following is the list of these seven Experiments:

- i) Experiment on Training of Adult Education Trainers - February 1991
- ii) ISRO-UGC Experiment for Country Wide Class Room - November 1991
- iii) ISRO-NPC Experiment on Continuing Education in Industry - February 1992
- iv) Experiment for Integrated Mission for Sustainable Development - July 1992
- v) ISRO-IETE Experiment in Continuing Education - August-September 1992
- vi) ISRO-IGNOU Experiment in Distance Education - October 1993
- vii) ISRO-AIMA Experiment in Distance Education - October 1993

Brief description of each of the experiments is given in this Appendix.

I Experiment on Training of Adult-Education Trainees

The first in the series of experiments on the use of satellite based interactive communication system was carried out by ISRO jointly with Gujarat Vidyapeeth. The three day experiment was carried out as a part of the ongoing 'Saksharata Abhiyan' programme from 25-27 February, 1991. The teaching-end was located at the Ahmedabad Earth Station (AES) of ISRO and the two class rooms were located at Rupal Village (Gandhinagar District, Gujarat) and Gujarat Vidyapeeth (Ahmedabad).

During the experiment, lectures dealing with Adult Education were delivered from AES by the faculty of Gujarat Vidyapeeth. These were transmitted via the INSAT-1B satellite and were received at the two class rooms which were equipped with the satellite terminals. The training was attended by more than 40 trainees. After viewing the lectures/video programmes, the participants at the class rooms asked questions to the faculty at AES on a audio channel via the satellite terminals and got clarifications.

This experiment which was well received with enthusiastic participation by both the Faculty and the trainees, provided valuable inputs in the designing of the satellite based interactive system for distance teaching and underlined the potential of such a system for several other applications.

I Experiment on Training of Adult Education Trainers (Feb. 25-27, 1991)

Collaborating Agencies	:	Gujarat Vidyapeeth, Ahmedabad
Application Area	:	Training of Adult Education Trainers
Duration	:	3 days
Transmission hours per day	:	3 hours
Total No. of Participants	:	45
Duration of one lecture	:	13 lectures ("live" and "canned") of 25 minutes each
Duration of talkback session	:	15 sessions of 15 minutes each
Space Segment used	:	INSAT-1B
Teaching end	:	Ahmedabad Earth Station (AES)/ISRO at Ahmedabad
Class Room Locations	:	Three: Rupal Village, Gujarat Vidyapeeth and AES
Satellite Talkback locations	:	One (Rupal)
Telephone Talkback locations	:	One (Gujarat Vidyapeeth)

II ISRO-UGC Experiment for Country Wide Class Room

Under its "Countrywide Classroom (CWCR)" programme initiated in August 1984, the University Grants Commission (UGC) has been telecasting educational TV programmes for two hours on every working day. The S-band transponder on INSAT-1D, which is presently used for Doordarshan's (DD) national/network transmissions, broadcasts these programmes for reception and redistribution by DD's transmitter network.

The CWCR has attracted a dedicated viewership, not only among students but also among people from diverse walks of life. The UGC has been looking for ways to enhance the effectiveness of CWCR transmissions. Towards this, UGC and ISRO have jointly carried out an experiment in the use of a satellite based interactive communication system for six days from 25-30 November, 1991 as a part of the CWCR programme.

For this experiment, Delhi Earth Station (DES) of ISRO was configured as teaching end to transmit via INSAT-1D satellite, the UGC's countrywide classroom programme with a small TV studio setup at the Earth Station. Two satellite-based talk-back terminals were deployed at Imphal and Jodhpur. Six media research centres located at Ahmedabad, Calcutta, Hyderabad, Madurai, Patiala and Roorkee were provided with STD telephones for the purpose of asking questions to the subject experts present at the teaching-end. As the programme was rebroadcast live by all the transmitters as a regular programme of UGC's CWCR, a large number of students and other viewers all over the country were also able to see the programmes, listen to the questions and answers and share the experience.

II ISRO-UGC Experiment for Country Wide Class Room (Nov. 25-30, 1991)

Collaborating Agencies	:	Consortium for Educational Communication of the UGC
Application Area	:	Enrichment Programme in the area of science, arts and commerce for undergraduate students
Duration	:	6 days
Transmission hours per day	:	1 hour
Total No. of participants	:	30 in each location
Duration of one lecture	:	20 minutes each (12 taped programmes)
Duration of Talkback session	:	10 minutes each (one per programme)
Space segment used	:	INSAT-1D
Teaching end	:	ISRO's Delhi Earth Station
Class Room Locations	:	8
Telephone Talkback locations	:	Patiala, Roorkee, Pune, Ahmedabad, Hyderabad, Calcutta
Satcom Talkback locations	:	Jodhpur, Imphal

III ISRO-NPC Experiment on Continuing Education in Industry

The experiment was conducted during 3-7 February, 1992 for Industrial workers. This was in collaboration with National Productivity Council (NPC) and industrial undertakings like HAL, BEML, HMT and L&T using INSAT-1B satellite. This experiment explored the use of satellite technology for interaction/communication between industrial employees/ workers and experts in the context of a training course on maintenance engineering and supervisory managerial skills. The Teaching-end was at ISTRAC, Bangalore. Participants were from: HAL/BEML (Bangalore), L&T/IIFFT (Kansbahal), HMT (Pinjore) Talk-back via satellite (DRS); and HAL (Nasik), HMT-BHEL-HAL/Hyderabad, BEML/KGF, NPC/Madras and L&T/Powai, Bombay, Talk-back using STD telephones.

The training was conducted through satellite broadcasts of classroom lectures supported by computer graphics, prerecorded actual shop floor situations, and other audio visual aids. The lectures were followed by questions/discussions from various participating centers through the talk-back network. More than 200 participants from these industries were trained. For this training program 20 video lectures of a total duration 500 minutes were produced.

III ISRO-NPC Experiment on Continuing Education in Industry (Feb. 3-7, 1992)

Collaborating Agencies	:	National Productivity Council Industries: L&T, BEML, HMT, HAL
Application Area	:	Training in Maintenance Engg. and Interpersonal Relations
Duration	:	6 days
Transmission hours per day	:	3 hours (average)
Total No. of Participants	:	213
Duration of one lecture	:	14 lectures of 30 minutes average
Duration of talkback session	:	10 sessions of 30 minutes average
Space Segment used	:	INSAT-1B
Teaching end	:	ISTRAC Campus (ISRO), Peenya, Bangalore
Class Room Locations	:	9 (incl. one at teaching end)
Satellite Talkback locations	:	3 (Bangalore, Kansbahal and Pinjore)
Telephone Talkback locations	:	5 (Nasik, KGF, Madras, Bombay and Hyderabad)



IV Experiment for Integrated Mission for Sustainable Development

The Planning Commission has recommended that Integrated Development Action Plans with emphasis on sustainable development using science and technology inputs should be prepared for 156 districts. It has further recommended that formulation of the action plans with NRSA - DOS as nodal agency be undertaken in six pilot districts which are representative basic development problems encountered the grassroot levels.

District Bhiwani in Haryana was one of the above six districts identified for this pilot project, of Integrated Mission for Sustainable Development. Based on the Action Plan jointly prepared by National Remote Sensing Agency (NRSA) of Department of Space and Haryana Remote Sensing Applications Centre, Video lectures (20 in number) on various agriculture related subjects (including a couple of lectures on Home Science) were planned, designed and recorded by DECU/ISRO production units in the field.

The experiment was successfully conducted from August 3 - 8, 1992. The teaching-end cum hub-station was the Delhi Earth Station (DES), and DRS with talkback facility was provided at four locations (class rooms) Tosham, Charki Dadri, Loharu and Bhiwani using INSAT-2A. Large number of farmers and extension workers participated in this experiment. The resource persons were from the Haryana Agriculture Univeristy.

This was the first experiment in providing communication support for the implementation of Action Plan derived from Remote Sensing Data.

IV Experiment for Integrated Mission for Sustainable Development (August 3-8, 1992)

Colloborating Agencies	:	NRSA-HARSAC-Govt. of Haryana- Haryana Agricultural University
Application Area	:	Extension Education(Communication support for Integrated Mission for Sustainable Development)
Duration	:	6 days
Transmission hours per day	:	3 hours 20 minutes (average)
Total No. of Participants	:	240
Duration of one lecture	:	19 of 22 minutes (average)
Duration of talkback session	:	19 of 20 minutes (average)
Space Segment used	:	INSAT-2A
Teaching end	:	Delhi Earth Station (ISRO), New Delhi
Class Room Locations	:	Four
Satellite Talkback Locations	:	Loharu, Charkhi Dhadri, Tosham and Bhiwani
Telephone Talkback locations	:	Nil

V ISRO-IETE Experiment in Continuing Education

The Centre for Distance Education (CDE) of IETE has been conducting correspondence courses for its student members appearing for AMIETE Examinations. There is a great demand from the student community for correspondence course in the field of electronics and communication. The usual mode of material distribution by mail is not interactive, hence questions asked by students can not be answered by expert in real time. The use of two way audio and one way video communication system was considered attractive.

An experiment in satellite based continuing education was conducted jointly with IETE from August 24 to September 2, 1992. Participants were spread over nine locations Delhi, Hyderabad, Pune and Bangalore were connected through Satellite Talk-back (DRS). Bhubaneswar, Jabalpur, Dehradun, Bombay and Vijayawada were connected by STD. DECU/ISRO's TV Studio at Ahmedabad was the Teaching end.

This experiment was spread over 10 days. The two subjects selected for the experiment were (i) Electron devices and circuits, (ii) Electromagnetic fields and waves. Twenty syllabus based lectures were delivered by experts from the IIT's and IISc to the electronics and communications students of IETE. Class room type "live" lectures were followed by question and answer sessions.

In this experiment, in contrast to the earlier experiments, the lectures were entirely in the "live" mode. The lectures were planned in eight weeks (to carry out the 10 day course of 2 hours per day) and involved exhaustive pre-telecast design, and rehearsals with pre-designed visual materials. The number of listening talkback centers was 10 with 400 and above 'distant' students participating. Conducting 2 hour live transmission every day required the producers and engineers to work in close collaboration with resource persons for smooth operations. The Experiment was conducted on broadcast mode via INSAT-2A with uplinking from Ahmedabad Earth Station (AES).

V ISRO-IETE Experiment in Continuing Education (Aug. 24-Sept. 2, 1992)

Collaborating Agencies	:	Institution of Electronics and Tele-Communication Engineers
Application Area	:	Continuing Education for Professionals (Circuits and Microwave Devices)
Duration	:	10 days
Transmission hours per day	:	2 hours 30 minutes
Total No. of Participants	:	60 per classroom
Duration of one lecture	:	40 minutes
Duration of talkback session	:	30 minutes
Space-segment used	:	INSAT-2A
Teaching end	:	Ahmedabad Earth Station, ISRO, Ahmedabad
Class Room Locations	:	10 (including one at teaching end)
Satellite Talkback locations	:	4 (Delhi, Hyderabad, Pune, Bangalore)
Telephone Talkback locations	:	5 (Bombay, Bhubaneswar, Jodhpur, Vijayawada and Dehra Dun)

VI ISRO-IGNOU Experiment in Distance Education

The Indira Gandhi National Open University (IGNOU) set up in 1985 provides access to higher education to large segments of the population. It organises programmes of continuing education and special programmes of higher education for specific target groups. IGNOU is also the apex body for the Open Universities and distance education institutions in the country. With its requirements spread across the country, IGNOU is an organisation with multi-location centres. It has been looking at various technologies, especially satellite based, which could help in its distance education programmes.

ISRO-IGNOU carried out between October 4-13, 1993 an experiment on the use of satellite-based inter-active communication system for distance education. The target groups for this ten-day experiment were Regional Directors, Counsellors and students of Post-Graduate Diploma in Higher Education. The teaching-end was the IGNOU Studio at its Campus in New Delhi. The Transportable Remote Area Communication Terminal (TRACT) of ISRO shifted to IGNOU campus provided the up-link earth station facility. The transmissions were carried via the Extended C-band Transponder of INSAT-2B. The experiment covered more than 500 participants over ten Centres of IGNOU.

VI ISRO-IGNOU Experiment in Distance Education (October 4-13, 1993)

Collaborating Agencies	:	Indira Gandhi National Open University (IGNOU)
Application Area	:	i) Extended Contact Programme for students of PG Diploma Course in Higher Education ii) Training of Counsellors iii) Interaction with Regional Directors/ Assistant Regional Directors
Duration	:	10 days
Transmission hours per day	:	5 hours
Total No. of Participants	:	525
Duration of one session (lecture + talkback)	:	90 minutes each (38 sessions for the 3 participant groups)
Space Segment used	:	INSAT-2B (Extended C-band Transponder)
Teaching End	:	ISRO's Transportable Communication Terminal (TRACT) and Studio at IGNOU Campus, New Delhi
Class Room Locations	:	10
Telephone Talkback locations	:	Bhopal, Bangalore, Pune, Ahmedabad, Hyderabad, Jaipur, Bhubaneswar, Madras, Cochin, Shillong

VII ISRO-AIMA Experiment in Distance Education

The Centre for Management Education (CME) of the All India Management Association (AIMA) has launched a new project called META (Management Education through Technological Advancement) to deliver high-quality management education. One major facet of which is the interactive satellite channel.

The configuration set-up for the ISRO-IGNOU experiment was used by the AIMA-CME to conduct its distance education programmes in management to its students of Post Graduate Diploma in Management as well as Management Members of local management associations at ten locations in the country. This three-day experiment conducted during 14-16 October, 1993 covered more than 300 participants.

VII ISRO-AIMA Experiment on Distance Education (October 14-16, 1993)

Collaborating Agencies	:	Centre for Management Education of the All-India Management Association (AIMA)
Application Area	:	Lectures in Management to student of the AIMA Diploma Course in Management
Duration	:	3 days
Transmission hours per day	:	3 hours*
Total No. of Participants	:	30 per location
Duration of one session (lecture/panel discussion + talkback)	:	90 minutes each
Space Segment used	:	INSAT-2B (Extended C-band transponder)
Teaching end	:	ISRO's Transportable Communication Terminal (TRACT) and Studio at IGNOU Campus, New Delhi
Class Room Locations	:	10
Telephone Talkback locations	:	Bhopal, Bangalore, Pune, Ahmedabad, Hyderabad, Jaipur, Bhubaneswar, Madras, Cochin, Shillong

* During a few sessions, transmission of print support materials in fax mode through insertion of data in the Vertical Blanking Interval (VBI) of the TV signal, also known as "faxcast", was carried out.