



Indian Earth Observation Programme

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GEO

1990



INSAT-1D
VHRR

1992



INSAT-2A
VHRR

1993



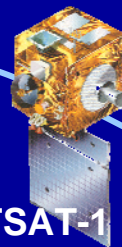
INSAT-2B
VHRR

1999



INSAT-2E
VHRR, CCD (1
KM)

2002



METSAT-1
VHRR – 2 Km(vis);
8 Km(IR & WV)

2003



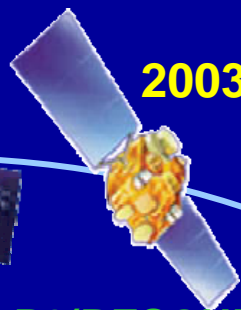
INSAT-3A
VHRR – 2
Km(vis);
8 Km(IR & WV)
CCD – 1 Km

1999



IRS-P4 (OCEANSAT-1)
OCM, MSMR

2003



IRS-P6(RESOURCESAT)

LISS 3 – 23.5/140 Km
LISS 4 - 5.8M/ 27Km
AWiFS - 55M/ 730 Km

2005



IRS-P5 (CARTOSAT-I)
PAN 2.5 m stereo

2007



IRS-P7 (CARTOSAT-II)
PAN 0.85 m

1996



IRS-P3
WiFS, MOS X-Ray

1995/1997



IRS-1C/1D LISS-3
(23/70M)
STEERABLE PAN (5.8 M)
WiFS (188M)

PRESENT ...

EO SYSTEM OF INDIA



Land & Water Series



IRS 1D

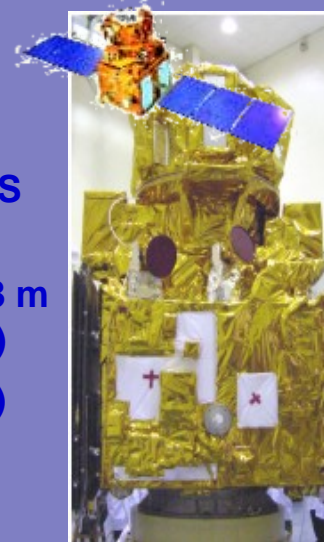


- 3 Cameras LISS-3, PAN & WiFS
- Spatial resolution of 5.8 m (PAN) – 180 m (WiFS)



29 September 1997

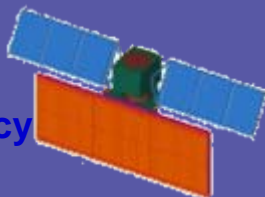
RESOURCESAT -1



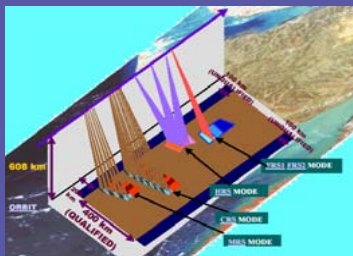
- 3 Cameras (AWiFS, LISS 3, LISS 4)
- Spatial resolution of 5.8 m (LISS 4) – 56 m (AWiFS)
- Swath of 23 km (LISS 4) to 800 km (AWiFS)

17 October 2003

RISAT - 1

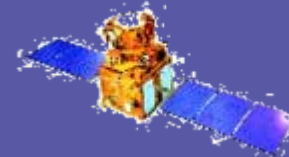


- C band SAR 5.35 GHz frequency
5 imaging modes
- single, dual & quad polarisation
- 18.3 to 48.6° look angle; 20.1-54.5° orbit incidence angle
- In sun-synchronous 500-600km orbit



2008

RESOURCESAT -2



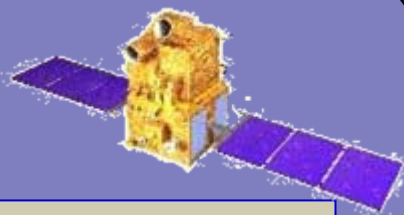
- 3 Cameras (AWiFS, LISS 3, LISS 4)
- Spatial resolution of 5.8 m (LISS 4) – 56 m (AWiFS)
- Swath of 23 km (LISS 4) to 800 km (AWiFS)

2008

Continuity mission for Resourcesat -1



CARTOSAT-1



- 2 panchromatic cameras
- Solid State Recorder (120 Gb)
- Resolution 2.5m; swath: 30 km
- Revisit : 5 days
- Along Track Stereo viewing (+26° / -5°)

Application Potential

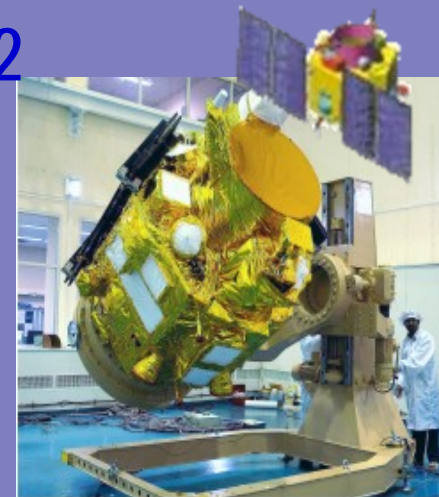


- Large Scale maps
- Thematic maps:
Cadastral overlay
- National Digital
Elevation Model
- Rural Development
- Urban infrastructure
& utility planning

May 5, 2005

CARTOSAT-2

- Panchromatic camera; Step & Stare imaging; steerable along & across
- Resolution: 0.8m
- Swath of 9.6 km
- Solid State Recorder (64 Gb)
- Revisit : 4 days



Camera



Application Potential

- Cadastral level mapping
- Urban & Rural infrastructure dev.
- LIS & GIS applications

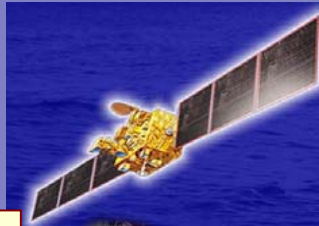
January 10, 2007



Ocean & Atmospheric Series



OCEANSAT-1

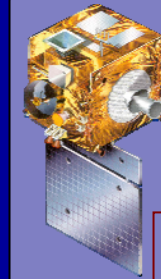


- 8 Spectral Bands
- ~ 360 m Resolution
- 2 Day Repetitivity

OCM

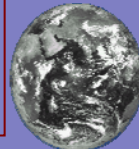
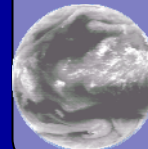
- 4 Freq. Dual Pol. MW Radiometer
- 2 Day Repetitivity

MSMR



Kalpana

INSAT 3A

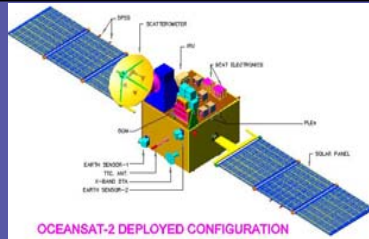


- VHRR Bands Visible, WV & Thermal Channels with resolution of 2 Km for Visible & 8 km for IR
- CCD Camera Bands: VIS, NIR & SWIR with Resolution of 1 km

OCEANSAT-II

OCM

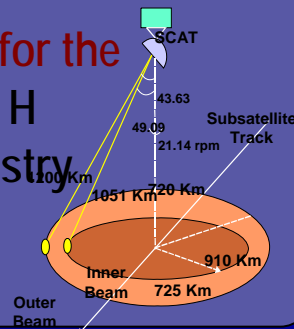
- 8 bands in 400-900 nm
- Resolution: 300-350 m



OCEANSAT-2 DEPLOYED CONFIGURATION

“Radio Occultation Sounder for the Atmosphere (ROSA)” for T & H profiles & Ionospheric chemistry

Ku band Scatterometer

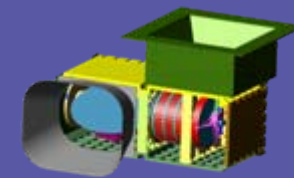
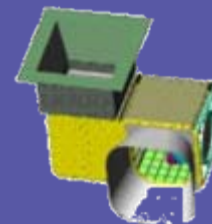


INSAT - 3D

Improved Understanding of Meso-scale Systems

IMAGER
6 Channel
1-8Km Resolution

SOUNDER
19 Channel
10 x 10 Km Resolution

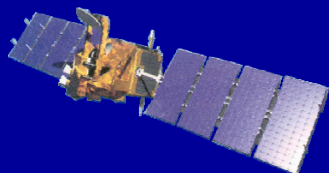




Ocean & Atmospheric Series



Megha Tropiques - A Joint ISRO-CNES Mission

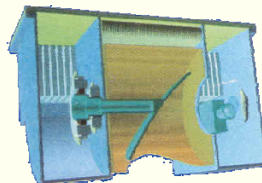


For studying water cycle and energy exchanges to better understand the life cycles of the tropical convective system

Low inclination (20°) for frequent simultaneous observations of tropics

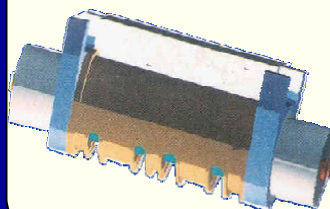
- Water vapour
- Clouds
- Cloud condensed water
- Precipitation
- Evaporation

SAPHIR



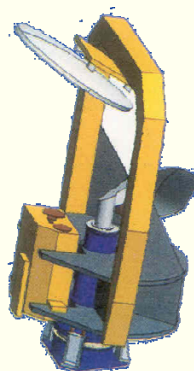
- Water vapour profile
- Six atmospheric layers upto 12 km height
- 10 km Horizontal Resolution

SCARAB



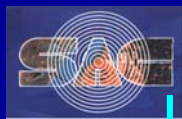
- Outgoing fluxes at TOA
- 40 km Horizontal Resolution

MADRAS



- Precipitation and Cloud properties
- 89 & 157 GHz : ice particles in cloud tops
- 10, 18 & 37 GHz: Cloud Liquid Water and precipitation; Sea Surface Wind speed
- 23 GHz : Integrated water vapour

Leading to SARAL



LISS-IV: sensor to support land parcel level assessment

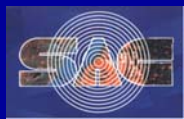




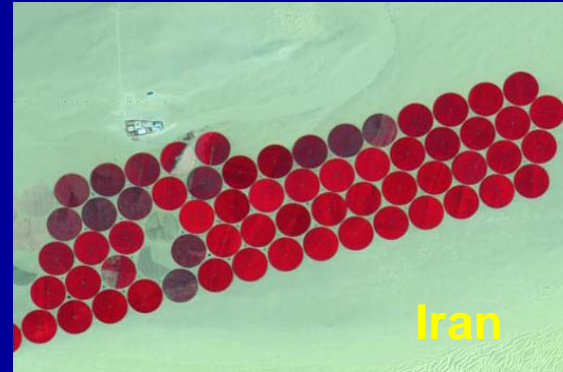
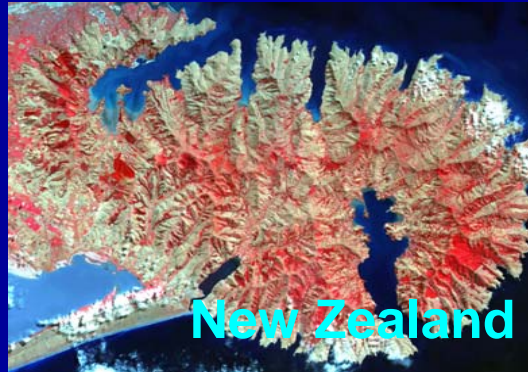
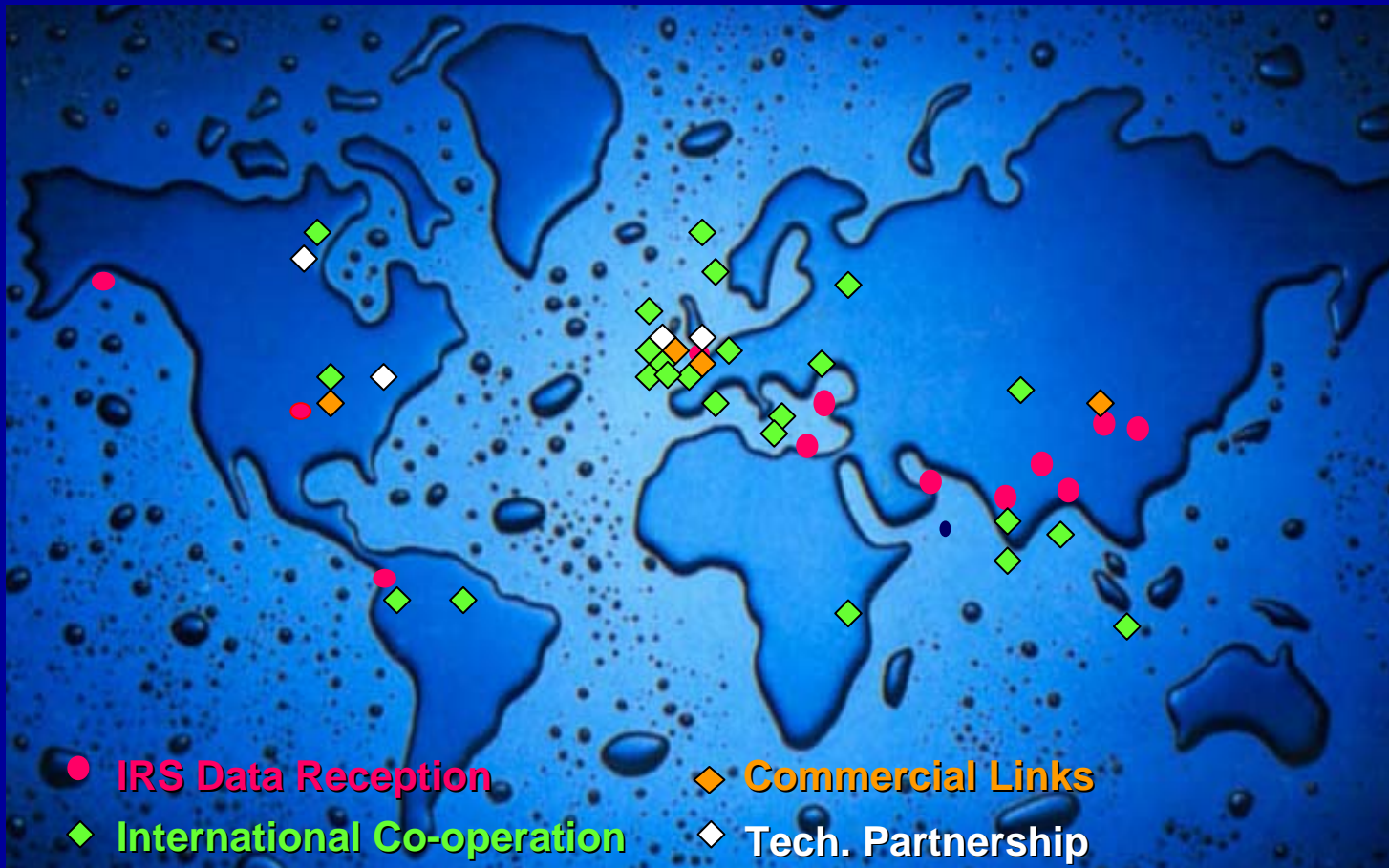
Future Indian Satellite Missions



Satellite	Sensor	Spectral Bands (μm) Frequency (GHz)	Spatial Resol. (m)
RISAT	SAR	5.3 GHz	3-50
Oceansat-2	Scatterometer	13.515 GHz	50 km
	OCM	0.402-0.885 (8 bands)	360
Megha Tropiques	MADRAS	18.7, 23.8, 36.5 GHz 89.0 GHz 157 GHz	40 km 10 km 6 km
	SAPHIR	183.31 \pm 0.2, 1.1, 2.7, 4.2, 6.6, 11GHz	10 km
	ScaRab	0.5-0.7, 0.2-4.0, 0.2-20.0, 10.5-12.5	25 km
INSAT-3D	Imager	6 Channels	1-4km
	Sounder	19 Channels	10 km
TWSAT	Multi-spectral	0.45-0.52 0.52-0.59 0.62-0.68 0.77-0.86	36
GEO-HR- Imager	CCD	VNIR	50
		SWIR	250
		Thermal	1 km
SARAL	Altimeter	35.75 GHz (Ka Band)	-



Global Coverage and Data Availability





Capacity building - Institutional network

Indian Institute of Remote Sensing - Post Graduate Diploma and Degree Courses and short-term training

Centre for Space Science Technology Education for Asia and the Pacific (CSSTEAP) - Post Graduate and Degree

No. of Universities - Post Graduate courses

Space Applications Centre (ISRO) and National Remote Sensing Agency (NRSA) - Project specific On-the-job trainings

UN-ESCAP/SAC(ISRO) Regional Seminar and Group Training on Monitoring and Assessment of Rice Crop in the ESCAP – Organized by SAC

ISRO/ANTRIX - Setting up of RS data reception and Image Analysis and GIS facility, and Training



CSSTEAP HQ, Dehra Dun



IIRS, Dehradun



SAC, Bopal, Ahmedabad



PRL, Ahmedabad



India's International Commitments

International Charter on Space and Major Disasters

- ISRO - a Charter Signatory
- Committed the services of IRS-1C/D, IRS P4, Resourcesat Satellites

Support to UN Agencies

- ESCAP - RESAP implementation (Disaster Management)
- UN OOSA – Action Team VII, DEMISCO Initiatives– SPIDER Network

Capacity Building

- Centre for Space Science & Technology Education for Asia and the Pacific (CSSTE-AP)
- Specialized course on geo-informatics for disaster management (700 International trainees in last 10 years)

Sharing of 'Best Practices'

- India to share the experience and knowledge on disaster management within International Cooperation

Support to Sentinel-Asia, CEOS, GEOSS Initiatives



THANK YOU

