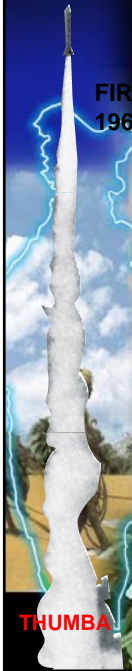


THE STORY BEGINS

FIRST
1963



THUMBA



“THERE ARE SOME WHO QUESTION THE RELEVANCE OF SPACE ACTIVITIES IN A DEVELOPING NATION

.....IF WE ARE TO PLAY A MEANINGFUL ROLE NATIONALLY, AND IN THE COMITY OF NATIONS, WE MUST BE SECOND TO NONE IN THE APPLICATION OF ADVANCED TECHNOLOGIES TO THE REAL PROBLEMS OF MAN AND SOCIETY”

AND THE VISION

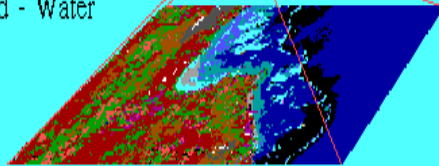
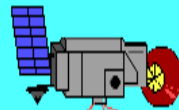
What is Remote Sensing ?

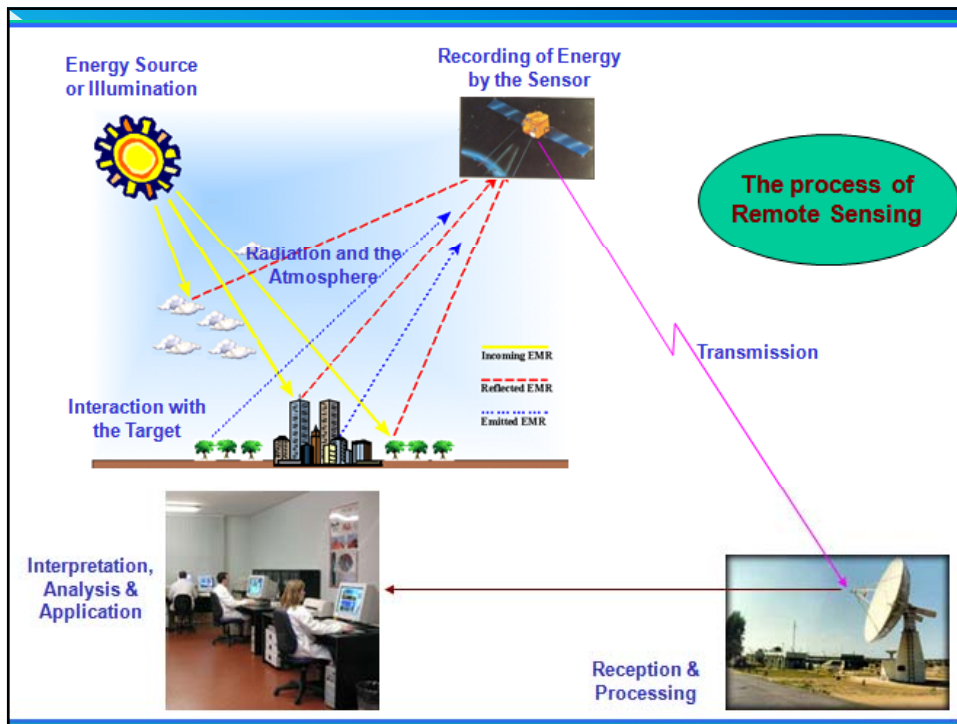
Information is gathered by **instruments** carried on suitable **platforms**. The information is used to study **targets** of interest on the Earth's surface.

Platform: Satellite

Instrument: Scanner

Target: Land - Water

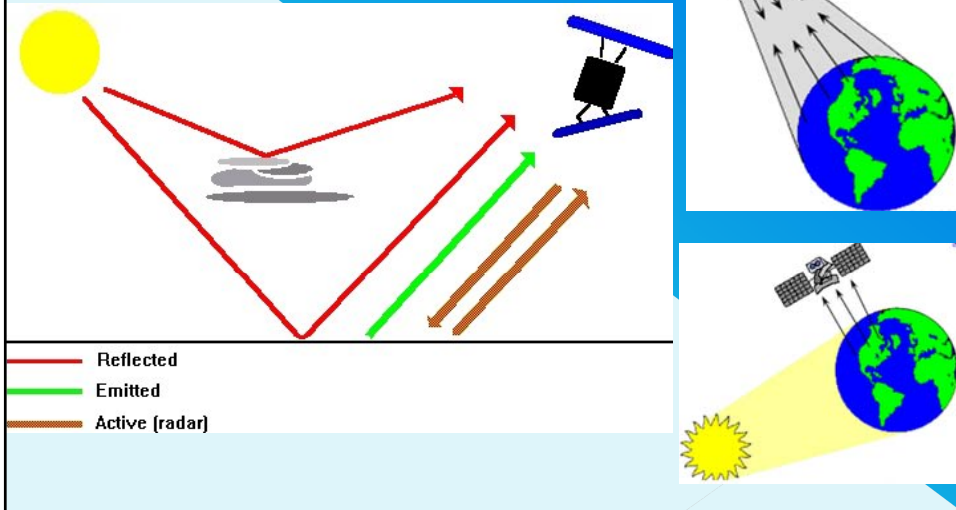




Advantages:

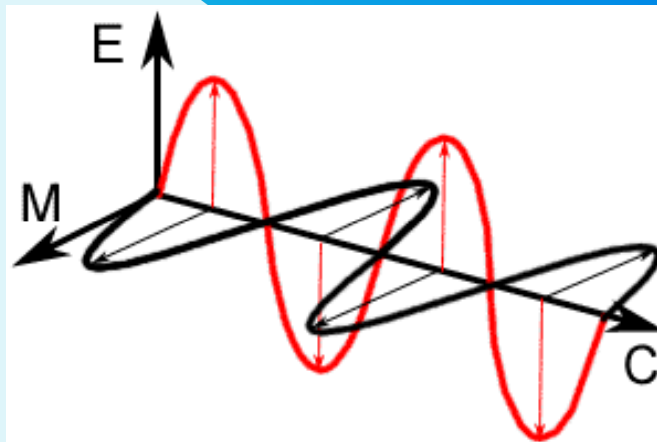
- Ability to provide data of inaccessible areas
- Provides global coverage
- Repetitive coverage of same area that helps study on temporal scale
- Helps to derive precise information
- Thematic maps such as Land Use/Land Cover, Forest type, Agriculture, Soil, Geology maps could be derived from Satellite data

Remote Sensing is of two types- Active and Passive Remote Sensing

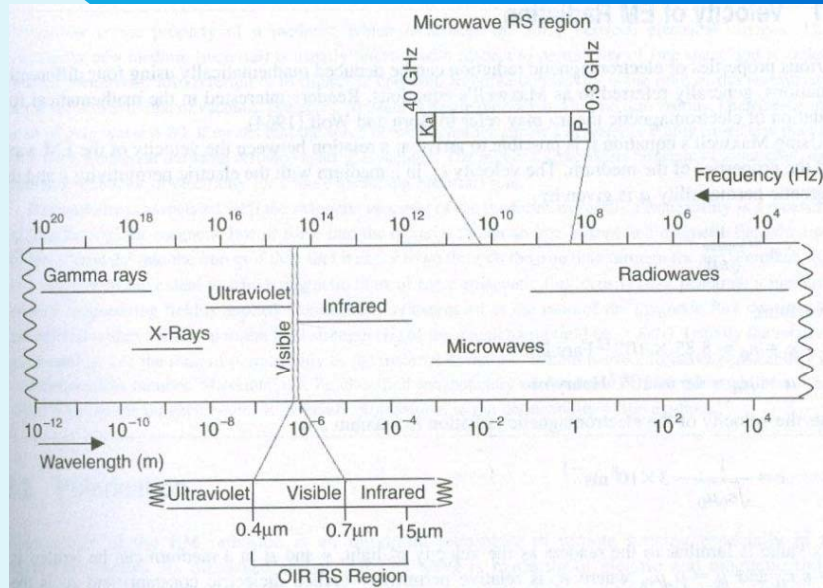


Electromagnetic (EM) Radiation

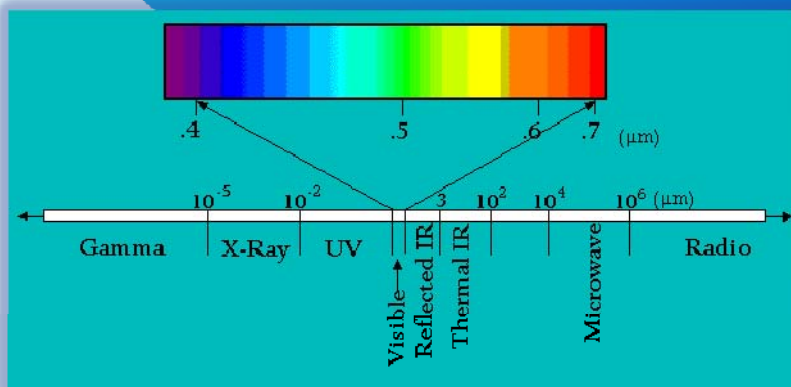
Motion of charged particles produce EM waves.
Changing electric fields are set up by the oscillation of charged particles.
Changing electric fields induce changing magnetic fields. Changing magnetic fields in turn set up more changing fields and so on.



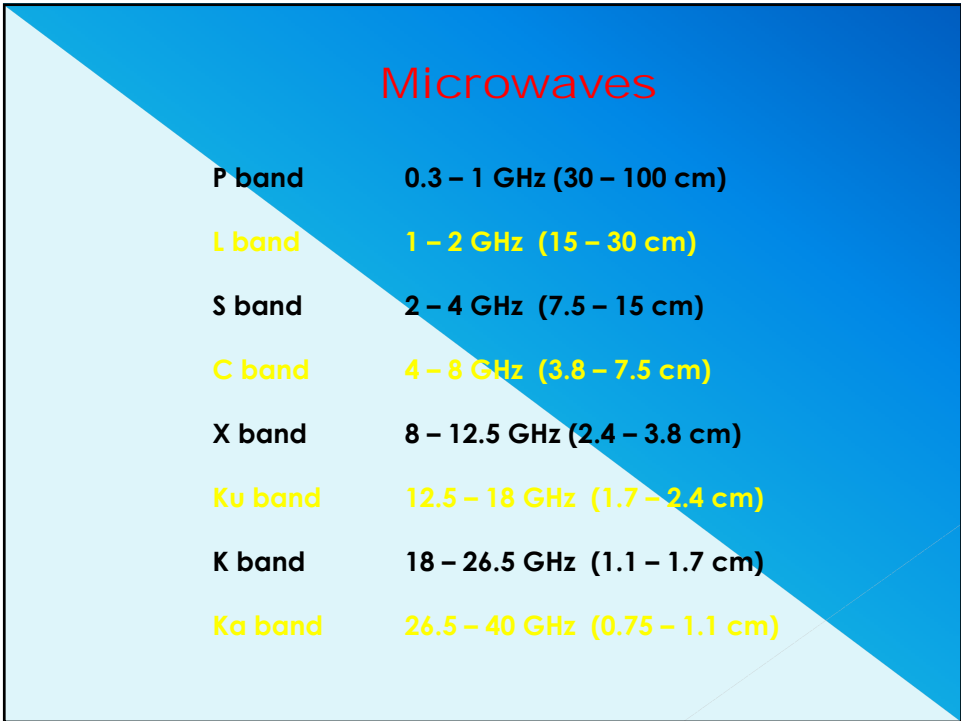
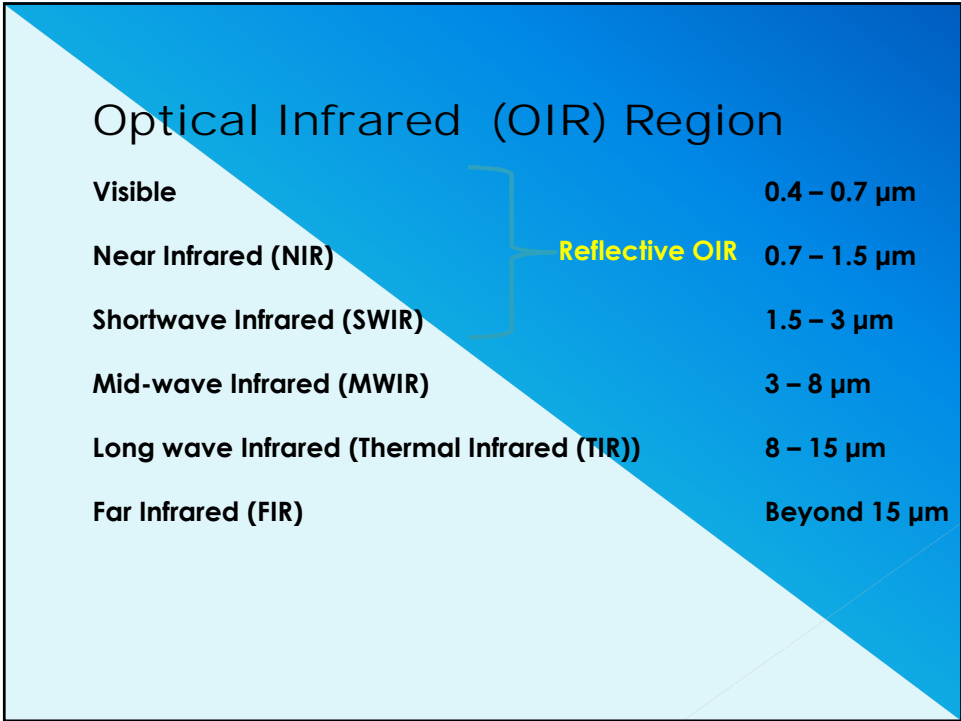
THE ELECTROMAGNETIC SPECTRUM



What can satellites see?



Satellite electromagnetic sensors let us “see” beyond the visible...



ENERGY INTERACTION

Conservation of Energy

When EM energy is incident on any given earth surface feature, three fundamental energy interactions are possible. A fraction of incident energy is reflected, absorbed and / or transmitted.

“Energy is neither created nor destroyed.”

$$\text{Incident energy} = \text{reflected energy} + \text{transmitted energy} + \text{absorbed energy}$$

Three forms of interaction



$$I = A + R + T \text{ or } A/I + R/I + T/I = 1 \text{ (100\%)}$$

Energy Interaction

Conservation of Energy

Two points about the conservation of energy relationship:

- The proportions of energy reflected, absorbed and transmitted will vary for different earth features depending on their material type and condition.
- The wavelength dependency. That is, even within a given feature type, the proportion of reflected, absorbed and transmitted energy will vary at different wavelengths.

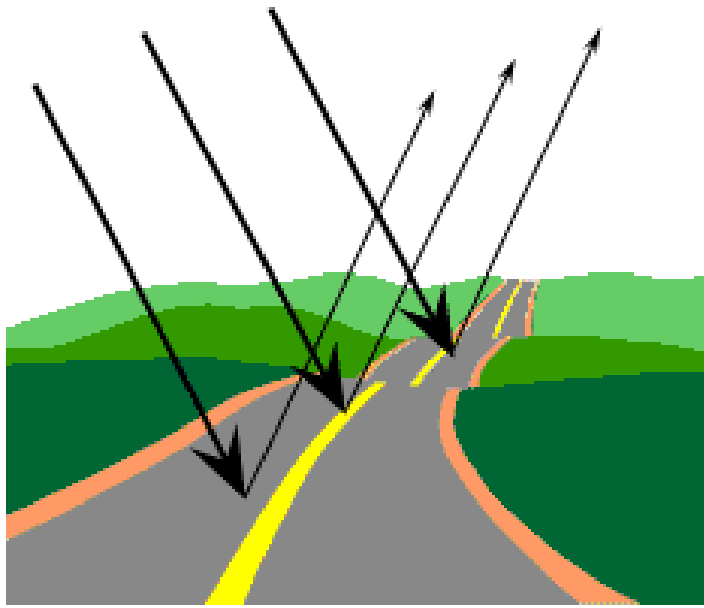
Two features may be distinguishable in one spectral band but not in another wavelength region. That's why we go for multi-spectral coverage.

Energy Interaction

Reflection

- Many remote sensing systems operate in Visible and NIR regions in which reflected energy is more. Hence, the reflectance properties of objects are more important.
- The reflectance is a function of surface roughness (or smoothness) of an object.
- Based on surface roughness, objects are categorized into two classes, 'specular' and 'diffused' reflectors.

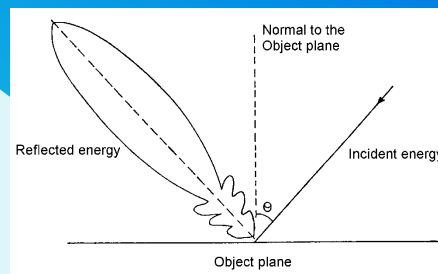
Specular Reflection



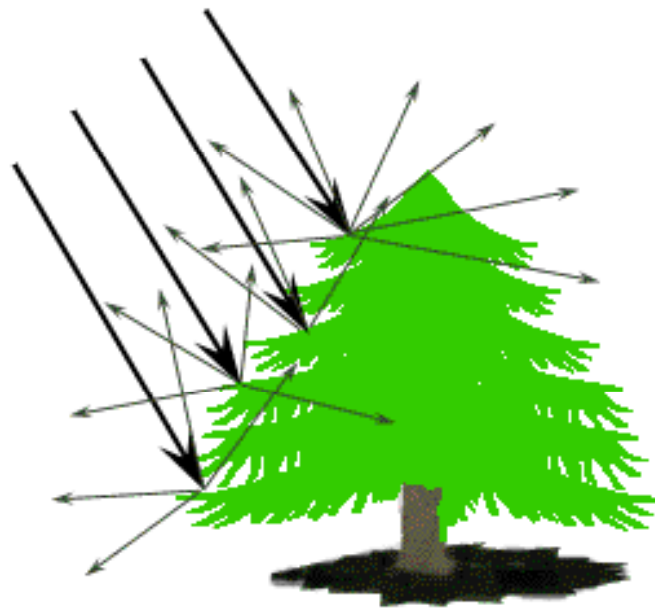
Energy Interaction

Specular reflectors

Objects which produce mirror like reflection are called Specular reflectors.



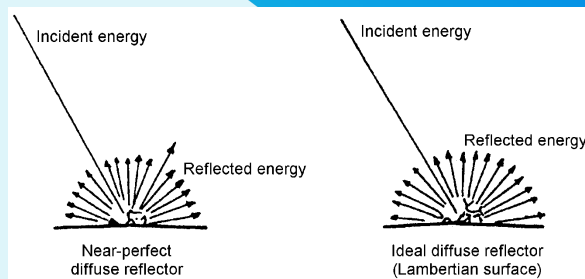
Diffuse Reflection

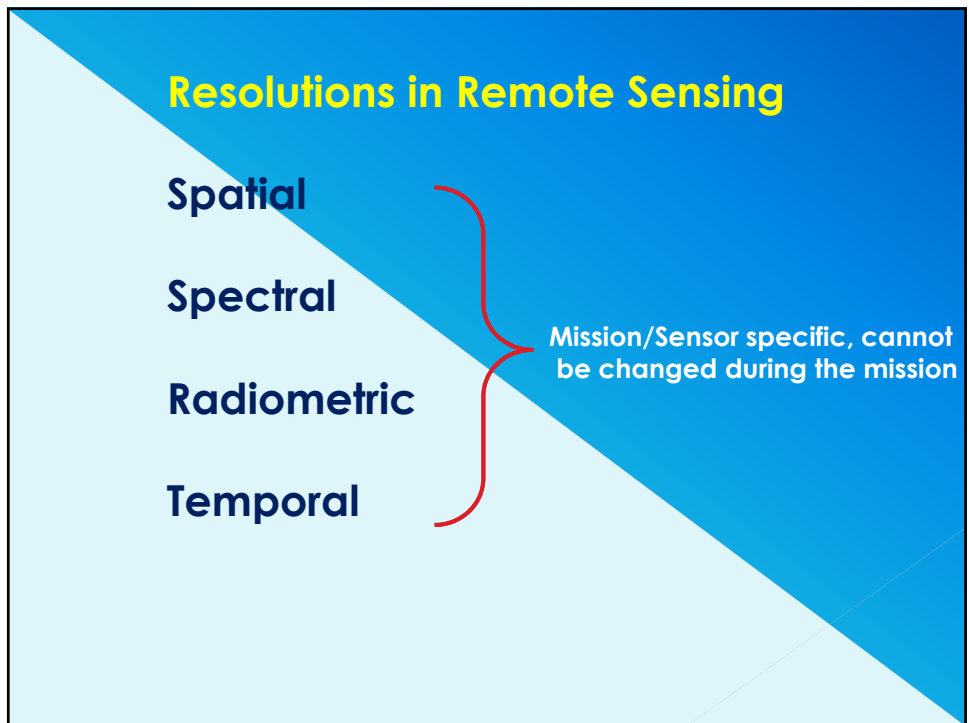
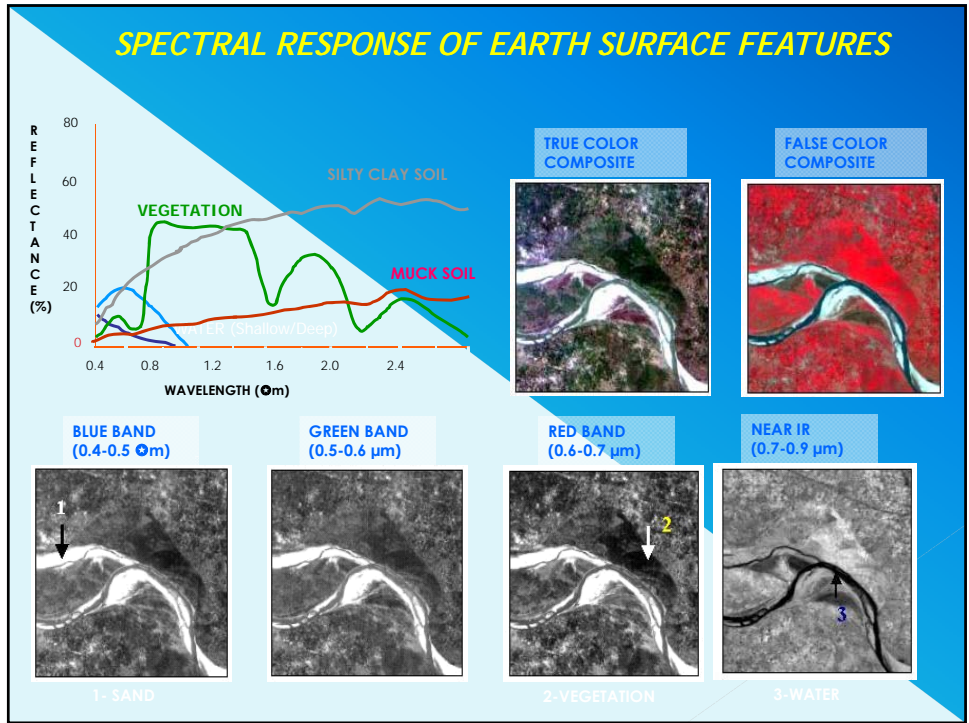


Energy Interaction

Diffuse reflectors

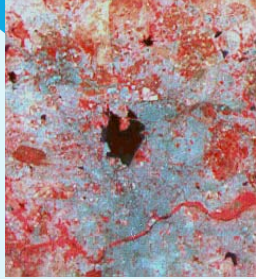
Rough surfaces that reflect uniformly in all directions independent of the angle of incidence are called Diffuse or Lambertian reflectors.



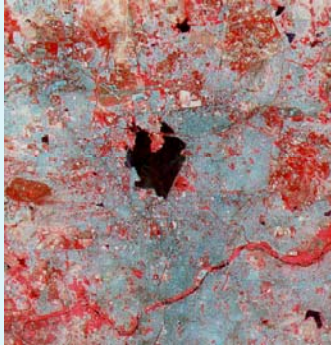


IRS-LISS-I/LISS-II and LISS-III Images Showing Part of Hyderabad


Effect of Spatial Resolution on Image contrast and clarity of features




LISS-I (72m)




LISS-II (36m)



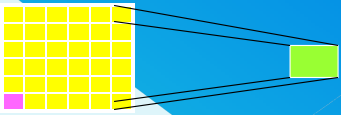
LISS-III (23m)



IKONOS




IRS - 5.8 m



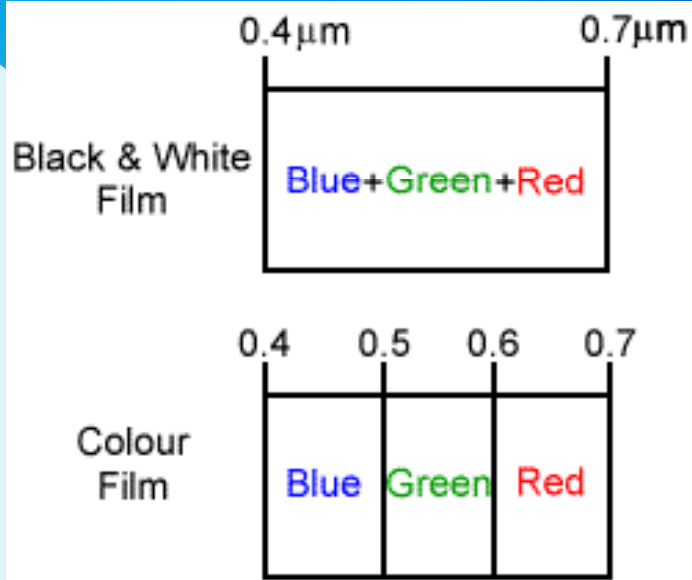
$1\text{ m} \times 1\text{ m}$

$6\text{ m} \times 6\text{ m}$



Rashtrapati Bhavan, New Delhi

Spectral Resolution



Radiometric Resolution

Refers to the number of possible brightness values in each band of data and is determined by the number of bits into which the recorded energy is divided.

In 8-bit data, the brightness values can range from 0 to 255 for each pixel (256 total possible values).

In 7-bit data, the values range from 0 to 127, or half as many possible values.

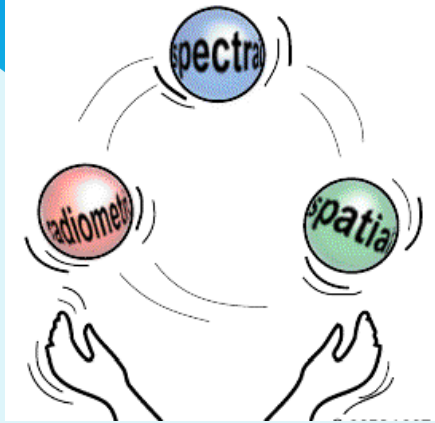
For comparison across bands, all the bands should have same radiometric resolution.

A 2-bit image



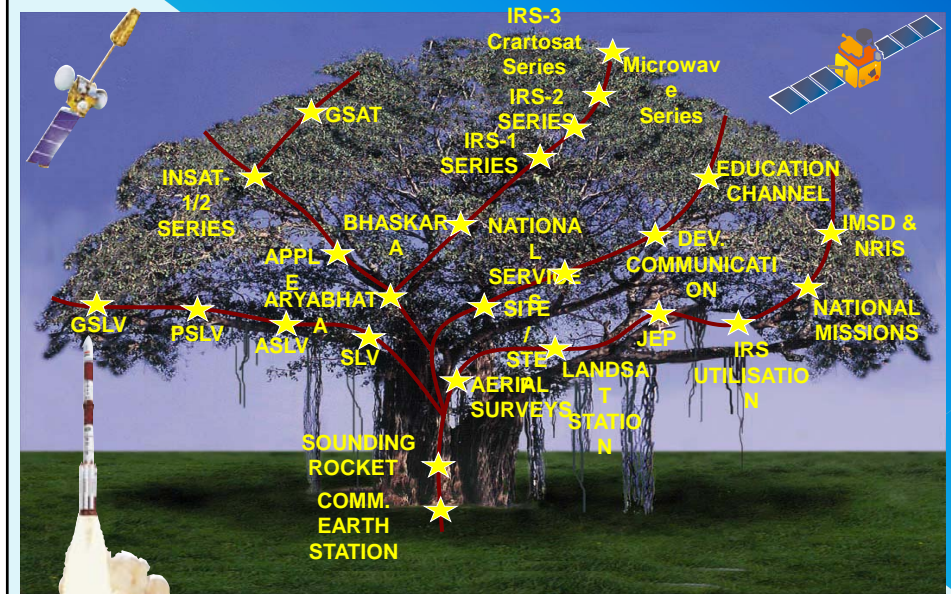
An 8-bit image

"...you just can't have it all!..."

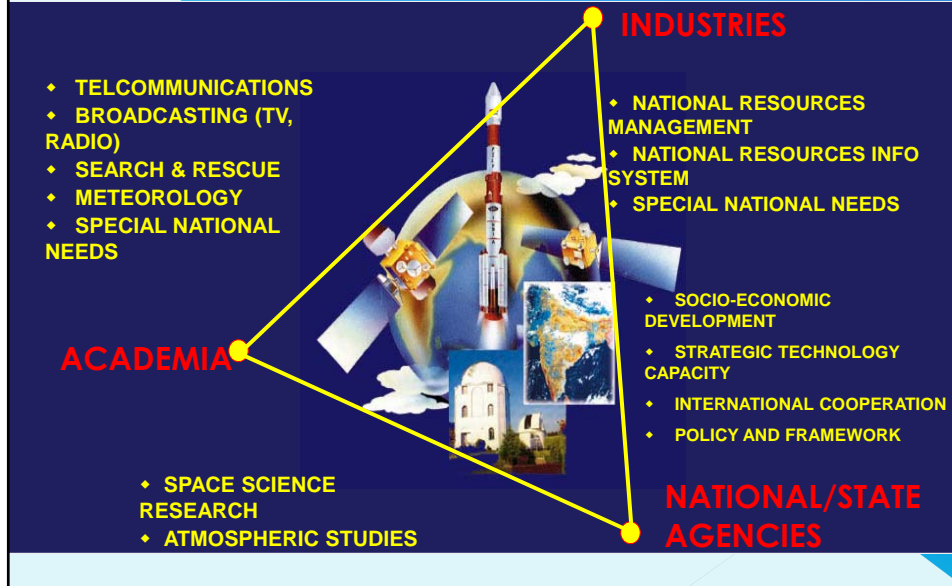


The three types of resolution must be balanced against the desired capabilities and objectives of the sensor.

The Evolution ..



Multiple Dimensions of Space

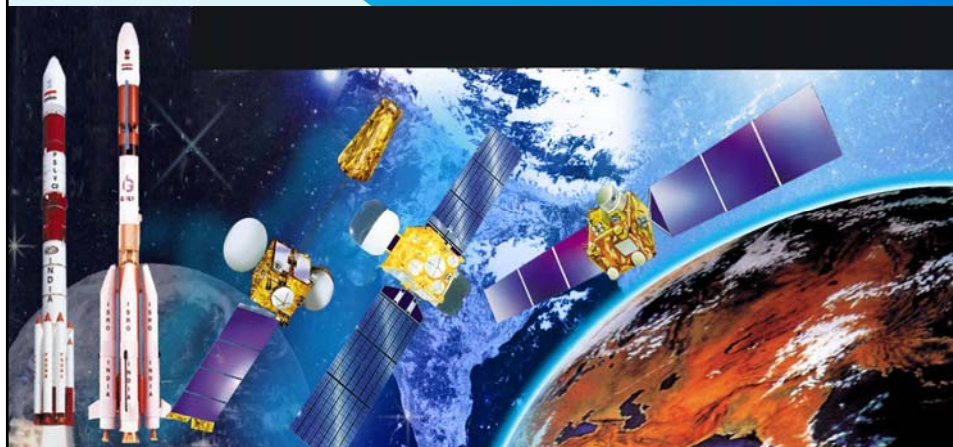


NATIONAL SPACE SYSTEMS

LAUNCH
VEHICLES

INSAT

IRS



INSAT FAMILY


APPLE	INSAT-1	INSAT-2	INSAT-2E
• SPIN STABILISED • 1 TRANSPONDER	• 3-AXIS STABILISED • 12C, 2S • 32 dbw (1 kw)	• 3-AXIS STABILISED • 12C, 6-ExtC, 2S, MSS, Ku • 36 dbw (1.5 kw)	• 3-AXIS STABILISED • 17C, GLOBAL • 36 dbw (2.5 kw)

INSAT APPLICATIONS


- SPEECH CIRCUITS ON TRUNK ROUTES
- TV BROADCASTING
- BUSINESS COMMUNICATIONS
- MOBILE SATELLITE SERVICES
- RADIO NETWORKING
- SEARCH AND RESCUE SERVICES
- VSAT CONNECTIVITY
- DATA COLLECTION PLATFORMS
- METEOROLOGY IMAGING
- DISASTER WARNING SYSTEM
- DATA COLLECTION PLATFORMS

**DEVELOPMENTAL COMMUNICATIONS
TRAINING AND EDUCATION**


BHASKARA TO INSAT



THEN ...



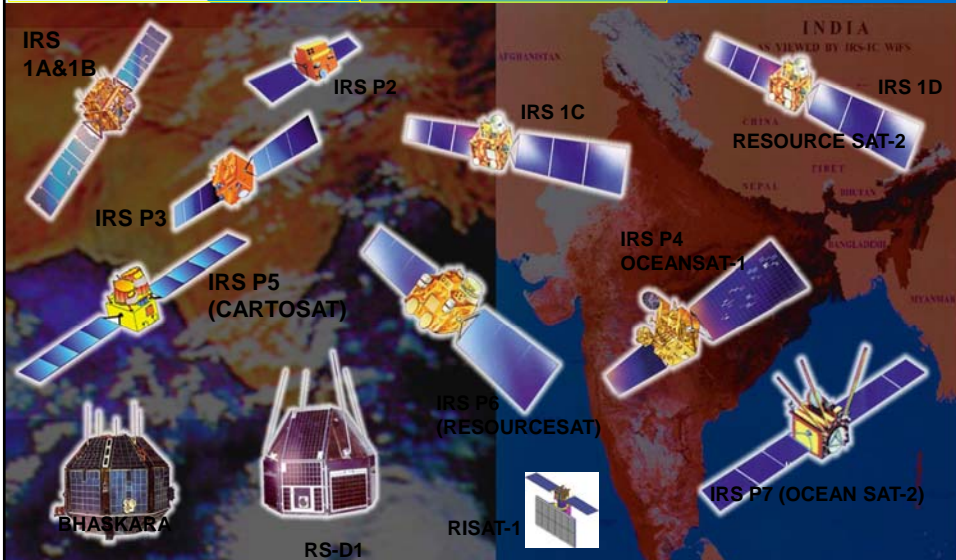
NOW ...

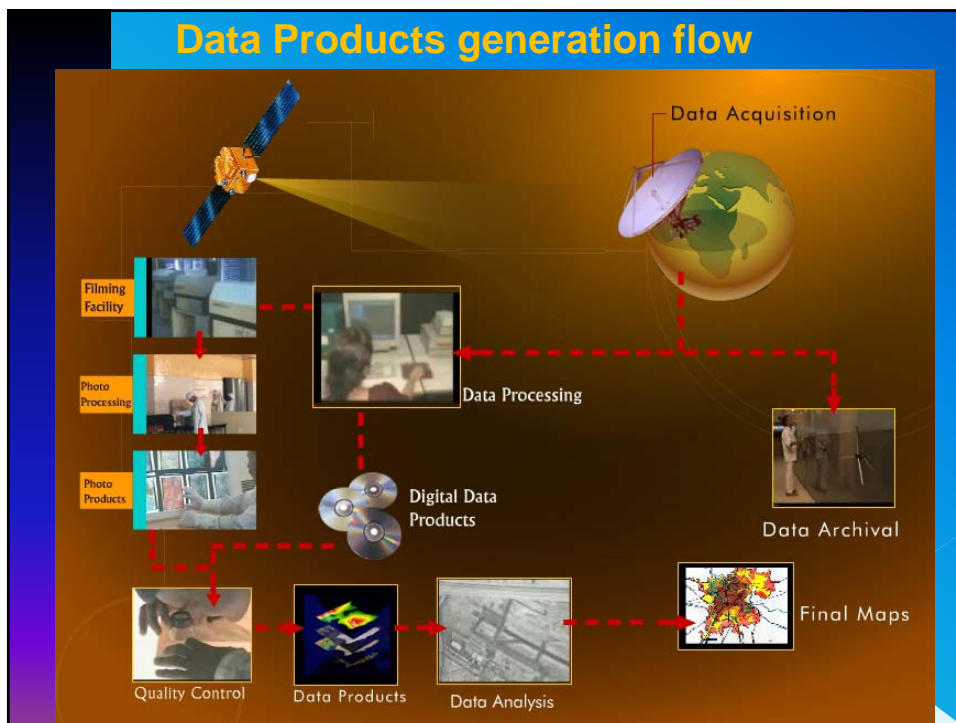
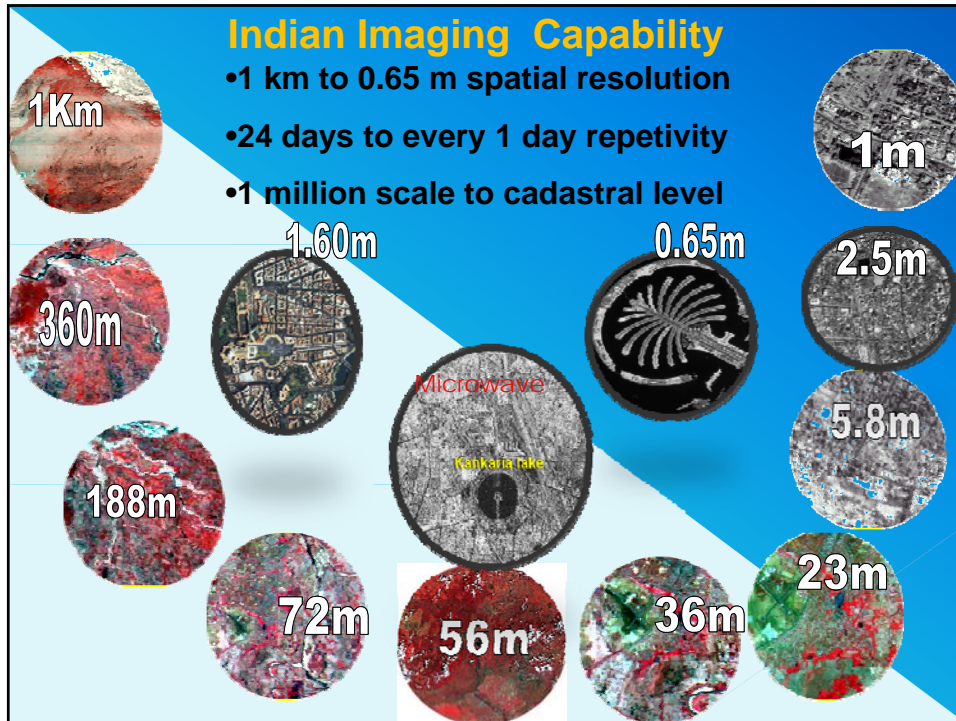


IRS SERIES


IMAGING IMPROVEMENTS
+1 km to 1 m RESOLUTION

GLOBAL COVERAGE
APPLICATION-SPECIFIC



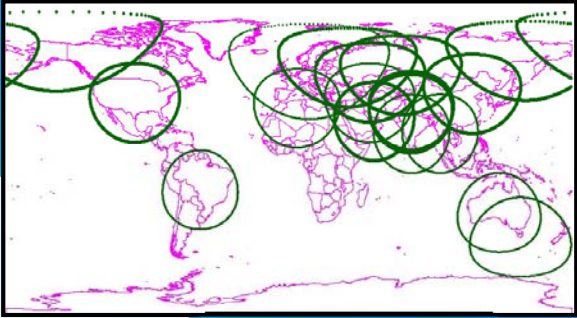


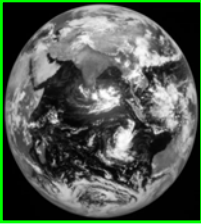
INTERNATIONAL DIMENSIONS



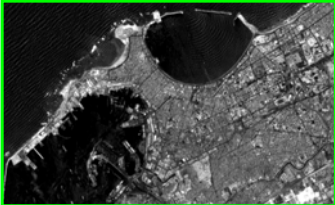
INSAT-2E WIDE BEAM COVERAGE

International Ground Stations






INSAT-2E-VHRR COVERAGE

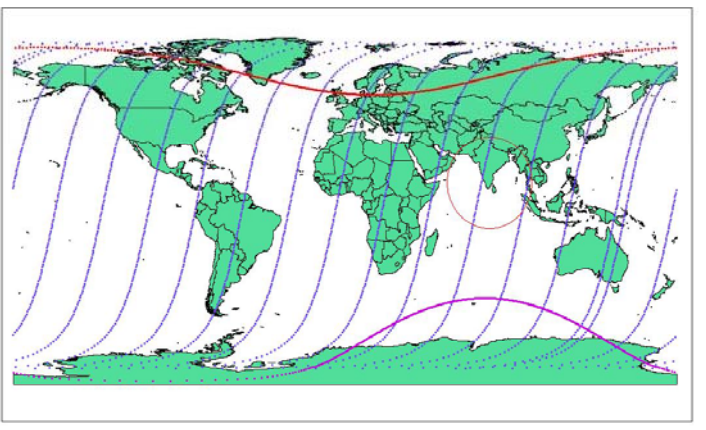


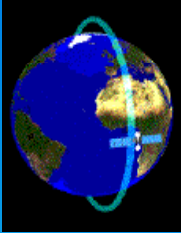
PAN IMAGE OF ALEXANDRIA



Neighboring countries

Satellite Orbits Around The Globe





- All the satellites orbit 14/15 times around the globe in 24 h
- The satellites have to be tasked for imaging based on the power and other satellite capacities
- Data downlink is always governed by the visibility of the station

Satellite Data Reception..

EARTH STATION AT SHADNAGAR,

ABOUT 60 KMS FROM HYDERABAD

1st 10 Meter Antenna 1980 1st 7.5 Meter Antenna 2003 3.7mtr Antenna -2008



**DEDICATED DATA RECEPTION
AND TRACKING, ARCHIVAL AND
REAL TIME QUICK-LOOK FACILITY**

Mobile Ground Station-2010 4.5 Meter Antenna-2012 2.7 Meter Antenna-2014



GENERATION OF BROWSE DATA

DATA RECEPTION STARTED WITH LANDSAT SATELLITE OF USA - 1979

**MULTI-MISSION CAPABILITY (INDIA'S IRS SERIES, USA'S LANDSAT-5,
NOAA-14 & 15 AND EUROPEAN ERS-1 & 2)**

IRS IMAGES – what can be seen ...



Cape town



Mangalore

IRS images in True color

Remote Sensing Applications

INFORMATION TO SOLUTIONS

- AGRICULTURE & CROPS
- FOREST & BIO-RESOURCES
 - WATER RESOURCES
 - GEOLOGY
- OCEAN/COASTAL
- ENVIRONMENT
- RURAL DEVELOPMENT
- URBAN MANAGEMENT
- CARTOGRAPHY/MAPPING
- CLIMATE MODELLING
- GLOBAL CHANGE

**INTEGRATED MISSION FOR SUSTAINABLE DEVELOPMENT
NATIONAL (NATURAL) RESOURCES INFORMATION SYSTEMS**

