Indian Remote Sensing Satellites
Resourcesat-1 (IRS P6) & Cartosat-1 (IRS P5)

Data Availability

DR. Rao S. Ramayananam
Director Indian Remote Sensing Satellite Program
GeoEye – ANTRIX Partnership

- **Long-standing Partnership**
  - For the last Ten years, ISRO, ANTRIX and Space Imaging have worked as partners to market India’s remote sensing program internationally.

- **17 International IRS Ground Stations**
  - Commercial and government ground stations collecting, processing and distributing IRS 1C and 1D imagery products for world-wide coverage

- **Resourcesat-1 Ground Stations**
  - 5 stations Receiving data: Norman & Alaska USA, Germany, China, UAE (Under implementation).

- **Cartosat-1 Ground Stations:**
  - Taiwan, Upgrade to two Cartosat Ground Stations under implementation

- **GeoEye Antrix Agreement:**
  - GeoEye is negotiating with Antrix a new Joint Marketing Agreement.
IRS 1C &1D International Ground Station Coverage

Currently Operating
- United Arab Emirates
- Union of Myanmar
- Eagle Vision 1, 2 & 5
- United States (Geo Eye)
  - Norman
  - Alaska
- Scannex (Russia)
  - Moscow
  - Eastern Siberia
  - Kazakhstan

Recently Discontinued
- Zorro, Taiwan
- Germany (NSG)
- Thailand (GISTDA)
- Japan (RESTEC)
- Argentina (CONAE)
- Ecuador (Clirson)

17 IRS 1C/1D ground stations throughout life of missions

Expected Life of Satellites: IRS 1C until end of 2006 and IRS 1D until end of 2007
Launched on October 17, 2003

817 km orbit, following IRS 1-C ground track

Spacecraft lift-off mass: 1360kg

5 year mission

Local time: 10:30 +/- 5 minutes

12 Orbits per day, 101.35 minutes

On-board memory: 152 GB (BOL), 120 GB (EOL)

- LISS-3: 141 km swath, 23.5 m resolution (all bands).
  - B2: 0.52 - 0.59
  - B3: 0.62 - 0.68
  - B4: 0.76 – 0.86
  - B5: 1.55 – 1.70

- LISS-4: 23.5 km (Mx mode) & 70.3 km (mono) swath, 5.8 m resolution (all bands).
  - B2: 0.52 - 0.59
  - B3: 0.62 - 0.68
  - B4: 0.76 – 0.86

- AWiFS: 737 km combined swath, 56 m resolution at nadi 70 m resolution at field edges.
  - B2: 0.52 - 0.59
  - B3: 0.62 - 0.68
  - B4: 0.76 – 0.86
  - B5: 1.55 – 1.70
IRS-P6 THREE TIER IMAGING

1/3 OF SWATH (ELECTRONIC STEERING)

±26° MECHANICAL STEERING THROUGH PSM

AWiFS-(A) & (B) GSD: 56m

LISS-3* GSD: 23.5m

LISS-4 GSD: 5.8m

Courtesy ASK, SAC
Advanced WiFS Camera (AWiFS)

- **Sensor:** 6 K CCD
- **Spectral bands:** 4 bands (0.52 - 0.59, 0.62 - 0.68, 0.77 - 0.86 and 1.5 - 1.7μ)
- **Swath:** 740 Km
- **Ground Resolution:** 56 m at Nadir, 70 m at edge (Average 60m).
- **Radiometric Resolution:** 10 Bits
- **SNR:** > 512
- **BBR:** < 0.25 pixel
- **Repetivity:** 5 days
LISS-3 Sensor

- **Sensor**: 6 K CCD per band
- **Spectral bands**: 4
- **Swath**: 140 Km
- **Ground Resolution**: 23.5 meter pixel in all 4 Bands

- **Radiometric Resolution**: 7 bits selected over 10 bits
- **BBR**: < 0.25 pixel
- **Repetivity**: 24 days
LISS-4 Sensor

- **Sensor:** 12 K CCD per band
- **Spectral bands:**
  - 3 bands (0.52-0.59, 0.62-0.68, and 0.77-0.86μ)
- **Swath, MSS Mode:** 23.9 km, selectable over 70 Km
- **Swath, Pan Mode:** 70 km in red band
- **Ground Resolution:** 5.8 meter pixel in all 3 bands
- **Radiometric Resolution:** 7 Bits selectable over 10bits
- **Steering Capability:** ± 26 degrees
- **BBR:** < 0.25 pixel
- **Revisit Capability:** 5 days

Kuwait City

Palm Island Dubai
Resourcesat Ground Stations
AWiFs Data Coverage

Germany station coverage to be added
LISS III Data Coverage

Germany, India and OBSSR to be added
LISS IV Data Coverage

Germany, India and OBSSR data to be added
CARTOSAT-1 was Launched on 5/5/05

Indian Space Research Organization (ISRO)
Launched the Cartosat-1
from Satish Dhawan Space Center, Sriharikota, India
on 5th May 2005
Mission Specifications

Orbit
Polar sun-synchronous

Orbital Altitude 618 km
Local time 10:30 AM
Revisit 5 days
Repetition 126 days
Orbits/day 14
Period 97 minutes
Cartosat-1 PAN Sensor

Real time stereo viewing

- Better than 2.5 m resolution
- Two Pan cameras - fore with 26 deg. and aft with -5 deg. Tilt (500 nm- 850 nm)
- Swath 26 km for stereo and 55 km for monoscopic mode.
- 8 km overlap between adjacent paths
- 10 bits
- Facility for across track tilt to give better revisit
Stereo data acquisition for CARTOSAT-1
Wide Swath data acquisition for CARTOSAT-1
AOI Based products (MONO and Stereo) - Digital data

- User Area Of Interest is given as multiple scenes - different dates of acquisitions, which are tiled but not Radiometrically matched.

- Minimum area of 25*25 Sq Km.

- Location accuracy will be better than 250m.

- These products are supplied as:
  
  - Radiometrically Corrected - LGSOWG format - CD-ROM/DVD (MONO & Stereo) with RPC File
  
  - Systematic - GEOTIFF format - CD-ROM/DVD (MONO)
  
  - Ortho Kit – With Systematic corrections and RPC file - Fast Format - CD-ROM/DVD (MONO)
## Cartosat-1 Data Products (Contd.,)

### Precision Georeferenced Products

- These are mosaiced Ortho rectified products best Radiometric match is attempted
- Location Accuracy will be better than 25 m

<table>
<thead>
<tr>
<th>Area Coverage</th>
<th>Level of processing</th>
<th>Photoprints Scale</th>
<th>Digital Data Format/ Media</th>
</tr>
</thead>
<tbody>
<tr>
<td>Map sheet based / Float</td>
<td>Ortho</td>
<td>1:25,000</td>
<td>GEOTIFF (RGB)/ CDROM</td>
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<tr>
<td>7.5’ * 7.5’</td>
<td>Ortho</td>
<td>1:25,000</td>
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<tr>
<td>(14 Km * 14 Km) Float</td>
<td>Ortho</td>
<td>1:12,500</td>
<td>GEOTIFF/CDROM</td>
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<tr>
<td>5’ * 5’</td>
<td>Ortho</td>
<td>1:5,000</td>
<td>GEOTIFF/CDROM</td>
</tr>
<tr>
<td>(4 Km * 4 Km)</td>
<td>Ortho</td>
<td>1:10,000</td>
<td>GEOTIFF/CDROM</td>
</tr>
<tr>
<td>3.75’ * 3.75’</td>
<td>Ortho</td>
<td>1:10,000</td>
<td>GEOTIFF/CDROM</td>
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Cartosat-1 Data Products (Cont.)

Merged Georeferenced Products

Sensors: IRS-P6(L-IV MX) + IRS-P5 (2.5 m color)

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</thead>
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<tr>
<td>Float</td>
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<td>1:10,000</td>
<td>GEOTIFF/CDROM</td>
</tr>
</tbody>
</table>
San Diego, Airport, USA
San Diego, USA
Denver, Downtown, USA
Pyongyang, North Korea
Anaglyph
Pyongyang, North Korea
Anaglyph
Thanks