

## **Analog Cyclone Warning Dissemination System ( ACWDS)**

### **INTRODUCTION :-**

India is a large country with coastline of about 8000 kms. which makes the country vulnerable to severe Tropical Cyclones arising in the Bay of Bengal and Arabian Sea during Pre-Monsoon ( April and May ) and Post-Monsoon ( October to December ) seasons every year . The tropical cyclones are most destructive weather systems and are mostly associated with torrential rain , very strong wind and storm surges causing huge loss of human lives , cattle , crops and other properties . Cyclones can not be prevented but the losses can be considerably reduced if warnings are issued well in advance to the areas likely to be affected by the approaching cyclones so that the local administration can take adequate measures .

### **Cyclone Warning Centres in IMD :-**

India Meteorological Department. has established three Area Cyclone Warning Centres ( ACWCs ) at Kolkata , Chennai and Mumbai and three Cyclone Warning Centres(CWCs) at Ahmedabad , Bhubneswar and Vishakhapatnam for providing cyclone warning services to the maritime states . Warnings against the adverse weather due to cyclone are issued by these centres for their respective areas of responsibility to various users like port authorities , commercial shipping, Indian Navy , fishermen and officials of Department of Fisheries , officials of the State and Central Govt. , Relief officials , Chief Secretaries of the coastal states , District Collectors , Tehshildars and BDOs for distress mitigation as soon as the warnings are received by them . The warning are issued to these officials in two stages. In first stage a “ Cyclone Alert ” is issued about 48 hrs. in advance of the commencement of the adverse weather over these areas . In second stage the “ Cyclone Warning ” is issued about 24 hours in advance .

### **Warning Dissemination :-**

IMD constantly examines the Arabian Sea and Bay of Bengal areas for likely genesis of tropical cyclones with the help of satellite imageries received through INSAT ( a Geostationary Satellite ) . Information from ships and ocean buoys is also considered . There is a chain of Cyclone Detection Radars ( CDRs ) installed along the coastal belt of India . These Radars can locate and track the approaching cyclones within the range of 400 kms. Information about the cyclone , such as areas likely to be affected , its intensity , direction of movement , time of reaching the coast etc. are prepared at the Area Cyclone Warning Centres (ACWCs ) . based on these , warning messages are issued at regular intervals from ACWCs (at Chennai, Kolkata and Mumbai) through different modes mentioned above . These modes of communications mainly depend on land line which are not very reliable and are likely to be disrupted during adverse weather condition particularly during cyclones .Satellite signals are available to anybody , anywhere , all the time and are not affected by the adverse weather conditions .

To over come above problem a satellite based system for dissemination of cyclone warning was started by IMD in consultation with Department of Space using broadcast capabilities of INSAT satellite in the C / S Band transponder in 1985 . This system is named as CWDS ( Cyclone Warning Dissemination System ) and as its technology is analogue based , it is called ACWDS and is still operational since last 25 years.

### **Technical Description of ACWDS :-**

The Disaster Warning System is an important application supported by INSAT and is used for dissemination of cyclone warning messages to the likely affected areas . The INSAT supports transmission of a narrow band low level carrier for disaster warning system along with four RN ( Radio Network ) Channels and TV channels with S-band . The code transmitter is located at ACWCs . The identification code of receivers , to whom the warning is addressed , is transmitted from the ACWCs on DOT ( Department of Telecommunication ) lines to the earth station . the voice messages are also transmitted using separate DOT lines . At the earth station , these signals modulate a designated IF carrier of 54.225 MHz. The modulated IF carrier is multiplexed with other IF carriers , Up - converted , Amplified and transmitted in C-band at 5859.225 MHz.

Transmission from INSAT satellite down to earth is in the S-band at a carrier frequency of 2559.225 MHz. At the receiving stations this signal is received by a 3.6 M parabolic mesh type dish antenna . The Front End Converter ( FEC ) , which is mounted on the feed of the antenna , eliminates the undesired noise , amplifies the signal and converts the S-band signal to IF signal . The IF signal is filtered by using a helical type narrow bypass filter to remove the TV signals . The signal is then amplified and demodulated using a frequency discriminator . The output signal is fed to the digital cards for detection of codes and subsequently activation of the siren and loud speaker .

The DWS works in broadcast mode and the operation is completed in two stages . The entire cyclone prone area is divided into various zones . The receivers located in a particular zone will have the same identification code . When it is required to address a particular zone , the code corresponding to that zone is set and transmitted . The receivers pertaining to that zone will detect the code and activate the siren , which attracts the attention of the local officials . In the second stage the voice message follows the siren and the officials can take the necessary action .

### **Digital Cyclone Warning Dissemination System(DCWDS) :-**

Later , IMD has also implemented the scheme of Digital CWDS ( DCWDS ) in Andhra Pradesh under Andhra Pradesh Hazard Mitigation ( APHM ) and Emergency Cyclone Recovery (ECR) projects funded by World Bank . Under these projects ,one hundred DCWDS receivers have been installed in AP and one in Kavaratti , Lakshadweep Island in 2002-03 with uplink station at RMC Chennai .

This system has an additional advantage of reception of Acknowledgement messages through Mobile Satellite Service ( MMS ) of INSAT and the quality of voice is very good as compared with analogue CWDS . The digital cyclone warning and dissemination system ( DCWDS ) is also designed to work in broadcast mode . It transmits a pre-selected digital code corresponding to remote station's receiver located at the coastal areas that are likely to be affected . Transmission is done from the small uplink station at RMC Chennai . All the satellite receivers receive the broadcast and only the selected group of receivers gets switched on their audio output . Alert siren sound and warning messages are appended to the receiver address code from ACWC . On reception of warning , the receiver will generate acknowledgement messages which are transmitted back to the ACWC Chennai through INSAT MSS fixed reporting terminal attached to the receivers .

The Network Management System at ACWC Chennai is responsible for creation , transmission and monitoring of cyclone warning messages and archival of those messages to unmanned satellite receivers installed

all along the Indian coastal line . The audio messages captured by microphone are digitalized using MPEG-2 format to create message packets in a customized protocol , with unique headers for selected stations . Header and message packets jointly form a data-packet so that required receivers are only energized by the transmission while others are not energized . The Acknowledgement messages sent by the remote stations' receivers are captured , analyzed and checked periodically . All Acknowledgement messages are logged systematically .

The frequencies used :-

Uplink – 5885.0 MHz , 200 KHz Bandwidth.

Down link – 2585.0 MHz , 200 KHz Bandwidth.

### **Direct To Home – Based Disaster Warning Dissemination System (DWDS) :-**

India Meteorological Department started INSAT – based cyclone warning dissemination system services in 1985 with a net work of 100 Analogue CWDS (Cyclone Warning Dissemination System) ( ACWDS ) receivers located along coastal areas of South Andhra Pradesh and North Tamil Nadu . Another 150 nos. of such receivers were installed in early 1990s covering coastal areas of Kerala, Karnataka , Maharashtra , Gujarat , Goa , West Bengal , Orissa and North Andhra Pradesh . At present IMD has a total network of 252 Analogue CWDS receivers and 101 nos. of Digital CWDS receivers ( 100 nos. in A.P. and 1 no. in Kavaratti, Lakshadweep Island ) . The DCWDS Receivers were installed during the year 2002 – 03 under Andhra Pradesh Hazard Mitigation (APHM ) and Emergency Cyclone Recovery

( ECR ) Projects - funded by World Bank . Analogue CWDS have served for about 25 years, more than their useful life( of 10 years) being obsolete technology , maintenance of these ACWDS receiver is a problem . So, IMD has decided to replace them with a suitable cost effective technology DTH – Based Disaster Warning Dissemination System . In this system, a commercially available Set Top Box (STB) , after suitable modification , has been used as DWDS receiver. IMD , ISRO and Doordarshan together decided to implement the methodology and commissioning of this DTH-Based DWDS System. ISRO and IMD jointly conceived the configuration and specification of the Digital Cyclone Warning Dissemination System for issuing disaster warning to cyclone – prone areas along the coastal areas from a centralized location . ISRO has taken initiatives to economize the receivers by modifying the commercially available DTH ( Direct To Home ) Set Top Boxes ( STB ) for this purpose . M/s BEL , Bangalore , has been entrusted the task of developing these receivers under the guidance and support of ISRO .

IMD has decided to replace all these ACWDS/DCWDS receivers by the new DTH-Based DWDS receivers. It has been decided that **total 500 nos.** of such systems will be installed all over the country in the disaster prone areas. The DTH-Based DWDS System can disseminate the warning messages in real time to multiple receiving locations spread over large geographical areas . Each receive location has a unique address and receivers can be addressed individually or group-wise .

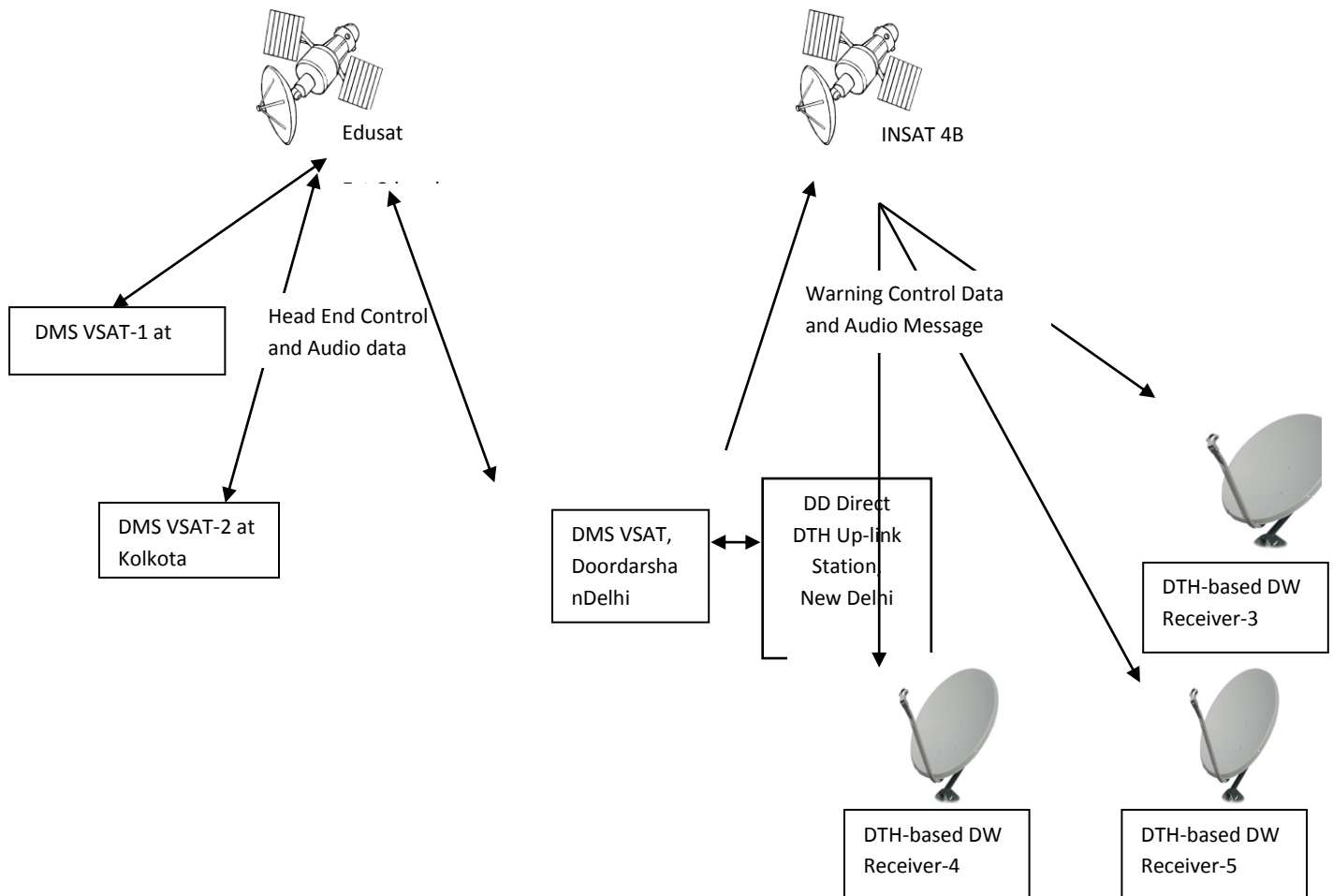
#### **DTH – Based DWDS Receivers ( ROT - Receive Only Terminal ) :-**

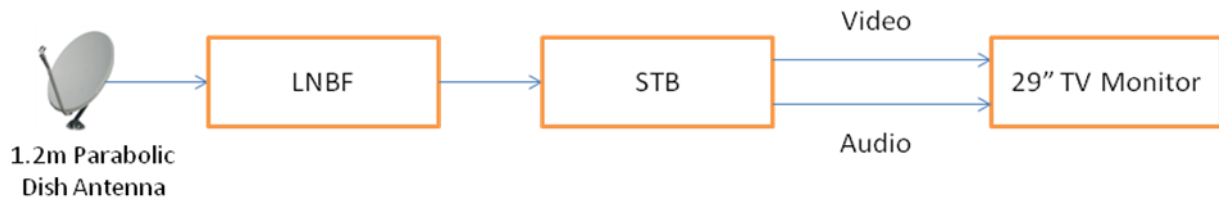
The receive only terminal ( ROT ) is capable of receiving DVB ( Digital Video Broadcasts ) from HUB ( i.e. Transmitter ) . The ROT System consists of :-

- 1) 1.2M off set feed parabolic dish antenna .
- 2) Low Noise Block Converter with Feed ( LNBF ) .
- 3) Digital Set Top Box ( STB ) ( MPEG-2/DVB ) .
- 4) Low Loss Cable ( RF Cable ) – Maximum length 25m .
- 5) 10Amp Charger with two nos. of batteries ( 12V/65AH ) to supply 24V DC .

The Ku-band signal (14.0 to 14.5 GHz band ) up-linked from the HUB is translated and relayed by the satellite ( EDUSAT ) . The down link signal gathered by the antenna dish is guided into the LNBF . The LNBF processes and down converts the signal frequency to L-Band ( 950 to 1450 MHz . ) , which passes through the low loss cable to STB . The STB processes the signal to recover the video and audio signals. These signals are fed to the Television set.

### DTH Based DWDS





Block Diagram of DTH-Based DWDS Receiver

- 1) **Antenna** : – 1.2M Ku-Band antenna with an offset focal point . In this antenna , the horn is offset at an angle of 22 degree and placed well clear of the main beam so that no blockage occurs . The offset arrangement avoids the 10% loss caused in the centre fed arrangement . The function of the antenna is to collect the signal and feed it to the LNBF .
- 2) **Low Noise Block Converter with Feed ( LNBF )** :- Mounted on the antenna . The function of LNBF is to pick up the weak incoming microwave signal ( Ku-Band ) via an internal tuned resonant probe , provide low noise amplification and finally down convert the whole block of frequencies to the one suitable for the cable transmission (L-Band) . All the components of the LNBF are hermetically sealed against the ingress of moisture . If the moisture gets into the unit – corrosion and subsequent failure may result .
- 3) **Set-Top-Box ( STB ) or Digital Satellite Receiver** :- The Disaster Warning Set Top Boxes (DWSTB) are used to decode the digitally modulated satellite signals to obtain high quality video and audio signals and digitally encode data used for warning dissemination acknowledgement . This unit also supplies DC voltage to LNBF and receives the L-Band signal from LNBF through the 25m low loss cable . The necessary down conversion, demodulation ( QPSK ) , decoding ( MPEG-2 ) takes place in it before it delivers analog video and audio signals suitable for the colour TV Set .The remote terminals are equipped with DTH Set Top Box operates on 230v AC as well as 24v DC batteries .