

**CURRENT STATUS OF INSAT AND KALPANA-I (METSAT)  
SATELLITES FOR METEOROLOGICAL APPLICATIONS**

Current Status of INSAT and KALPANA-I (METSAT)  
Satellites for Meteorological Applications

CGMS Members are invited to take note.

## **CURRENT STATUS OF INSAT AND KALPANA-I (METSAT) SATELLITES FOR METEOROLOGICAL APPLICATIONS**

### **INTRODUCTION**

INSAT is an operational multipurpose satellite system 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 Telecommunications (DOT), the India Meteorological Department (IMD), Doordarshan and All India Radio (AIR). The responsibility for overall management and coordination of the INSAT system among the user agencies rests with the INSAT co-ordination committee (ICC).

All INSAT satellites are three-axis body stabilised spacecrafts. The last satellite of INSAT-2 series i.e., INSAT-2E launched successfully on 3 April, 1999. It is operational from May 1999. It has a payload, called Charged Coupled Device (CCD) camera capable of taking 1 km resolution images in 3 bands. The meteorological imaging capability has also been upgraded on this satellite, as compared to its predecessors, by providing a water vapor channel with 8 km resolution in the VHRR, the imaging instrument of the satellite. A dedicated Meteorological Satellite METSAT (Kalpana-I) has been launched by India in October, 2002 for earth imagery with three channel Very High Resolution Radiometer (VHRR) and Data Relay Transponder (DRT) for collection of meteorological and hydrological data from automatic weather stations. One more satellite INSAT 3A was launched by India for 3 channel VHRR cloud imagery (Visible, Infrared and Water Vapour), Charged Coupled Device (CCD) camera (Visible, Near IR and SWIR) and DRT payload in April, 2003. Both these satellites are working satisfactorily and are operationally used for meteorological applications.

### **1.2 CURRENT OPERATIONAL STATUS**

The imaging mission is working satisfactorily with METSAT(Kalpana-I) satellite and INSAT - 3A and they continue to be used operationally. High resolution (1km) images in 3 channels are also available operationally from INSAT - 3A CCD camera onboard. The activities like image processing, derivation of meteorological products, data archival and dissemination of products to field stations for operational use 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. CCD images from INSAT - 3A are also being taken every three hours for operational use during daytime. More frequent images are taken if situation demands. For the derivation of CMV's half hourly triplets at 00 UTC are also received from Kalpana-1 and data processed. The INSAT derived CMV are put on GTS.

### 1.3 **METEOROLOGICAL DATA DISSEMINATION (MDD)**

The processing system is also being used for generating analogue cloud imagery from METSAT(Kalpana-I) satellite and INSAT - 3A data which are transmitted through to field stations using S-band broadcast capability of the satellite along with other conventional meteorological data and FAX charts. This scheme is called Meteorological Data Dissemination (MDD).

There are about 90 MDD receiving stations in the country being operated by different agencies. Three MDD receiving stations are also operating in neighbouring countries at Sri Lanka, Bangladesh and Male under bi-lateral agreement. In general, the processed images are sent to these stations every three hours, and every hour during cyclone periods. These stations are receiving 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.

There is a plan to replace existing Analogue MDD with latest state of art Digital MDD system to transmit digital imagery, satellite data and weather data for forecasting offices in HRIT/LRIT formats.

### 1.4 **DATA COLLECTION PLATFORM (DCP)**

The Data Relay transponder (DRT) on board METSAT(Kalpana-I) satellite and INSAT - 3A is being used for collection of meteorological, hydrological and oceanographic data from remote and inaccessible areas. IMD has installed 100 Data Collection Platforms (DCPs). Other agencies have also installed about 200 DCP stations.

Characteristics of DCPs.

Frequency of transmission	402.75 MHz ( uplink) $\pm$ 100 KHz
Downlink frequency	4504.1 MHz
Bit rate	4.8 kbps
EIRP ( uplink)	16.5 dbw
Mode of transmission	Burst mode
Burst length	87 milliseconds
Number of sensor	Max 16
Number of bits in one frame	422 bits

### 1.5 **CYCLONE WARNING DISSEMINATION SYSTEM (CWDS)**

For quick dissemination of warnings against 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 using broadcast capability of INSAT satellite. IMD's Area Cyclone Warning Centres

(ACWC) generate these special warning bulletins and transmit them every hour in local languages to the affected areas. 350 such receiver stations have been installed by IMD. Out of these 100 are one Digital CWDS (DCWDS) based on advanced technology installed during 2003 in one of the Indian State. The DCWDS has been deployed with Acknowledgement Transmitters also to get confirmation at transmitting station. CWDS has proved very effective system of warning people during the cyclone affecting the coastal areas. For this service the frequency of transmission from ground to satellite (uplink) is 5859.225 and 5885.0 MHz and Downlink is at 2559.225,2585.0 MHz respectively.

## **1.6 TRAINING AND REASEARCH ACTIVITIES**

IMD is providing training in satellite meteorology to Indian and foreign students under SAARC and other related programme on a regular basis. The theory and practical classes are conducted by expert scientists. A new institute had been set up in 1998 at Ahmedabad (India) to teach Satellite Meteorology and other related subjects to national and foreign personnel. This institution is named as “ Centre for Space Science and Technology Education for Asia and the Pacific (CSSTE-AP)” and is affiliated to the United Nations. IMD’s experts are delivering lectures on satellite Meteorology in the Post Graduate training course conducted periodically by this Institute.

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). Indian Institute of Science and a few national universities are utilizing INSAT data for research in meteorology and Atmospheric Science.

## **1.7 RECEPTION OF NOAA SATELLITE DATA**

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

## **1.8 PDUS for METEOSAT-5 data reception :**

A PDUS receiving station has been working at IMD, New Delhi for reception of imagery data from METEOSAT-5 SATELLITE LOCATED AT 63 deg E over the Indian Ocean. This system is operational since March, 2000.

## **1.9 INDO –US data Exchange Centre**

Under the bilateral programme of co-operation with USA, an INDO-US data Exchange Centre has been established at IMD, New Delhi in Nov., 99 for exchange of

satellite data with USA. Processed INSAT imagery data is being transmitted every three hours to the USA. GOES imagery data is also being received from USA.

Data exchange takes place through dedicated communication links.

### Appendix-A

#### INSAT-2 : Geostationary Satellite Series

Satellite	Launch Date	Met. Payload with Wavelength Bands	Major Applications
INSAT-2E	April,1999	1. VHRR + WV Band : 5.7 - 7.1 $\mu$ m 2. CCD Payload Bands : 0.63 - 0.69 $\mu$ m 0.77 - 0.86 $\mu$ m 1.55 - 1.70 $\mu$ m	<ul style="list-style-type: none"> <li>• Monitoring cyclones &amp; monsoon</li> <li>• CMV Winds</li> <li>• OLR</li> <li>• Rainfall Estimation</li> <li>• Mesoscale features</li> <li>• Flood/intense precipitation advisory</li> <li>• Snow detection</li> <li>• Crop discrimination</li> <li>• Aerosols studies</li> </ul>

**Appendix-B****INDIAN NATIONAL SATELLITE (INSAT) and METSAT****INSAT-3: Geostationary Satellite Series – PRESENT**

<b>Satellite</b>	<b>Launch Date</b>	<b>Met. Payload with Wavelength Bands</b>	<b>Major Applications</b>
METSAT (Kalpana -I)	October,2002	VHRR : Similar to INSAT-2E/3A	<ul style="list-style-type: none"> <li>• Monitoring cyclones &amp; monsoon</li> <li>• CMV Winds</li> <li>• OLR</li> </ul> Rainfall Estimation
INSAT-3A ( Similar to INSAT-2E)	April, 2003	1. VHRR : As above + WV Band :5.7- 7.1 $\mu$ m 2. CCD Payload Bands : 0.63-0.69 $\mu$ m 0.77-0.86 $\mu$ m 1.55-1.70 $\mu$ m	<ul style="list-style-type: none"> <li>• Monitoring cyclones &amp; monsoon</li> <li>• CMV Winds</li> <li>• OLR</li> <li>• Rainfall Estimation</li> <li>• Mesoscale features</li> <li>• Flood/intense precipitation advisory</li> <li>• Snow detection</li> <li>• Crop discrimination</li> <li>• Aerosols studies</li> </ul> Temperature/humidity profile ( with INSAT-3D)