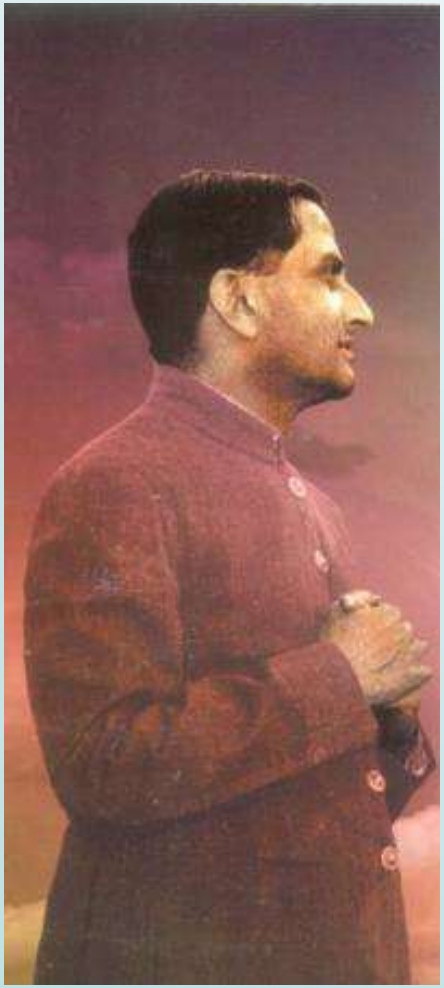
Overview

Indian Space Programme & Space Systems and Satellites for National Development

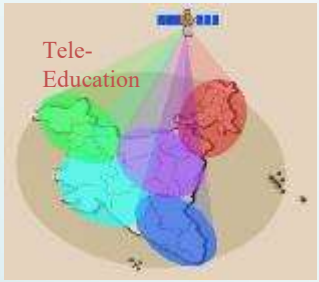
इसरो ISRO

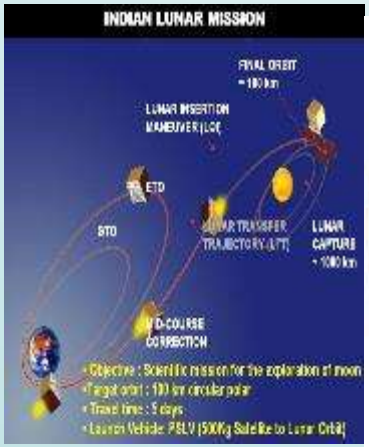
Indian Space Programme : Vision



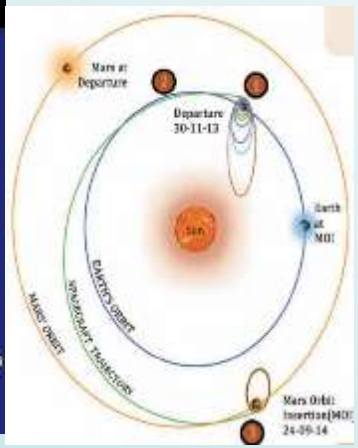
…….Harness space technology for national development, while pursuing space science research and planetary exploration

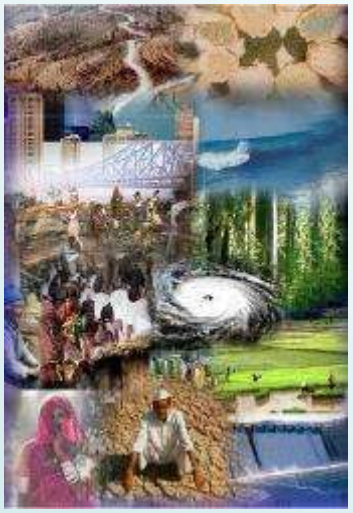
INDEPENDENT ACCESS TO SPACE…..through inclusive growth





MARS Mission





Socio Economic Security

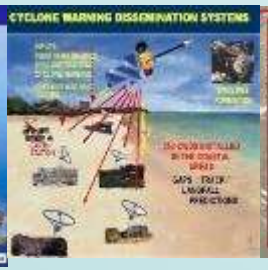
Sustainable Development

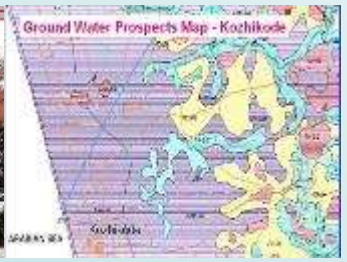
Disaster Risk Reduction

Developmental Governance

Human Resource Development

"..we must be second to none in the application of advanced technologies to the real problems of man and society."





Indian Space Programme: Dimensions

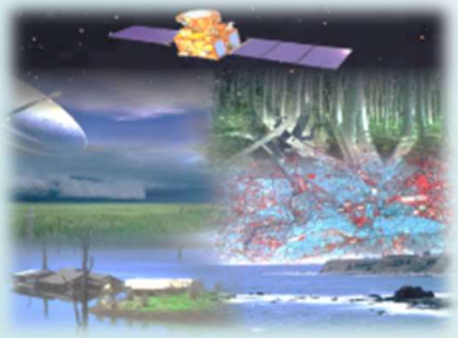
Vision: Harness space technology for national development, while pursuing space science research and planetary exploration

Space Transportation

- PSLV
- GSLV
- Reusable LV
- Modular LV

Space Infrastructure

- Earth Observation
- Communication
- Navigation
- Space Science & Planetary Missions



Capacity building

- Human Resource Development
- Indigenization
- Technical Infrastructure
- International Cooperation
- Industry, Academia,
- Outreach

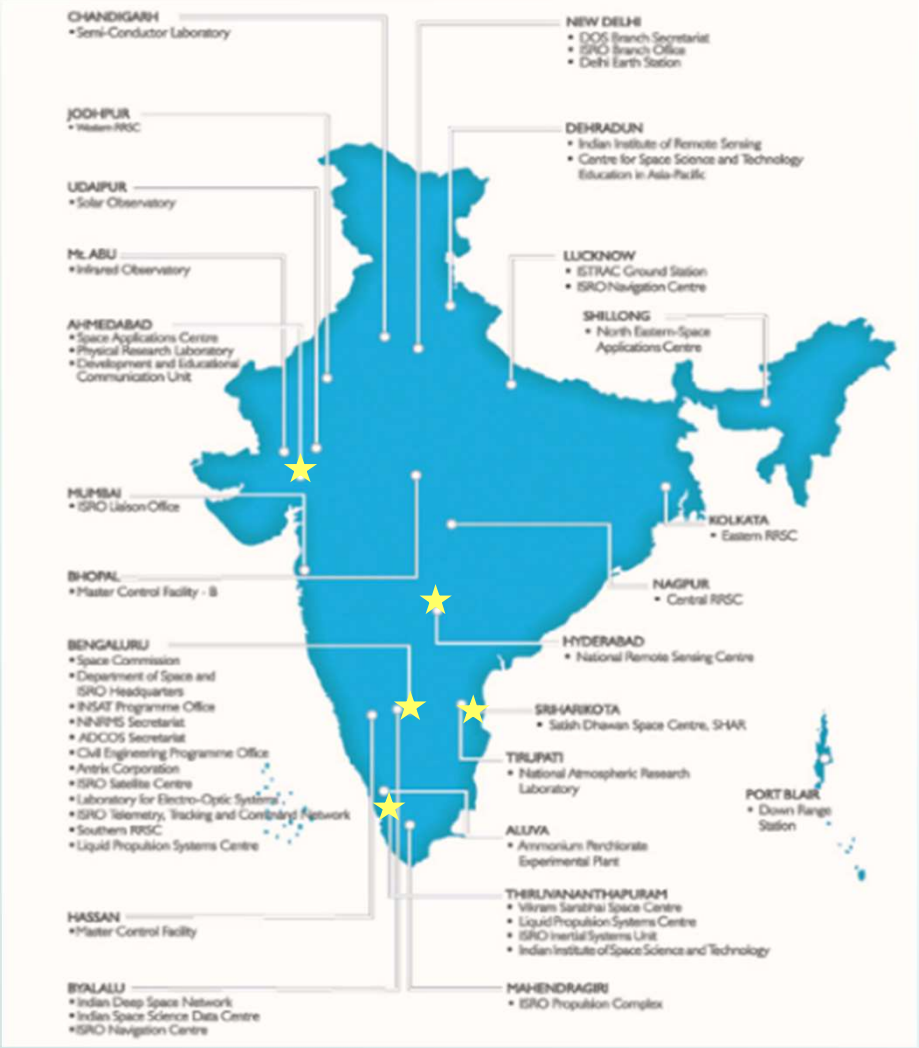
Space Applications

- Socio economic Security, Sustainable Development, DRR & Governance
- Synergistic Applications (EO, SatCom & Navigation)

The Organisation

- Initiated in 1960's (1962 – INCOSPAR; 1969 – ISRO; 1972 - Space Commission & Department of Space)
- 3 National committees coordinate space system establishment and applications:
  - INSAT Coordination Committee (ICC)
  - Planning Committee on National Natural Resources Management System (PC-NNRMS)
  - Advisory Committee for Space Sciences (ADCOS)
- The DOS Secretariat and ISRO Headquarters (with programme offices) are located at Bengaluru.

Location Map



Accomplishments in Space: 191 missions

111 Satellites

- Remote Sensing
- Communication
- Navigation
- Space Science

10 Student satellites

5 Experimental missions

Space Capsule Recovery Experiment

Crew Module Atmospheric Re-entry Experiment

Reusable Launch Vehicle Technology Demonstrator

Scramjet Engine Technology Demonstrator

Crew Escape System at Launchpad

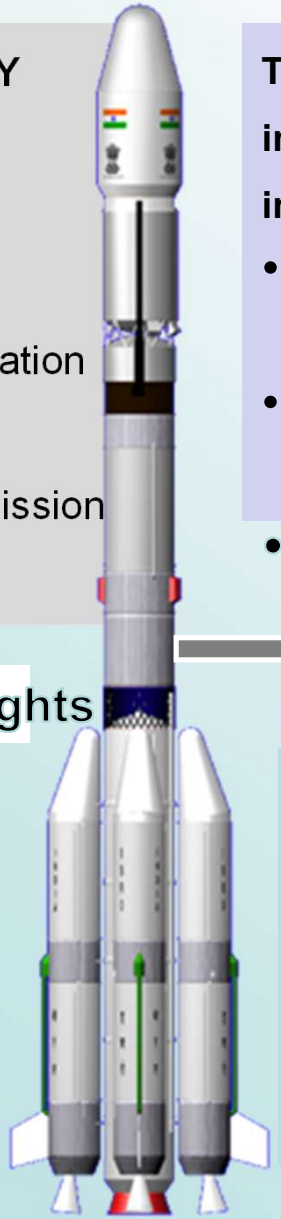
328 Satellites of 33 countries

Launch Vehicles

MISSION CAPABILITY

- SSO
- GTO
- Sub-GTO Orbit
- Low and Mid Inclination Orbits
- Multiple Satellite Mission (104 satellites)

49 Successful Flights



To achieve indigenous capability in launching 2 t class satellites into GTO

- Proven PSLV propulsion modules for the first two stages.
- **Flight proven indigenous cryo Engine for the third Stage**

- 10 Successful Missions

To achieve indigenous capability in launching 5t class satellites into GTO

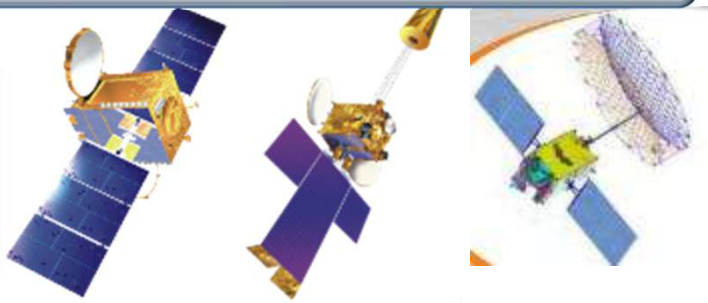
- 5m Payload Fairing
- **2 S-200 + L110 + C-25 Cryo Upper Stage**

- 3 Successful missions

India's Current Space Assets

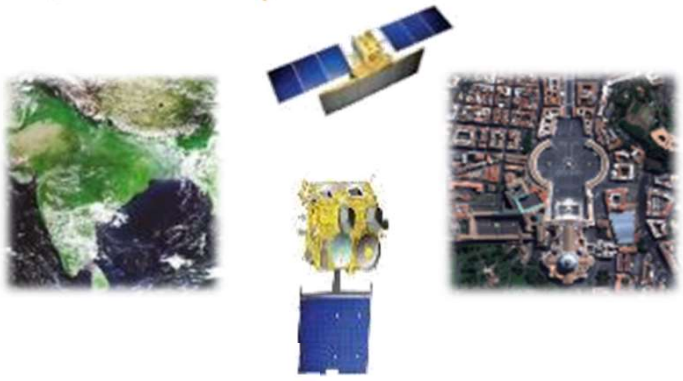
18

- **Communication satellites** (INSAT- 4B and GSAT-6, 7, 7A, 8, 9, 10, 11,12, 14, 15, 16, 17, 18, 19, 29 , 30 & 31)
- **>300 Transponders in C, Ext C & Ku bands**



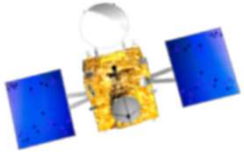
23

- **Remote Sensing satellites**
- **2 in Geo orbit** (INSAT 3D & 3DR)
- **21 in Sun-sync orbit** (RESOURCESAT-1/ 2 & 2A; CARTOSAT-1/ 2/ 2Series (6)/3; RISAT-2/2B/2B1R; OCEANSAT 2; MEGHA-TROPIQUES; SARAL, SCATSAT-1; HySIS, EOS-1)



8

- **Navigation satellites** (IRNSS 1A -1G; 1I)
- **GAGAN Payloads in GSAT 8, 10 & 15**



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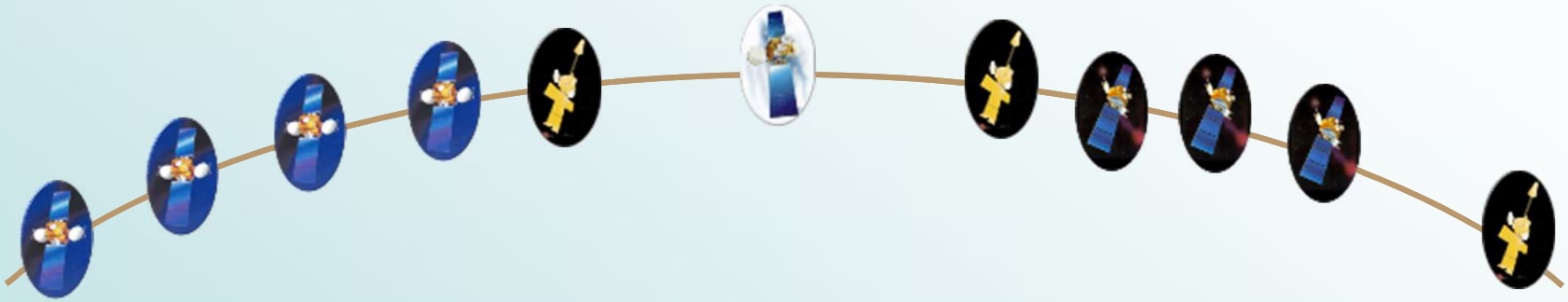
- **Space Science satellites (**MOM, ASTROSAT & Chandrayaan 2**)**

Indian Communication Satellites



18 Communication Satellites

~300 Transponders in Ku, Ka, C, Ext C & S bands

Strengthening Societal Applications

Tele-Education, Dev. Communication/ E-Governance, Telemedicine

Emergency Communication Infrastructure
(Fixed Networks, On-site Deployable, Terminals, Hand-held Devices),

Empowerment at Village level

Satellite Based Services

Satellite Communications

Video Services (DTH and TV Broadcasting)

Connectivity Services (VSAT based)

DTH

ATMs

Oil & Gas (VSAT)

Satellite broadband Network

Inflight connectivity

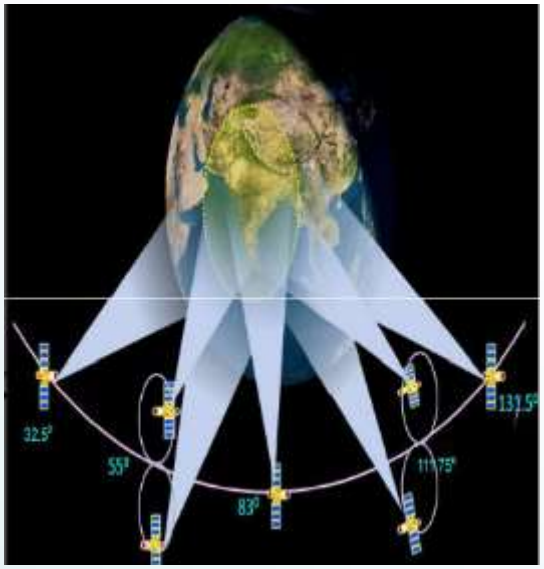
Satellite Navigation – IRNSS & GAGAN

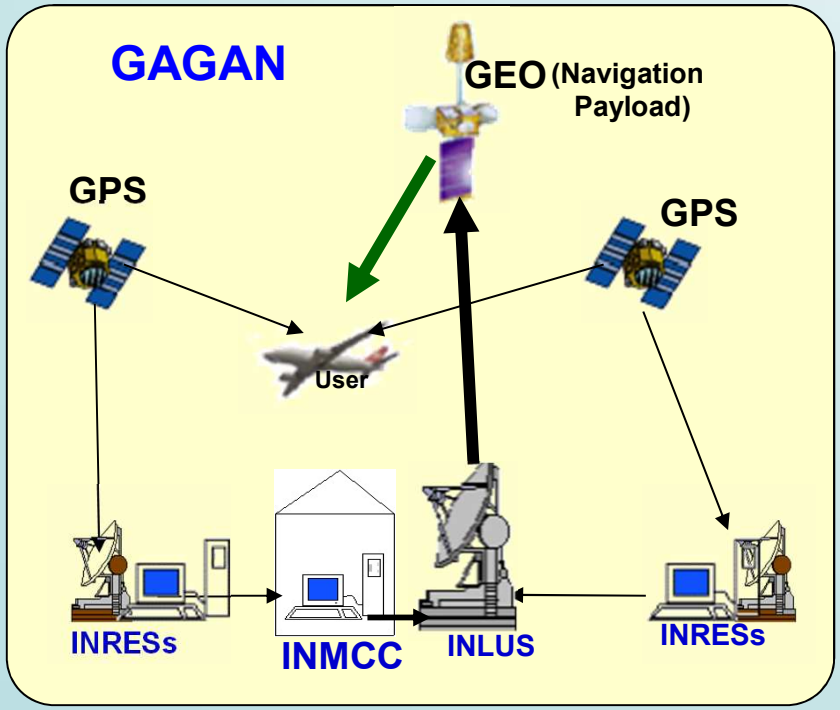
IRNSS

Indian Regional Navigational Satellite System

- Consists of 7 Satellites, 3 in Geo-Stationary orbit and 4 Satellites in GEO Synchronous orbit
- Constellation completed.

✓ Standard Positioning and Restricted Services
✓ L5 & S-band
✓ Position Accuracy : < 5 m
✓ Time Accuracy : < 20 ns





GAGAN: GPS & Geo-Augmented Navigation

- Augmentation of existing Global system: Improved Positioning Accuracies (from 30m to 6m)
- Three payloads in GSAT Satellites
- Applications: Aviation and Non-Aviation

Space Application : Satellite Navigation

SATELLITE-BASED AUGMENTATION OF GPS NAVIGATION SIGNALS

Gagan Payloads in 3 GSATs

- Certified by DGCA - "En-route Navigation" over Indian Airspace
- 4th country to offer Navigation services to aviation sector

NavIC – Navigation With Indian Constellation

Indigenous navigation system

IRNSS

More than 5000 Level Crossings still unmanned on Broad Gauge network !

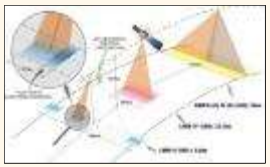

Isro: Trial of sat-based warning system at unmanned rly crossings satisfactory

Times of India 28 May 2018

Current Operational Remote Sensing Capabilities

Natural Resources Inventory & Disaster Management

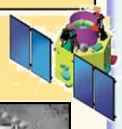
RESOURCESAT- 2 & 2A



- Three tier imaging : 56 m / 23 m / 5.8 m
- Revisit Capability : 03 / 11 / 03 days

Large Scale Mapping, Infrastru. Planning & Cartography

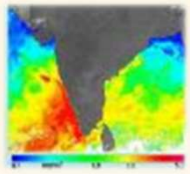
CARTOSAT-1, CARTOSAT-2S, CARTOSAT-3

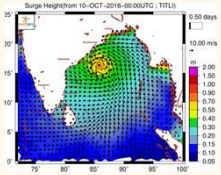


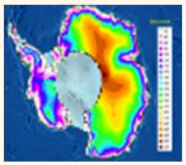
- 2.5 m Stereo imaging
- 1m PAN
- Sub-meter PAN and 1.5 m Multi-spectral

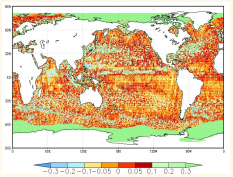
Oceanography

OCEANSAT-2; SARAL; SCATSAT-1





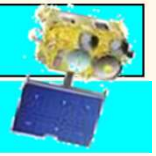


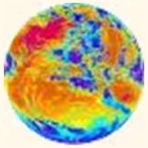


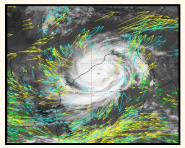
- Ocean Color 360 m with 2 days revisit
- Ocean Altimeter
- Ocean Surface Winds
- Ocean State Forecast

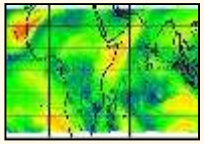
Weather and Climate

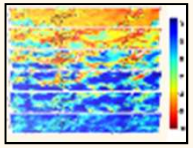
INSAT-3D; INSAT-3DR; MEGHA-TROPIQUES











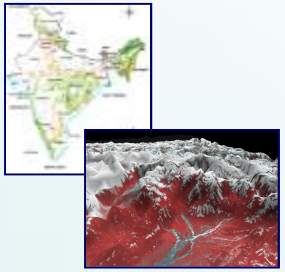
- 6 Channel Imager – 48 images per day
- 19 Channel Sounder – Atm. Profiles
- Temp. & Humidity Profiles
- Radiation Budget
- Radio Occultation

EO Applications for Societal Benefits

Agriculture & Soils

- Crop Production Forecast
- Saline/ Sodic Soils mapping
- Agro-Met Services & Disaster Surveillance (pest, floods, drought)
- Horticulture development

Bio Resources & Environment

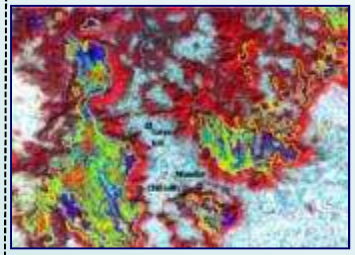


- Forest Cover & Type mapping
- Wetland Inventory & Conservation plans
- Biodiversity Characterization
- Desertification Status mapping
- Coastal, Mangroves, Coral related
- Snow & Glacier studies

Cartography

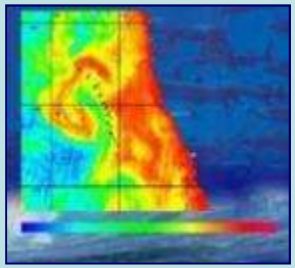
- GCP Library for IRS Data correction
- Large Scale Mapping
- Topo-map updation - Satellite-based
- Digital Elevation Model (Carto-DEM)
- Cadastral Level mapping

Geology & Mineral Resources



- Landslide Hazard Zonation
- Mineral/ Oil Exploration, Mining Areas,
- Seismo-tectonic Studies
- Engineering & Geo-Environmental studies

Ocean and Meteorology

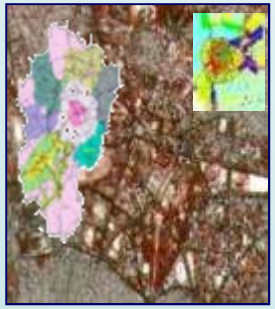


- Ocean Primary Productivity
- Ocean State Forecast (OSF)
- Storm Surge Modeling
- Regional Weather prediction
- Tropical Cyclones & Mesoscale studies
- Extended Range Monsoon Prediction

Rural Development

- National Drinking Water Mission
- Wastelands Mapping/ Updation
- Watershed Development & Monitoring
- Land Records Modernization Plan

EO Applications for Societal Benefits



Urban Development

- Urban Sprawl Mapping of Major Cities
- Master/ Structure Plans
- Comprehensive Dev. Plans (CDP) of selected Cities/ Towns
- Base Map generation for Towns
- National Urban Information System

Water Resources

- Irrigation Infrastructure assessment
- Water Resources Information System
- Command Area/ Irrigation Performance Evaluation
- Snow-melt Run-off Estimation
- Reservoir Capacity Evaluation
- Site Selection for Hydro-Power

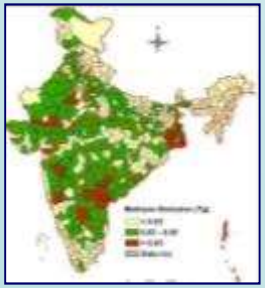
NR Census

- Periodic Inventory of Natural Resources under NR Census Programme:

  Land use/ Land Cover, Soil, Geomorphology, Wetland, Land degradation, Snow & Glaciers, Vegetation

Disaster Management Support

- Operationally addressing various natural disasters like Flood, Cyclone, Drought, Landslide, Earthquake and Forest Fire
- R&D Studies on Early warning Systems, Decision Support Tools

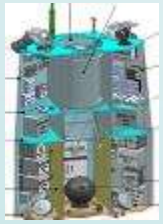


Climate Change Studies

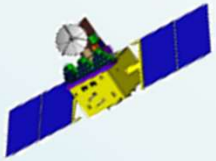
- Mapping the indicators, Monitoring the agents and Modelling the Impact
- Characterisation of climate variables (Land, Atmosphere & Oceans)
- Methane Emission, Timberline study, LU LC Change dynamics, etc.

EO Missions - Near Future

HRSAT-1 (3 Nos.)

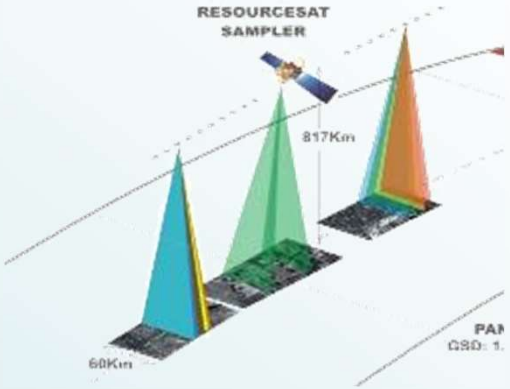


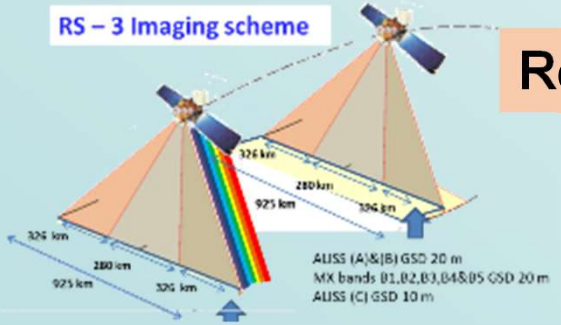
OCEANSAT- 3



GISAT-1

RISAT-1A

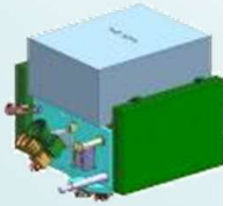




Resourcesat - 3

Resourcesat Sampler – 3S

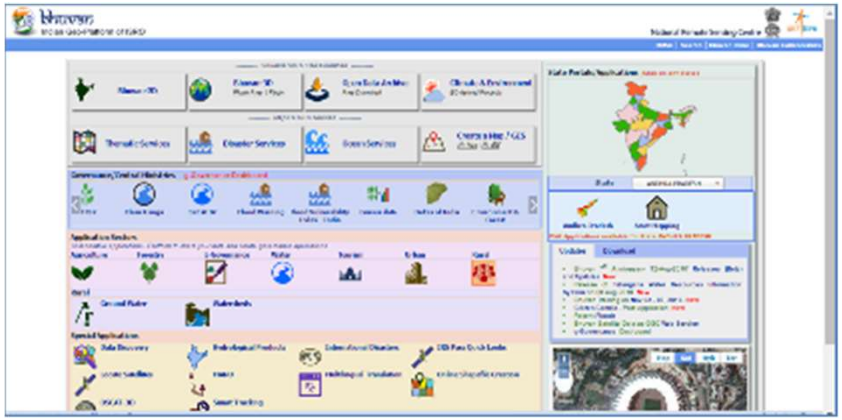
NISAR



TRISHNA

Bhuvan – Geospatial Platform of ISRO / INDIA

(https://bhuvan.nrsc.gov.in/)



NOEDA Downloads

2011 till date > 1.2 Million

https://mosdac.gov.in

Meteorological & Oceanographic Satellite Data Archival Centre

(Indian Store-house for Meteorological and Oceanographic Data)

https://vedas.sac.gov.in

Visualisation of Earth observation Data and Archival System

Platform to motivate young researchers and academia to showcase their spatio-temporal analytical skills using Indian EO data & build geo-spatial applications.

Capacity Building

CSSTE-AP

- Centre for Space Science & Technology Education in Asia & the Pacific – UN Centre for AP region
- Offers 9 Months PG Courses - RS & GIS; SATCOM, SATMET & Space Science

IIST

- Indian Institute of Space Science & Technology
- Setup in Sep 2007, the first professional Space University in India
- Offers UG, PG & Doctoral programmes in Aerospace Engineering, Avionics and Physical Sciences

IIRS

- Indian Institute of Remote Sensing, Dehradun
- Offers M.Tech and M.Sc., courses
- Also offers PG Diploma, Certificate, Customized Courses

2975 officials from 109 Countries are offered training by IIRS & CSSTEAP

NewSpace India Limted
(A CPSE under Department of Space)

Khalifa Stadium area, Qatar.
High resolution Multi-spectral Image of Cartosat 3 acquired on 28-Dec-2019 (Sub meter resolution)