

STATUS OF INDIAN NATIONAL SATELLITE (INSAT) SYSTEM

1. INTRODUCTION

INSAT is an operational multipurpose satellite catering to the needs of three different services, viz Television & Radio Broadcasting, Communications and Meteorology. The INSAT project is a joint venture of the Department of Space (DOS), the Department of Telecommunications (DOT), the India Meteorological Department (IMD), All India Radio (AIR) and Television Service. The overall management and coordination of the INSAT system among the user agencies rests with the INSAT Co-ordination Committee (ICC).

The first satellite INSAT-1A of the INSAT-1 series was launched in April, 1982 and ceased to function as of September 1982. The second satellite INSAT-1B was launched on 30 August 1983 and it became operational on 15 October, 1983. It was the main operational satellite all through the 1980s and provided very good service during its mission life. It was deorbited in July, 93. The third satellite of the series INSAT-1C was launched on 22 July 1988. Due to some technical problem it lost control on 22nd November, 1989. The last satellite of INSAT-1 series (INSAT-1D) was launched on 12 June, 1990 and became operational on 17 July, 90 and is still working. The predicted End Of Life (EOL) is end of 1999 but some of the services may continue in inclined orbit.

The 2nd generation of INSAT satellites (INSAT-2 series) were started from July, 1992 with the successful launch of the first satellite of the series (INSAT-2A) on 10th July 92. The 2nd satellite of INSAT-2 programme i.e. (INSAT-2B) was also launched successfully on 22 July, 1993. INSAT satellites are three-axis body stabilised spacecrafts. Recently INSAT-2E satellite has also been launched on 3 April, 99. At present it is being operated in a test mode. It has a new payload, called Charged Coupled Device (CCD) camera capable of taking 1Km resolution images in 3 bands.

1.1. CURRENT OPERATIONAL STATUS

The imaging mission is working satisfactorily with INSAT-1D and INSAT-2B satellites, and they continue to be used operationally. The Infra-Red (IR) channel data from INSAT-2B is not available due to technical problems. INSAT-2B is used for receiving VIS data only. The activities like image processing, derivation of meteorological products, data archival and dissemination of products for operational use to field

stations are being done on routine basis.

VHRR images are normally received at three-hourly intervals. More frequent images are taken for monitoring the development of special weather phenomena as and when the situation demands. For the derivation of CMV's half hourly triplets at 00 UTC, 06 UTC and 12 UTC are also received and processed. The CMV's are available on GTS.

1.2. CHARACTERISTICS OF VHRR PAYLOAD

The VHRR onboard INSAT-1D and 2A/2B includes:

- (a) A visible channel operating in the spectral wavelength of 0.55 - 0.75 microns
- (b) Infrared (IR) channel operating in 10.5-12.5 microns

Main differences between Insat-1 and Insat-2 are in VHRR resolution, scan time, data rate and frequency of transmission .

Parameter	INSAT-1D		INSAT-2A/2B	
	Visible	Infrared	Visible	IR
Spatial Resolution in Km	2.75	11	2.0	8.0
Scanning lines	4548	1137	6240	1560
Quantization level	1024	1024	1024	1024
Field of view (ur)	76.8	307	56	224
Detectors	Silicon photodiodes	HgCdTe	Si	HgCdTe
Location	74 Deg E		93.5 Deg E	
Modes of Operation	Full Frame 20 X 20 Sector Scan		FF 20 X 20 Normal Scan 20 E-W X 5 N Sector Scan 20 EW X 5 NS	

INSAT data are being processed at IMD facility "INSAT Meteorological Data Processing System (IMDPS)" located in IMD's campus at Lodi Road, New Delhi. The DCP data is also processed at this facility.

The processing system is configured around eight VAX Computers in a clustered network, with a number of other peripheral devices attached. The processed data and products are stored on a 4 GB size data base. Users can access the data base in real-time through four work stations connected

to the system. Imagery data of the synoptic hours are being archived as hard copies. Processed 8 bit imagery data are also archived on magnetic tapes at 6250BPI for later use in R&D related works. Quantitative products such as OLR, QPE & SSTs are also archived on magnetic tapes.

Photographic recorders of three different types are also connected to the system for generation of B&W and colour photographic pictures in real-time for the main users. Pictures in the form of negatives on photo-films are also archived for later use.

1.4 METEOROLOGICAL DATA DISSEMINATION (MDD)

The system processing is also being used for generating analogue type of data which are transmitted through INSAT-2B to field stations during S-band broadcast capability of the satellite.

There are about 90 MDD stations in the country being operated by different agencies and one such station is installed in Male, Maldives under Bi-lateral agreement. In general, the processed images are sent to these stations every three hours, but every hour during cyclone periods. These stations are receiving the direct broadcasts of cloud imagery, weather facsimile charts and meteorological data on an operational basis.

The frequency of transmission from ground to satellite (Uplink) is 5899.225 MHz and Downlink is at 2599.225 MHz.

1.5 DATA COLLECTION PLATFORM (DCP)

The Data Relay Transponder (DRT) on board INSAT is being used for collection of meteorological, hydrological and oceanographic data from remote and inaccessible areas. The DCP data are received through INSAT-2B. IMD has installed 100 Data Collection Platforms (DCPs). Other agencies have also installed some DCP stations.

Characteristics of DCPs.

Frequency of transmission	402.75 MHz (uplink)
Downlink frequency	4503.1 MHz
Bit rate	4.8 kbps
EIRP (uplink)	16.5 dbw
Mode of transmission	Burst mode
Burst length	87 milliseconds
Number of sensor	10;7 analog & 3 digital
Number of bits in one frame	422 bits

1.6 CYCLONE WARNING DISSEMINATION SYSTEM (CWDS)

For quick dissemination of weather warnings of impending disaster from approaching cyclones, specially designed

receivers have been installed by IMD within the vulnerable coastal areas for direct transmission of warnings to the officials and people in general through INSAT. IMD's Area Cyclone Warning Centres (ACWC) generate these special warning bulletins and transmit them every hour in local languages to the affected areas. 250 such receiver stations have been installed by IMD. CWDS has proved very effective system of warning people during the cyclone period. The frequency of Uplink is 5859.225 MHz and Downlink is at 2559.225 MHz.

1.7 TRAINING AND RESEARCH ACTIVITIES

IMD is providing training to Indian and foreign students under SAARC and other programmes in Satellite Meteorology on a regular basis. The theory and practical classes are conducted by expert scientists. An Institute had been set up last year to teach Satellite Meteorology to national and foreign personnel. The Institute's name is "Centre for Space Science and Technology Education for Asia and the Pacific (CSSTE-AP)" and is affiliated to the United Nations.

IMD and other institutions namely, Space Applications Centre, Indian Institute of Technology, National Centre for Medium Range Weather Forecasting (NCMRWF), Indian Institute of Tropical Meteorology (IITM), Universities, Indian Institute of Science etc are utilising INSAT data for research in meteorology and Atmospheric Sciences. The validation of the INSAT derived products is also being carried out by IMD scientists.

1.8 RECEPTION OF NOAA SATELLITE DATA

The data from NOAA series of polar orbiting satellites are received and processed by IMD at Delhi and Chennai. Both AVHRR and TOVS data are processed in real time and the cloud imagery and derived products are being utilised by the weather forecasters. The derived products are archived for distribution on demand basis to scientists. The vertical temperature and moisture profiles derived from the NOAA satellite have shown positive impact on numerical models.

2. FUTURE PLANS

2.1. INSAT-3A

The next satellite of INSAT series ie., INSAT-3A is scheduled for launch sometime during 4th quarter of next year (2000). From meteorological point of view, it will have VHRR and CCD payloads similar to INSAT-2E.

2.2. INSAT-3D

It is under consideration to design mainly a Geostationary Meteorological Satellite having on board six

channel Imager and a Nineteen channel Sounder by end of the year 2002. It will cater to the needs of Numerical Weather Forecasters in a better manner.

3. INTERNATIONAL CO-OPERATION

Last year India had signed a MOU with US for the bilateral exchange of satellite data in the field of Earth and Atmospheric Sciences for mutual benefit. Communication links for exchange of INSAT and GOES data have been established and are being operated in a test mode at present. India had also signed MOU with Sri Lanka for setting up a meteorological data receiving system (MDD) for obtaining INSAT pictures, weather fax charts and conventional data through INSAT. The project has been completed. MDD receiving station at Sri Lanka is now operational. MDD station at Male has also been upgraded recently (June,99) by providing better capabilities of a work station for display of images.
