COMMUNICATION REVOLUTION USING SPACE TECHNOLOGY

(Lecture –2)

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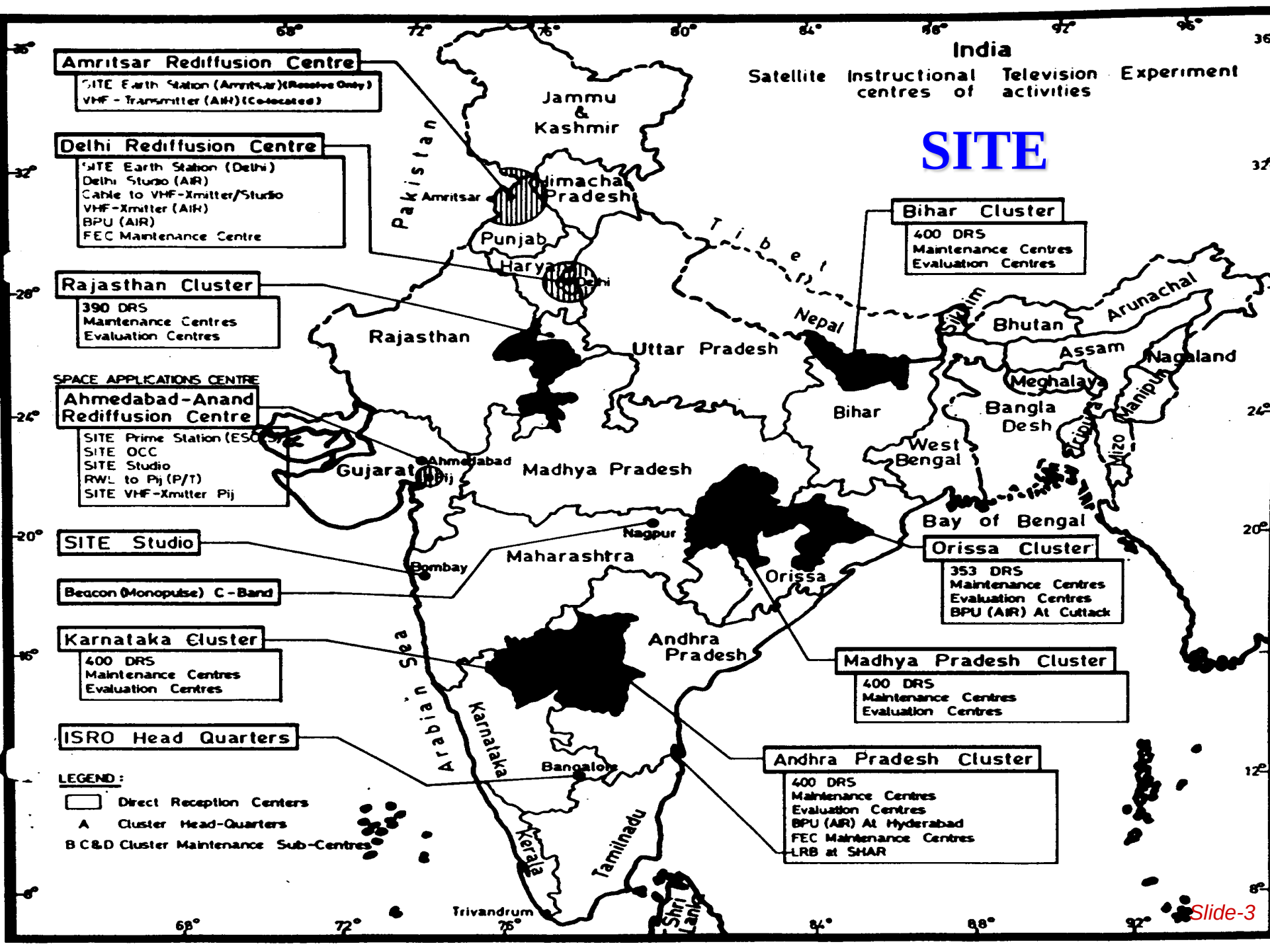
EARLY EXPERIMENTS

- ✓ Krishi Darshan of 80 Villages around Delhi
- ✓ Early Communication Experiments

  Experimental Space Communication Earth Station (1969), Ahmedabad
- ✓ Conduct of SITE (1975-76), Using ATS-6 Satellite of NASA
- ✓ Direct Reception to a Village set using 10ft Chicken Mesh Antenna

  Educational & Developmental Programs to 2400 Remote Villages

  Programs specially prepared for Village Audience on Education, Health, Hyegene, Nutrition, Science & Family Planning
- ✓ Established Need for Direct Reception + Rebroadcast for Nationwide TV Broadcast.


India
Satellite Instructional Television Experiment
centres of activities
SITE
Amritsar Rediffusion Centre
SITE Earth Station (Amritsar)(Receive Only)
VHF - Transmitter (AIR)(Co-located)
Delhi Rediffusion Centre
SITE Earth Station (Delhi)
Delhi Studio (AIR)
Cable to VHF-Xmitter/Studio
VHF-Xmitter (AIR)
BPU (AIR)
FEC Maintenance Centre
Rajasthan Cluster
390 DRS
Maintenance Centres
Evaluation Centres
SPACE APPLICATIONS CENTRE
Ahmedabad-Anand Rediffusion Centre
SITE Prime Station (ESCS)
SITE OCC
SITE Studio
RWL to Pij (P/T)
SITE VHF-Xmitter Pij
SITE Studio
Beacon (Monopulse) C-Band
Karnataka Cluster
400 DRS
Maintenance Centres
Evaluation Centres
ISRO Head Quarters
LEGEND :
Direct Reception Centers
A Cluster Head-Quarters
B C&D Cluster Maintenance Sub-Centres
Bihar Cluster
400 DRS
Maintenance Centres
Evaluation Centres
Orissa Cluster
353 DRS
Maintenance Centres
Evaluation Centres
BPU (AIR) At Cuttack
Madhya Pradesh Cluster
400 DRS
Maintenance Centres
Evaluation Centres
Andhra Pradesh Cluster
400 DRS
Maintenance Centres
Evaluation Centres
BPU (AIR) At Hyderabad
FEC Maintenance Centres
LRB at SHAR
Jammu & Kashmir
Himachal Pradesh
Punjab
Haryana
Delhi
Rajasthan
Uttar Pradesh
Bihar
Nepal
Sikkim
Bhutan
Arunachal
Assam
Nagaland
Meghalaya
Manipur
Tripura
Mizo
Bangla Desh
West Bengal
Bay of Bengal
Gujarat
Ahmedabad
Pij
Madhya Pradesh
Nagpur
Maharashtra
Bombay
Orissa
Andhra Pradesh
Arabian Sea
Karnataka
Bangalore
Kerala
Tamilnadu
Trivandrum
Shri Lanka
Pakistan
Amritsar
Tibet
68°
72°
76°
80°
84°
88°
92°
96°
36°
32°
28°
24°
20°
16°
12°
8°

TECHNOLOGY BUILD-UP

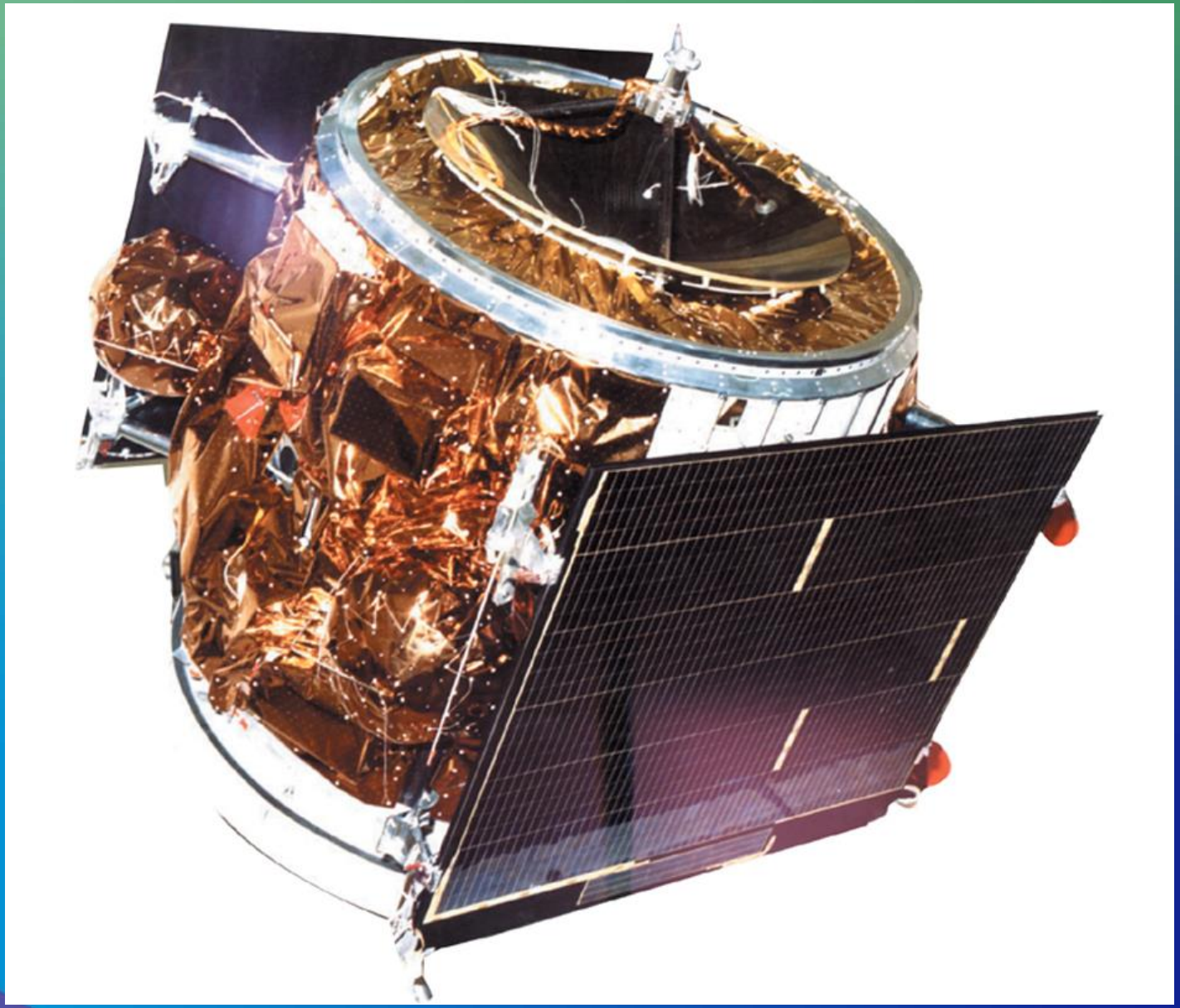
- ✓ Conduct of STEP(1976-77) Using Franco-German Satellite
  SYMPHONY Hardware Experiments Related to Modulation Techniques, point-to-point, point-to-multipoint communication.
- ✓ Launch of APPLE (Ariane Passenger Payload Experiment) carrying two C-Band Transponders on Ariane (1981)

Design, Fabrication & Launch of 3-axis stabilised satellite

Carried out Orbit Raising, Manoeuvering and Operating the Satellite for over 2.5 years.

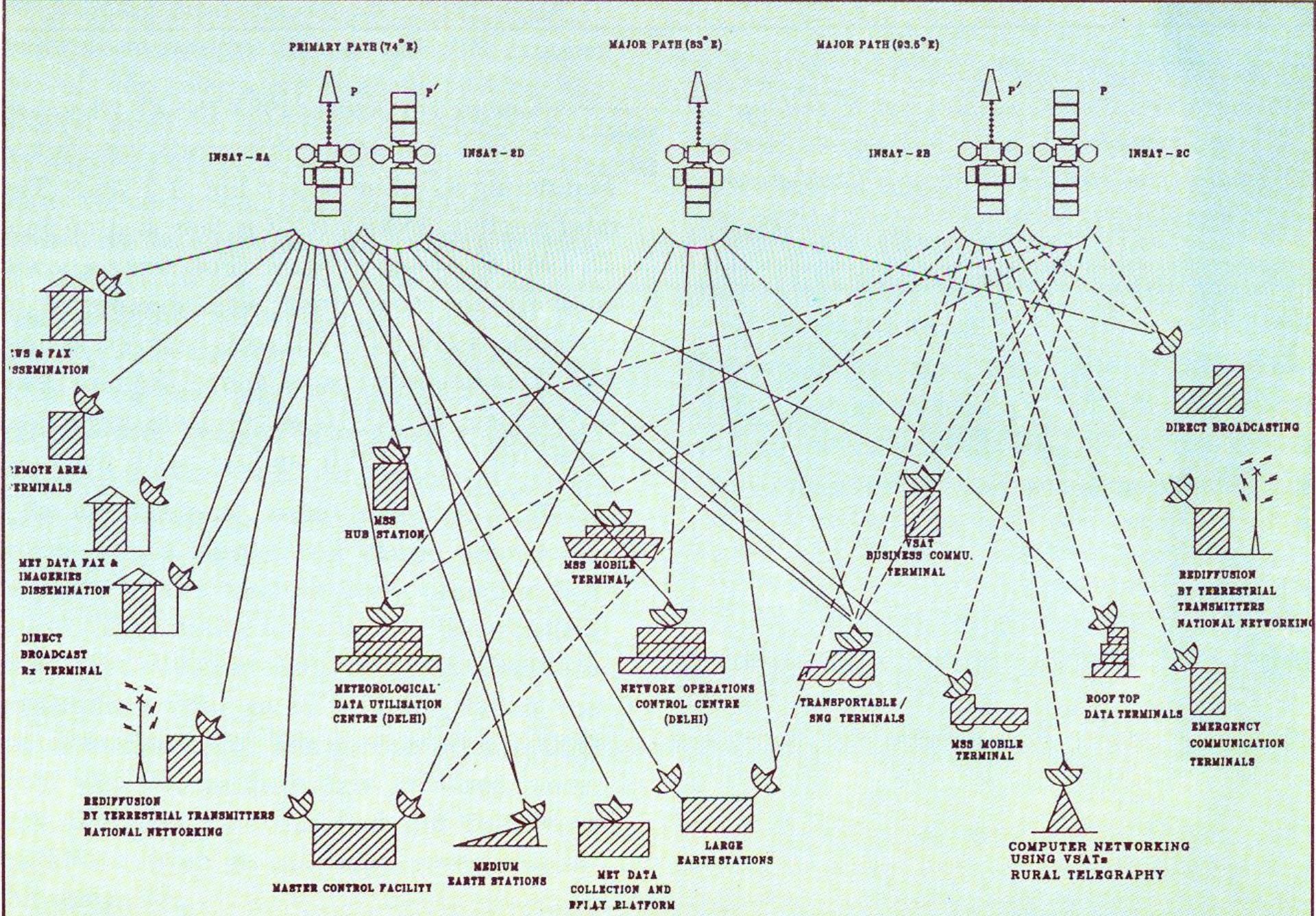
End-to-end Communication/TV Broadcast Experiments carried out.

APPLE



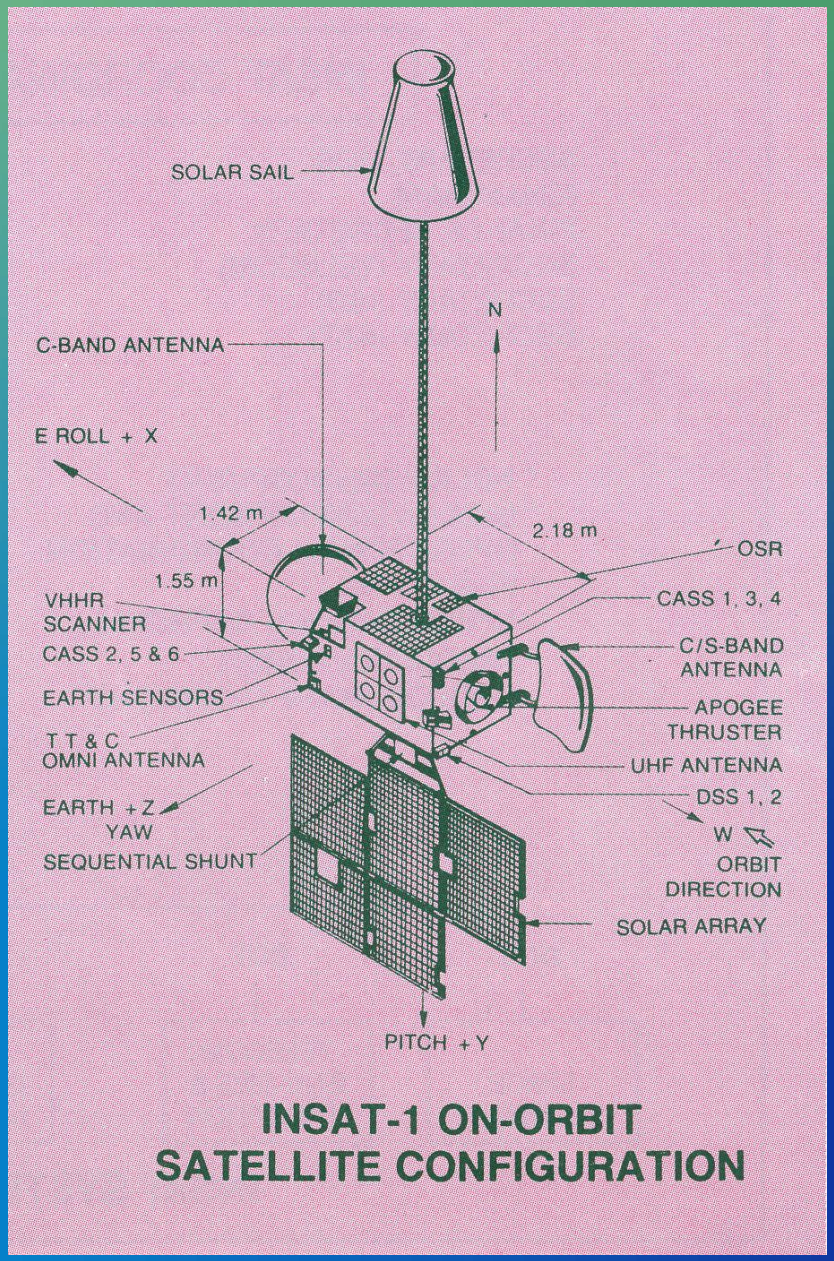
CONCEPTUALISATION OF INSAT

- ✓ Joint Studies with Philco-Ford, GE, MIT/Lincoln
- ✓ Evolution of INSAT Design
- ✓ Direct Reception TV to Villages and in Rebroadcast Mode to Urban Areas
- ✓ Multi-purpose Satellite Combining Communication, TV Broadcast and Meteorology to achieve economy of cost
- ✓ Concept of 2 Satellite Configuration, One in major path and the Second as stand-by on-orbit back-up + additional capacity



INSAT SYSTEM CONCEPT

INSAT-1 ON-ORBIT SATELLITE CONFIGURATION



INNOVATIVE INSAT DESIGN

- ✓ One sided asymmetrical 12 m^2 Solar Panel – A long Solar Boom & Sail for Stabilisation.
- ✓ 1200 Kg, 20m length to tip of Solar Sail.
- ✓ VHRR(IR) Detector Cooled by Passive Cooler to < 100^o K, Exposed to Space.
- ✓ 7 Years Life
- ✓ Rapid Expansion of Communication, TV Broadcast, Education on a Nationwide Basis. TV Expanded from 8 to over 200 TV Transmitters in 2 years plus, 5000 Direct Reception Sets.
- ✓ Meteorological Services including Locale-Specific Disaster Warning.

FIRST GENERATION INSATs

- ✓ Choice of Ford Aerospace Communication Corporation for Fabrication/Launching
- ✓ INSAT-1A (1981), INSAT-1B(1983) INSAT-1C(1988), INSAT-1D(1990)

12 National Coverage C-Band (Communication, TV Broadcast, Education)

2 S-Band National Coverage High Power (Direct Reception TV & Radio Networking)

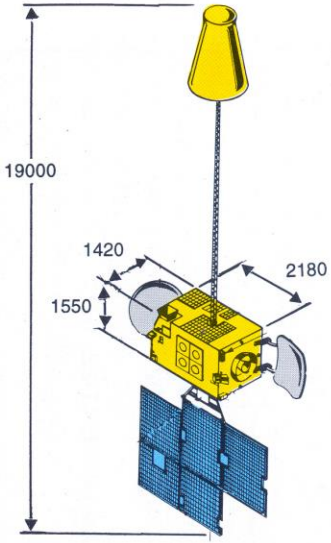
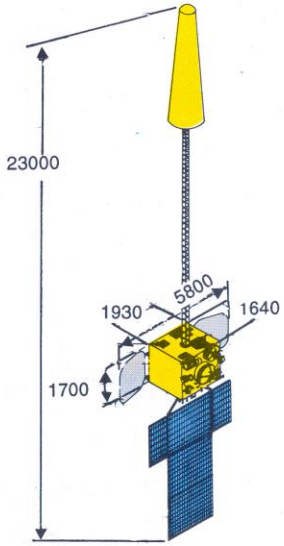
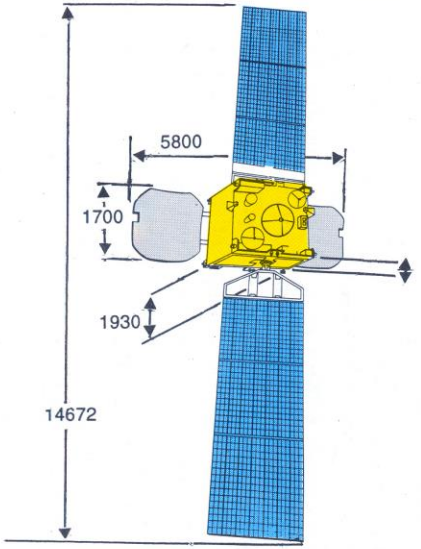
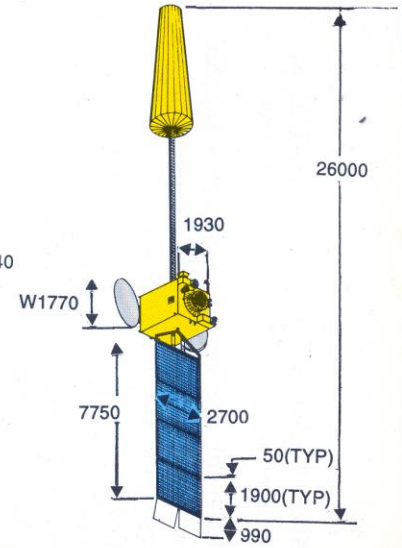
VHRR (Meteorology) Visible -- 2.75 km Resolution
IR -- 11 Km Resolution

A Data Relay Transponder for Relaying Remote Area, Meteorological Data from unattended platforms.

SECOND GENERATION INSATs

- ✓ Indigenously designed and fabricated, large capacity than INSAT-1
  - 2000 Kg, 12 C-Band, 6 Extended C-Band, 2 S-Band Transponders
  - – Data Relay Transponder
  - – VHRR (2 km in Visible, 8 km in IR)
  - – Solar Sail and Boom – 23 m from Tip-to-Tip
  - – Extended C Primarily for Fixed Satellite Services (VSATs)
- ✓ INSAT-2A (1992), INSAT-2B (1993), INSAT-2C(1995), INSAT-2D(1997)
  - VHRR Deleted-Added large Com. Coverage (Higher Power) for Mobile Communication & 3 Ku-Band for Fixed Satellite Services.
- ✓ INSAT-2E(1999)
  - Water Vapour Channel (8km), CCD Camera Visible, Near IR(1km)

INSAT-1 & INSAT-2 COMPARISON

	INSAT-1D	INSAT-2A/2B	INSAT-2C/2D	INSAT-2E
				
Length	19m	23m	14.6m	26m
Dry mass (Kg)	550	905	980	1100
Life (Yrs)	7	7	7	12
Power (W)	930	1024	1620	2300
Battery (AH)	2x12	2x18	2x24	2x50
Structure (mm^3)	1930x1640x1700	1930x1640x1700	1930x1640x1700 North & South Panels extended by 500 & 350 mm	1930x1700x2300
Payloads				
C-band	12 (4 W)	12 (4 W)	12(50/10/4W)	12(65/35 W)
Ext-C	-	6(4/8 W)	6(4/8 W)	5(35 W)
S-band	2(50 W)	2(50 W)	1(50 W)	-
S-Mobile	-	-	1(50 W)	-
C-Mobile	-	-	1(4 W)	-
Ku-band	-	-	3(20 W)	-
VHRR (Visible/IR/WV)	2.75/11 Km	2/8 Km	-	2/8/8 Km
CCD camera	-	-	-	1 Km
DRT	Yes	Yes	-	-
SASR	-	Yes	-	-

THIRD GENERATION INSATs

- ✓ Rapid expansion of VSAT Services (Fixed Satellite Services)
- ✓ INSAT-3B (2000), 12 Extended C-Band + 3 Ku-Band
- ✓ INSAT-3A (2003), INSAT-3C(2002), INSAT-3E(2003)

  2700 Kg – Extensive Communication in C, Ext C and Ku
- ✓ Kalpana (2002) – Met. Satellite and GSAT-2(2003) using GSLV
- ✓ GSAT-3 (EDUSAT) in 2004 – 1900 Kg

  For Telemedicine, Primary & University Education.

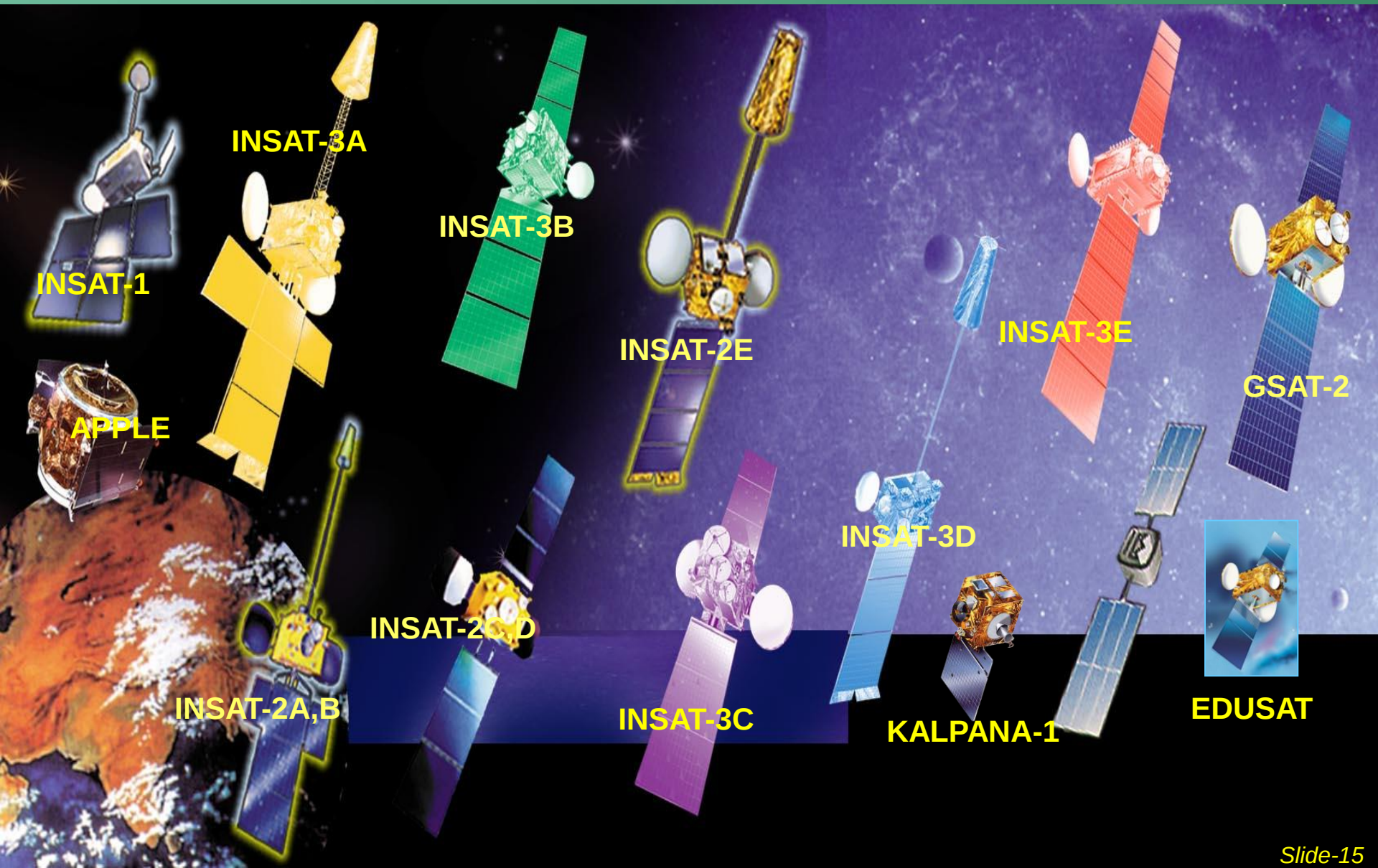
FOURTH GENERATION INSATs

- ✓ INSAT-4 series is planned to have 5/7 satellites.
- ✓ The transponder configuration of this series has been worked out after critically evaluating the requirement projected by different users/user departments.
- ✓ By 2007 INSAT will have nearly about 200 active transponders in various bands.
- ✓ INSAT-4A (2005)

  12 Ku (high power) and 12 C band transponders and will be located at 83 deg. E and 93.5 deg. E orbit slots in that order.

  Services like DTH, Broadband Multimedia, Video on Demand and Interactive TV.
- ✓ INSAT-4C (2006) Mission Failed

INSAT FAMILY



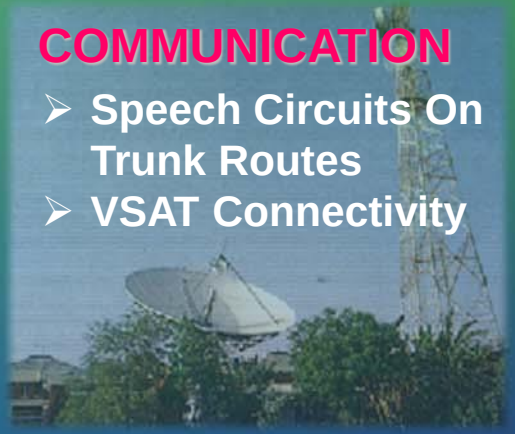
INSAT Applications

BROADCAST

- Television Broadcasting
- Direct To Home (DTH)
- TV & Radio Networking

COMMUNICATION

- Speech Circuits On Trunk Routes
- VSAT Connectivity



METEOROLOGICAL

- Meteorological Imaging
- Data Collection Platform
- Disaster Warning

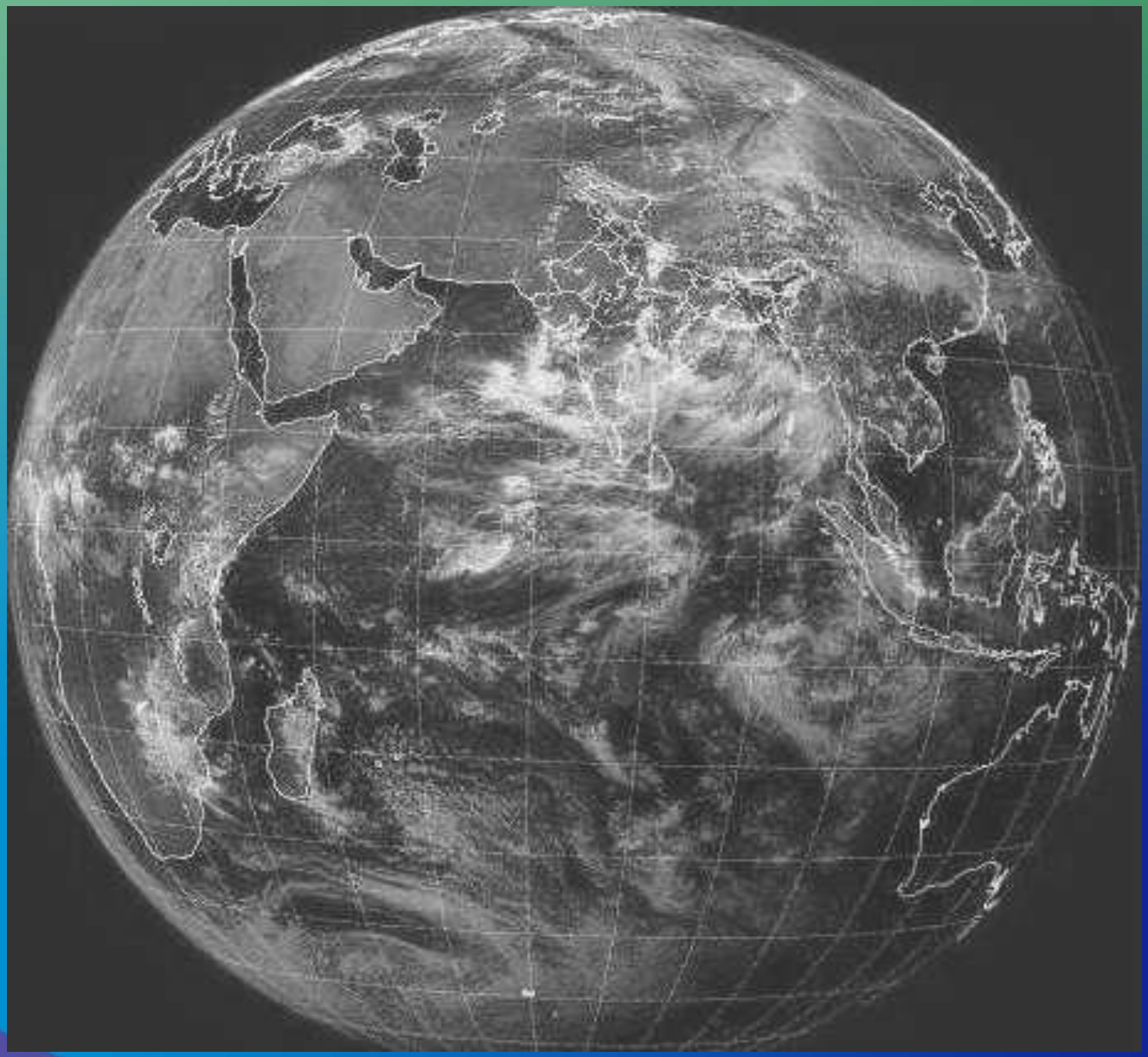
OTHERS

- Mobile Satellite Service
- Search and Rescue
- Satellite Navigation

DEVELOPMENTAL

- Tele-health
- Tele-education
- Emergency Communication

MATEOROLOGICAL IMAGING



CYCLONE/DISASTER WARNING SYSTEMS

INPUTS

INSAT VHRR IMAGING/
CYCLONE TRACKING
CYCLONE WARNING

CYCLONE WARNING CENTRE

C-BAND UP LINK

S-BAND DOWN LINK

CYCLONE FORMATION

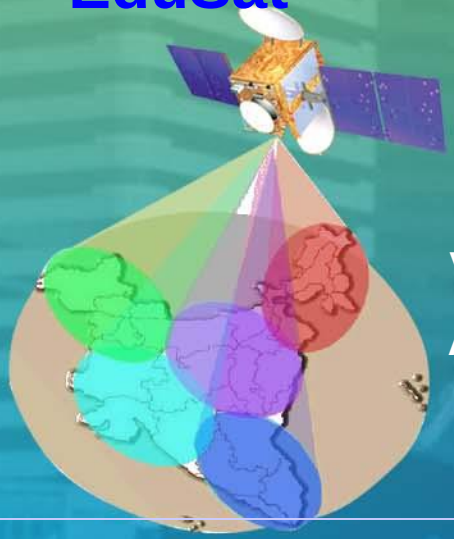
EARTH STATION

250 CWDS INSTALLED IN THE COASTAL AREAS

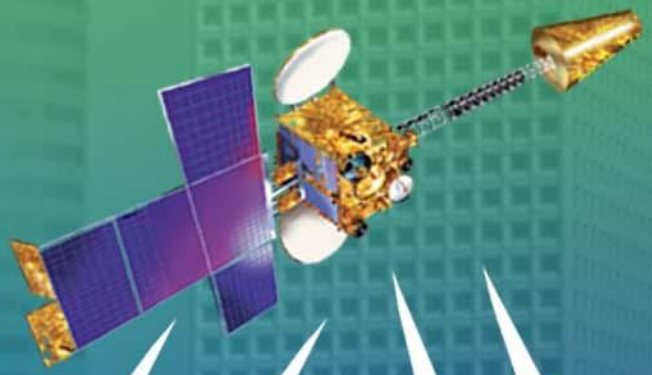
Research on Landfall Predictions

Tele Education

EduSat



5 Spot Beams in Ku Band
1 National Beam in Ku Band
1 National Beam in Ext C Band (6 Channels)



Video + Audio

Video + Audio

Audio

Multimedia Content

Teaching-End

Receive Only

Class Room-1

Video Interactive

Class Room-2

EDUSAT Network

Ku &
Ext C

Studio

HUB

State Capital

0.9/1.2/1.8m

ROT

School

1.2/1.8 m

SIT

Higher Secondary/University

MEDICAL FACILITY IN INDIA

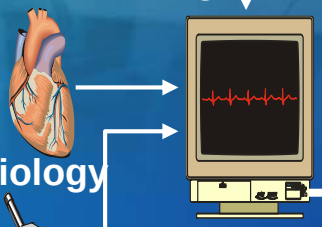
- ✓ One Doctor for 2,500 people (1 in 250 in US/1 in 25,000 in Africa) and one bed for 2,000 people.
- ✓ 75% of Doctors work in Urban and 20% in Semi-Urban areas.
- ✓ Rural population constituting 65% of population, looked after by 25,000 PHCs and ill-equipped 1,50,000 Sub-Centers.
- ✓ Need for Providing Advanced Medical facility to Semi-Urban and Rural Population.

Telemedicine

173 Hospitals
- 134 Dist/ Rural Hospitals
- 34 Super Specialty Hospitals
- 5 Mobile Vans

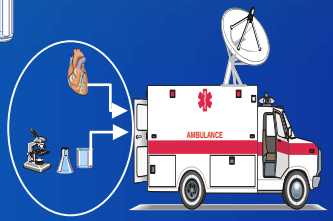
Dist/Rural Hospital

Video Conferencing



Cardiology

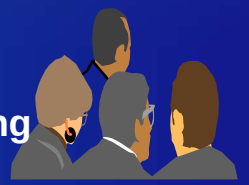
Pathology



> 1.2 Lakh patients treated

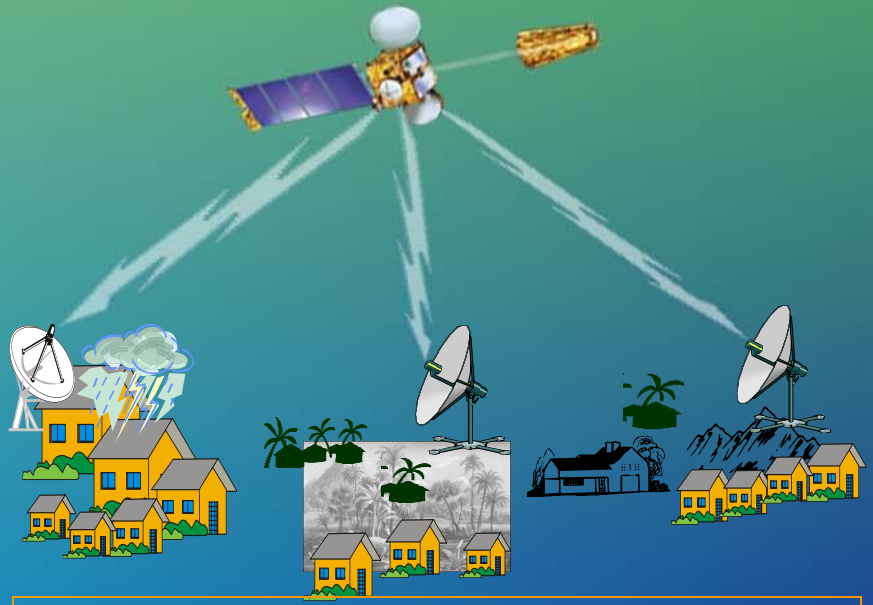
Health Specialist Centre

Video Conferencing



Panel of Doctors

Village Resource Centre (VRC)



Space-based Services for Community Outreach

Thanks