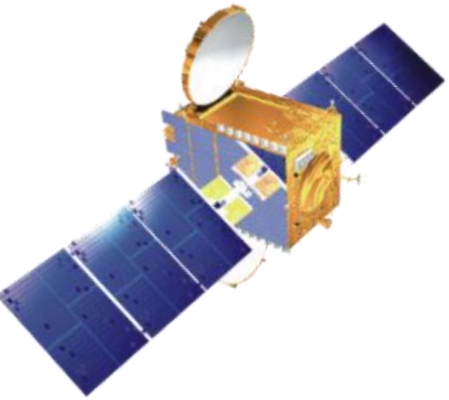


सत्यमेव जयते

Government of India
Department of Space

Touching Lives : Satellite applications for services to Society

By

Dr. SV Sharma

Deputy Director, SPA, ISRO Satellite Centre

ISAC
ISRO Satellite Centre
October, 2015

INDIAN SPACE PROGRAMME

Indian Space Vision- Shared, Nurtured and enriched over the decades

People Centric
Application Driven

Space science
& Exploration

Space Applications

Exploration
Satellites

Earth Observation
Satellites

Navigation
Satellites

Communication
Satellites

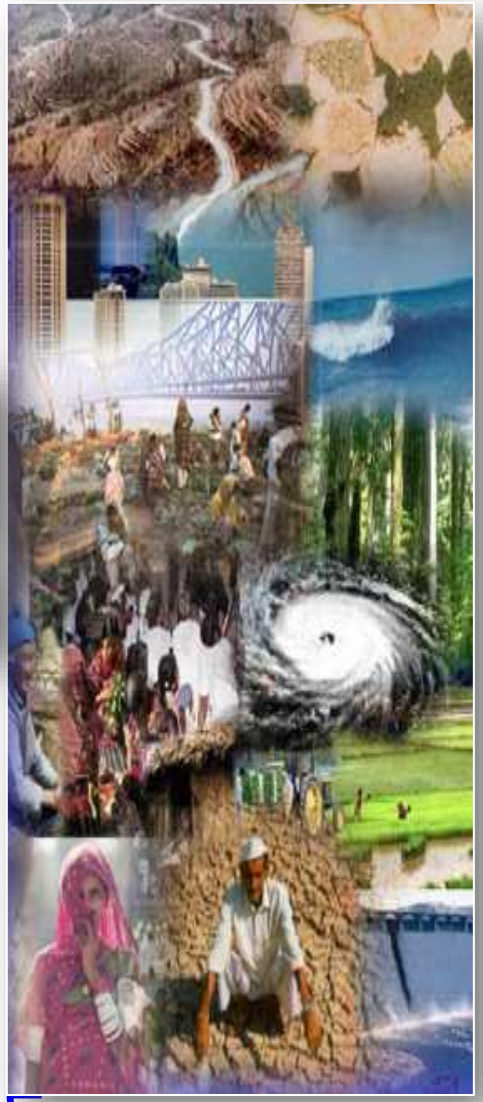
PSLV

GSLV

SATELLITE APPLICATIONS : BENEFITS TO THE SOCIETY

Satellites play a vital role in transforming the lives of human mankind. The benefits of satellites are tremendous in the areas of :

1. Agriculture
2. Energy & Environment
3. Infrastructure Planning
4. Water Resources
5. Developmental Planning
6. Communication
7. Navigation
8. Weather & Disaster Management
9. Health & Education
10. Space Science – Quest for Knowledge



Satellite Benefits : Agriculture

Satellite based Images are used by various ministries like Agriculture, Textiles, Fertilisers, Food & Public distribution and Commerce for :

1. National Crop Forecast
2. Pre-harvest Conditions for Crop production assessment
3. Multiple Crop Production Forecasting of Major Crops - Generation of Soil Fertility maps
4. Groundwater Mapping
5. Digital Soil Mapping (*Present availability 1:50,000 scale)*
6. Identification of Silkworm food plants (Mulberry)
7. SILKS (**S**ericulture **I**nformation **L**inkages & **K**nowledge **S**ystems) Developed by ISRO - Identification of Potential areas for development of silkworm food plants

Agriculture

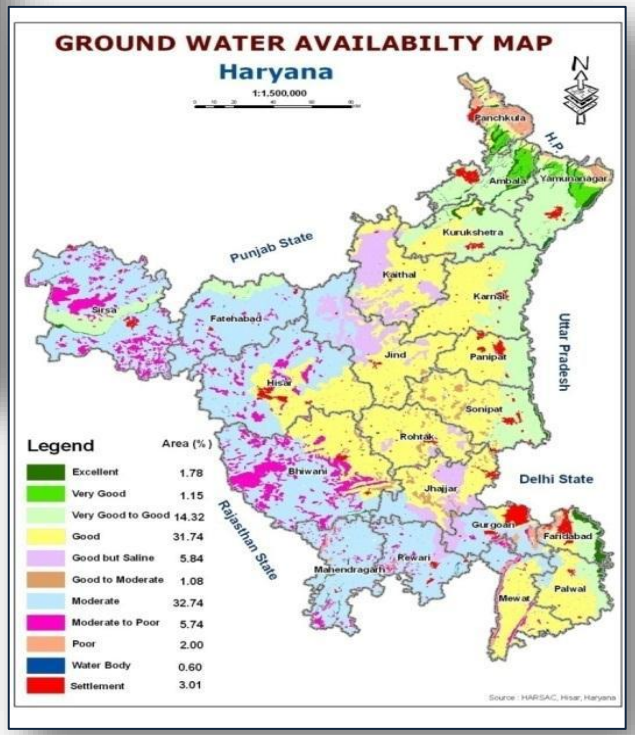
Silkworms

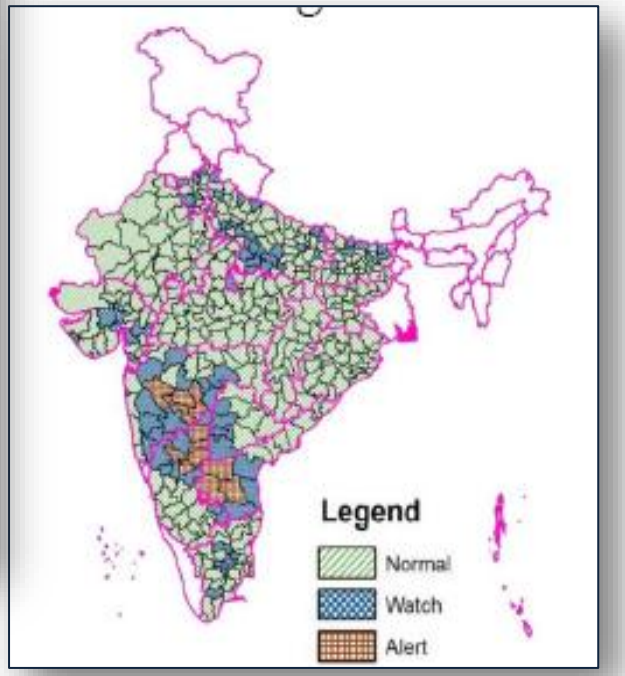
Satellite Benefits : Agriculture

Soil Mapping

Agricultural Drought Assessment Mapping

Ground Water Availability mapping





Crop acreage & production estimation

Satellite Benefits : Energy & Environment

Satellite based Images are used by various ministries/Departments like Biotechnology, Power, New & Renewable Energy , Mines , Petroleum & Natural Gas for :

Forest

1. **Natural resource management :**
   - Forest & wildlife
   - Biodiversity and bio-prospecting
   - Desertification
   - Snow and glaciers
   - Wetlands
   - Climate change
2. **Environment impact assessment :**
   - Tsunami studies,
   - Coastal dynamics
   - Monitoring of volcanic activities
3. **Mine Mapping:**
   - Geo-morphological & lineament mapping for mining
   - Regional Survey maps
   - Surveillance for land reclamation and coal mine fires

Mining

Satellite Benefits : Energy & Environment

Satellite based Images are used by various ministries/Departments like Biotechnology, Power, New & Renewable Energy , Mines , Petroleum & Natural Gas for :

4. **Power Sector**:
   - Site identification and survey for power projects
   - Transmission line route selection & Identification of route for pipeline and drilling locations, Monitoring & hazard detection for pipelines
   - Geo-scientific surveys

Power Sector

5. **Energy Sector:**
   - Wind Resource Atlas,
   - capacity of reservoirs and rivers for hydro power projects

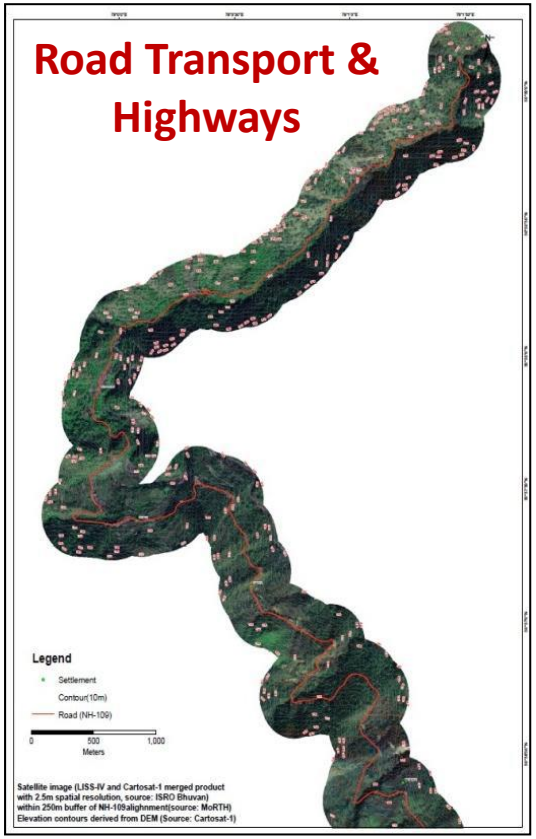
Energy Sector

6. **Environment:**
   - Forest Cover/Type mapping, Forest fire alert system (near real time)
   - MOEFCC–Bhuvan Portal: Information on land use,
   - wastelands and land degradation
   - Mapping & monitoring of protected areas & coastal
   - zones
   - Radio-telemetry of wild fauna

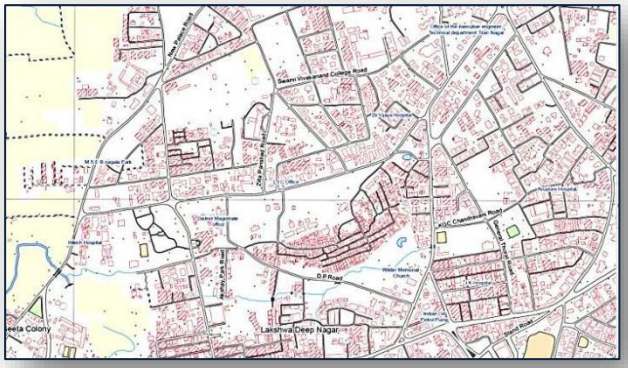
Satellite Benefits : Infrastructure Planning

Satellite based Images are extensively used for Infrastructure Planning in the areas of:

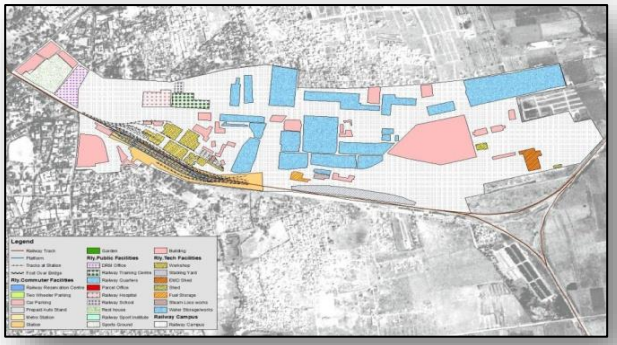
1. **Urban development:**
   - National Urban Information System
   - GIS based Planning
2. **Indian Railways**
   - Alignments in Project Design
   - SATCOM for Communication
3. **Road Transport & Highways**
   - Highway Alignments
   - Designing Ring Roads and Bypasses
4. **Rural Development**



Urban Development



Indian Railways



Satellite Benefits : Infrastructure Planning

Satellite based Images are extensively used for Infrastructure Planning in the areas of:

4.Tourism & Culture

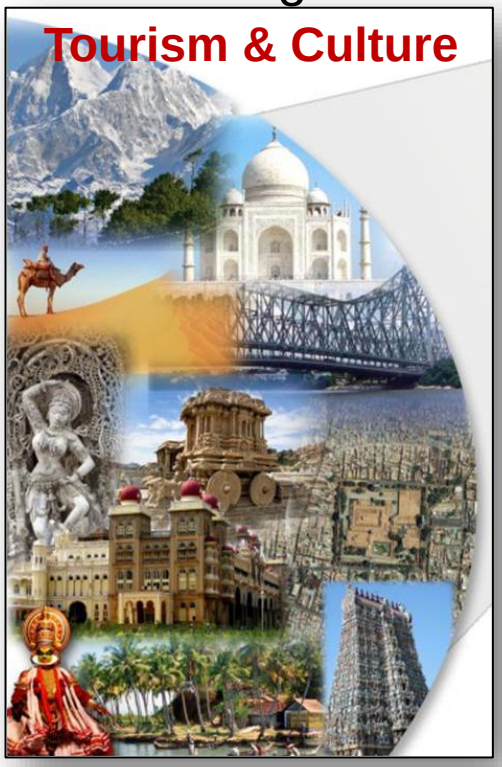
- GIS Based Tourism Information Systems
- World Heritage Site Management Plan (HAMPI, NALANDA)

5. Industrial Policy Promotion

- Infrastructure Planning for Industrial Nodes

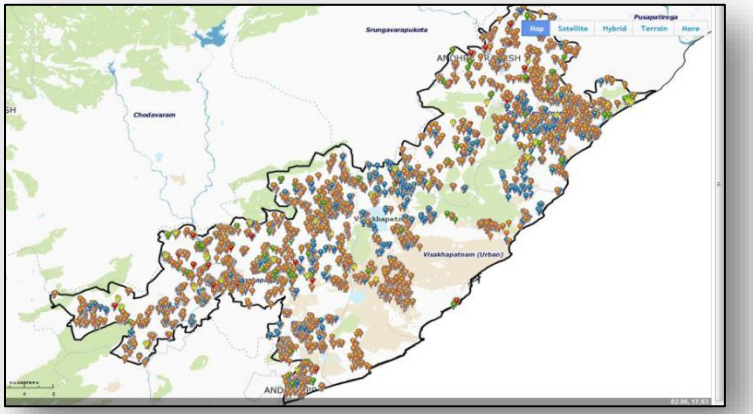
6.Housing and Urban Poverty Alleviation.

- Geo Spatial Support for Slum redevelopment



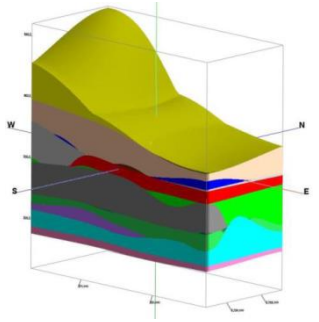
Industrial Planning

Urban poverty Alleviation

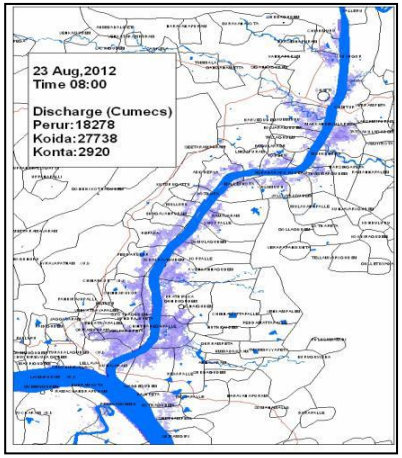


Satellite Benefits : Water Resources

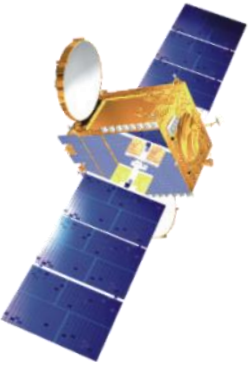
Satellite based Images are extensively used by Ministry of Water Resources, River Development & Ganga Rejuvenation , Ministry of Drinking Water and Sanitation , Ministry of Tribal Affairs etc for -



- Water Resources Information System (India-WRIS)
- Assessment of water resources
- 3D Aquifer mapping integrating ground water information with satellite derived spatial layers
- Flood Forecasting and Flood Prone Area Imaging
- Assessment of Irrigation Potential Utility
- Sustainable Management of Fishery resources:
  - Potential Fishing Zone information (Marine)
  - Water bodies & ground water prospects mapping
  - Weather assessment, forecasting & Forewarning
  - Real time monitoring & tracking of fishing vessels
- Land use maps for fodder lands for animal husbandry and dairy.



Satellite Benefits : Communication



BROADCAST

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

Broadcast Services

COMMUNICATION

- Speech Circuits on Trunk Routes
- VSAT Connectivity

Communication

METEOROLOGY & OTHERS

- Weather Forecasting
- Search and Rescue
- Mobile Satellite Service
- Satellite Navigation

Meteorology

Satellite Benefits : Navigation

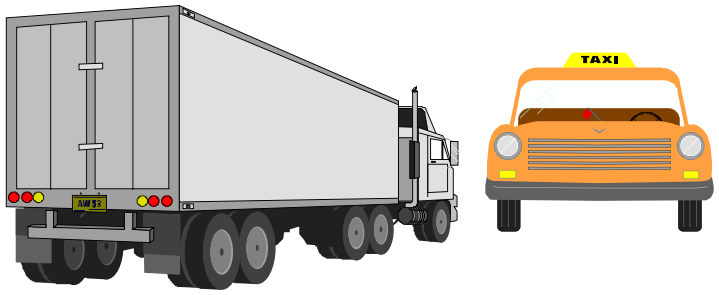
- Satellite linked aircraft tracking system for densely packing aircraft during ascent and descent
- Tracking and location system for helicopters and small aircrafts
- Tracking fishing vessels using satellite links via embedded chips
- Monitoring of oil spills in eco-sensitive areas using radar based imaging
- Indigenous navigation system for public at large to replace Global Positioning System (GPS)

Maritime

Aviation

Intelligent Vehicle Systems

Positive Train Control



Fleet Management

Satellite Benefits : Weather & Disaster Management

Satellites play a vital role in Weather Forecasting, Disaster Management and Mitigation Activities.

Weather, Cyclone, Tsunami, Earthquake:

- weather & ocean services; Multi-hazard early warning and glacial monitoring.
- Annual Economic Benefit from Agro-meterological Advisories and Potential Fishery Zone Advisories are estimated to be **~50,000 Cr. and 34,000 Cr.** respectively. (NCEAR, 2011).

Flood

- Near real time flood inundation mapping, Flood hazard zonation, Glacial Lake Outburst Flood (GLOF) studies

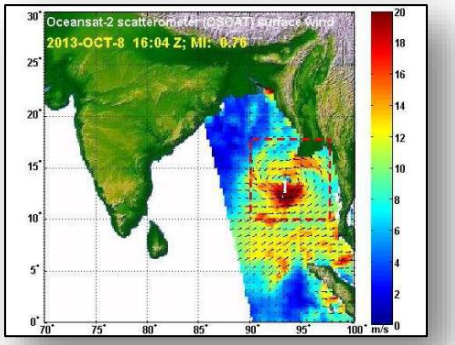
Landslides

- Landslide inventory/ susceptibility and geological/ structural mapping.

Forest Fire

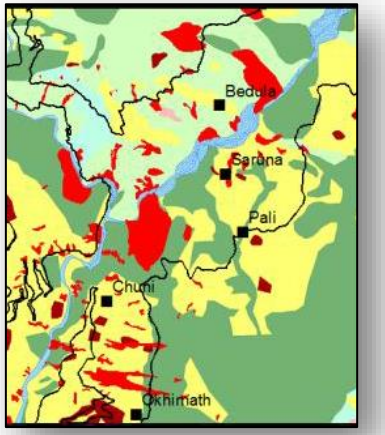
- Operational space based monitoring & dissemination of fire alerts since 2006. Daily 4 observations of active forest fires from Bhuvan Geo-portal.

Cyclone



Flood

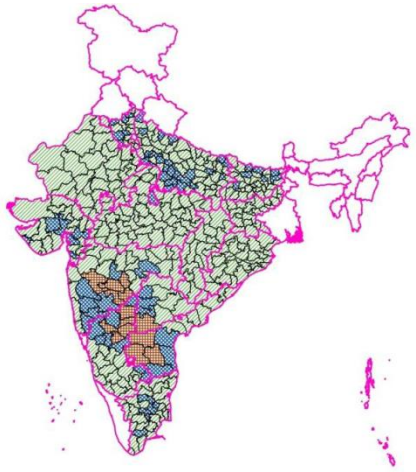
Landslides



Satellite Benefits : Weather & Disaster Management

Satellites play a vital role in Weather Forecasting, Disaster Management and Mitigation Activities. They are used by Ministry of Earth Sciences, Water resources, Mines, Environment & Forests , Agriculture & Cooperation , Home Affairs.

Drought Assessment Map



Drought

- Fortnightly/ Monthly District Level Agricultural Drought Assessment for 14 states.
- Large number of Remote Sensing based Indices are used for Drought Assessment.

Disaster Response

- Aerospace Products & Services are being utilised for Disaster Response and Mitigation, NDEM database for online visualisation and analysis.
- Satellite based Communication network for Emergency Communication.

Cyclone Phailin,Orissa

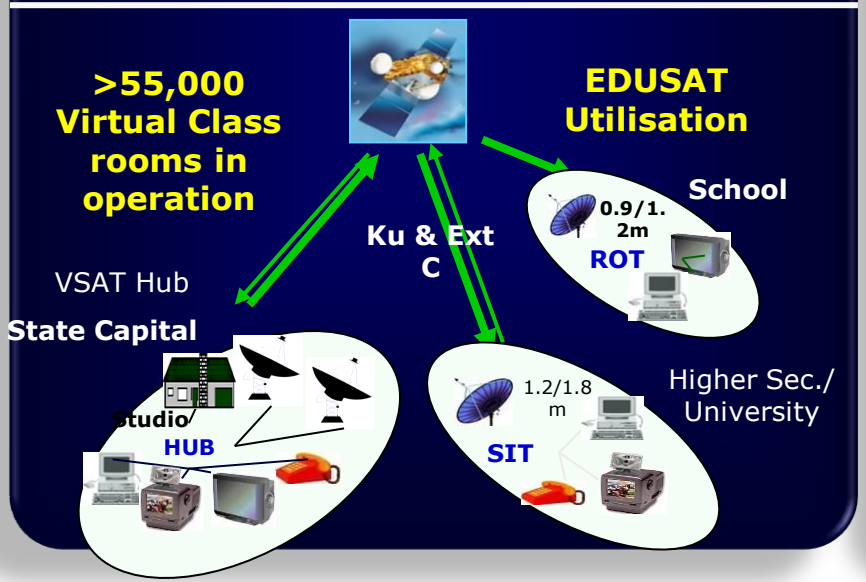
Case: Indian Ocean Tsunami 2004 & Orissa Cyclone Phailin, 2013

- Satellite data and flood inundation maps in GIS platform extensively used for Decision Support and pinpoint air dropping operation during floods.
- During Cyclone Phailin Satellite data helped in reducing the risks.

Satellite Benefits : Health & Education

Tele-Education

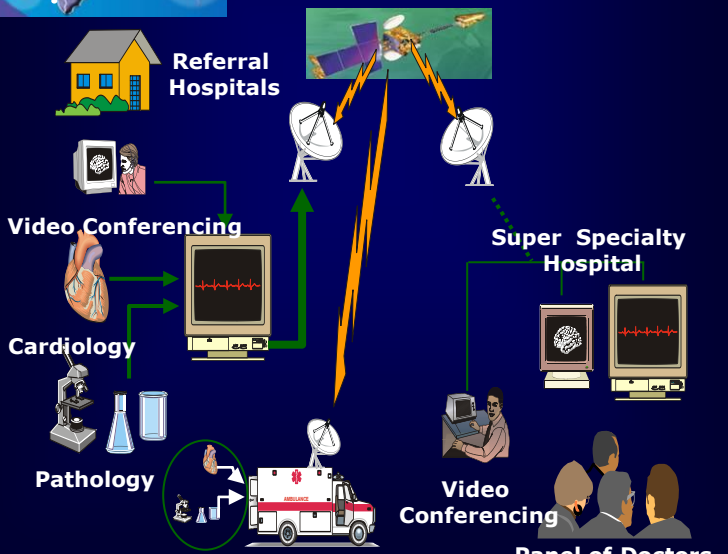
- Training & Development Communication Channel (TDCC - 1995)
- Jhabua Development Communications Project (JDCP - 1996)
- GRAMSAT Pilot Project (GPP)



10 Lakh students benefited across 26 states & 3 union territories

Tele-Medicine

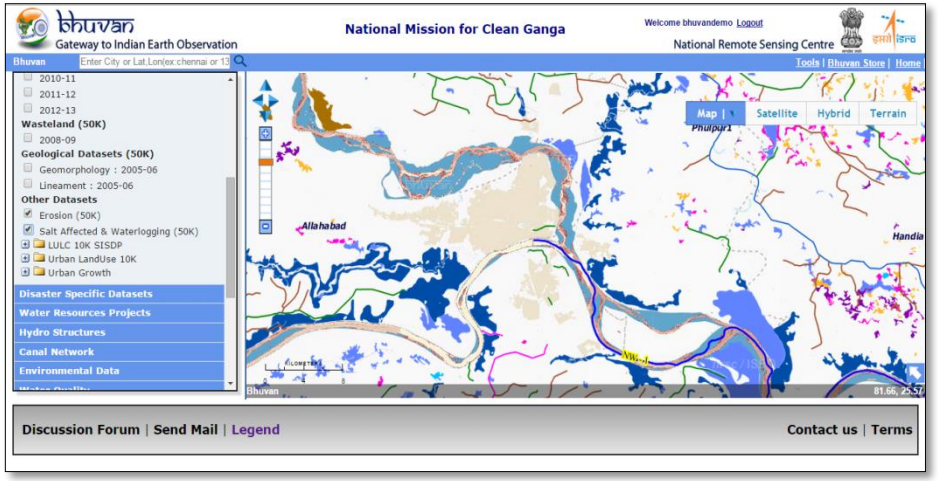
- >384 Hospitals
- ~235 Dist/ Rural
- 60 Super Specialty
- *> 4 Lakh patients treated*



18 mobile telemedicine units & 60 speciality hospitals

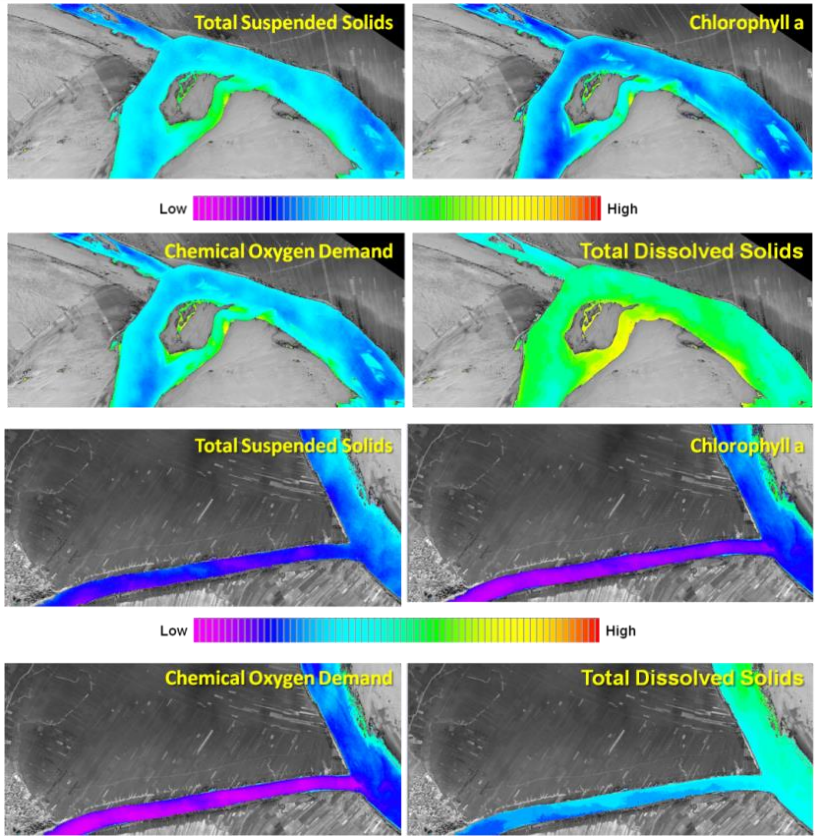
DEDICATED SATELLITE BASED SERVICES IN THE AREAS OF EDUCATION & HEALTH SECTORS

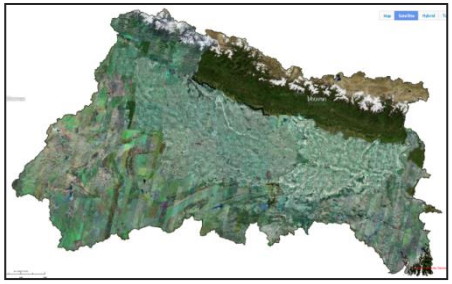
Space Technology Support for National Mission for Clean Ganga



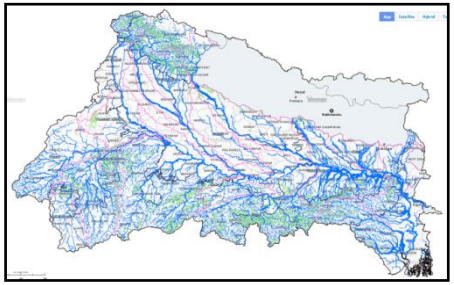
Comprehensive database for entire basin
Water Quality Monitoring and Evaluation
Geomorphological Monitoring & Evaluation
Hydrological Monitoring & Evaluation
Bioresources Monitoring & Evaluation

Water Quality

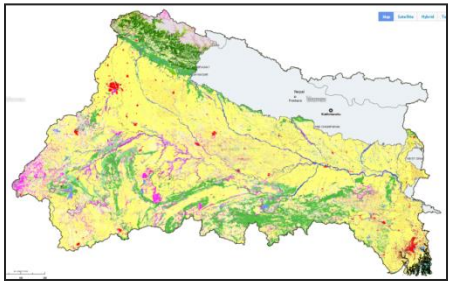




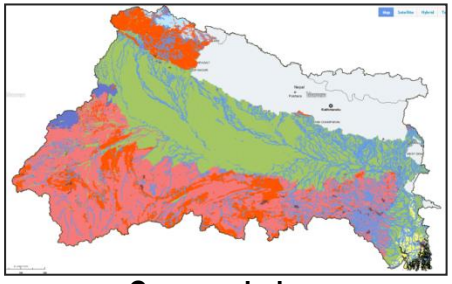
Satellite image



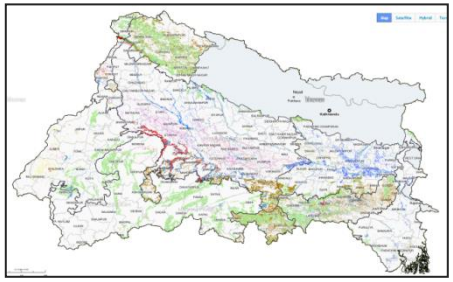
Drainage Network



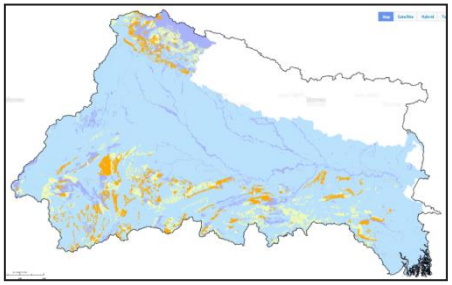
Landuse / Landcover



Geomorphology



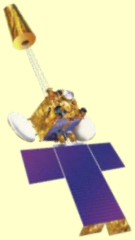
Erosion & Salt affected areas



Soil Depth

Supporting Neighbours

Satellite for SAARC region



- Configuration being finalised.
- Conference in India on benefits of Space Technology.

Satellite data support:

- International Disaster Charter – 141 datasets for 34 events in 2014 (24 countries)
- Sentinel Asia – data support to 7 countries in 2014
- ASEAN – data support for resource assessment
- UN-SPIDER - Disaster data support

SAARC STROM (Severe Thunderstorms Observations and Regional Modeling)

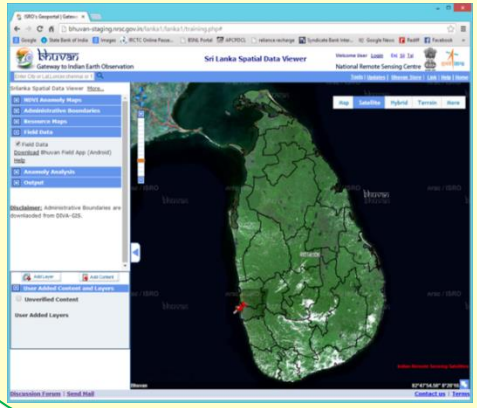
- Assistance to establish a network of weather stations in SAARC countries
- AWS – Bhutan (10), Bangladesh (24), Nepal (16)
- GPS Sonde – Bangladesh (1), Bhutan (1), Nepal (2)
- DWR – Nepal (1)

CSSTE-AP

Capacity building through Centre for Space Science and Technology Education for Asia and Pacific region

- 1400 participants from 34 Countries of Asia-Pacific region
- 29 participants from 18 countries outside this region

UN-ESCAP & ISRO Initiative on Sri Lanka Drought Mechanism



- Software for Drought Monitoring System-Sri Lanka (DMS-SL) developed.
- Five assessments done
- Organized two training programmes

12TH FYP PROGRAMME PROFILE (2012 – 2017)

Total Missions : 58 (Satellites: 33 Launch vehicles: 25)

MISSIONS	2012-13	2013-14	2014-15	2015-16	2016-17	2017- 18
EARTH OBSERVATION SATELLITES	SARAL		CARTO-2C	RESOR-2A CARTO-2D	OCEAN-3 CARTO-3 GISAT	RISAT-1A SCATSAT-1
COMMUNICATION & NAVIGATION SATELLITES	IRNSS-1 GSAT-14	IRNSS-2 IRNSS-3 GSAT-6	IRNSS-4 IRNSS-5 IRNSS-6	IRNSS-7 GSAT-9	GSAT-6A GSAT– 19E GSAT-11S GSAT-Ka	GSAT-7A INSAT-3DR GSAT– 20 GSAT-21(P) (satellite procured)
Procured Launch Service	INSAT-3D GSAT-10	GSAT-7 GSAT-15	GSAT-16 GSAT-11	GSAT-17 GSAT-18		
SPACE SCIENCE & PLANETARY EXPLORATION SATELLITES		ASTROSAT MARS	CHANDRAYAAN-2		ADITYA	MARS-2
INDIAN LAUNCH VEHICLES	C20 C21 C22 D5 X1 Exp	C23 C24 C25 C26 D6	C27 C28 C29 C30 F08	C31 C32 C33 F09	C34 C35 C36 F10 F11 D1	C37 F12 F13 D2
S/C TO BE REALISED PER YEAR	5	7	7	6	8	7

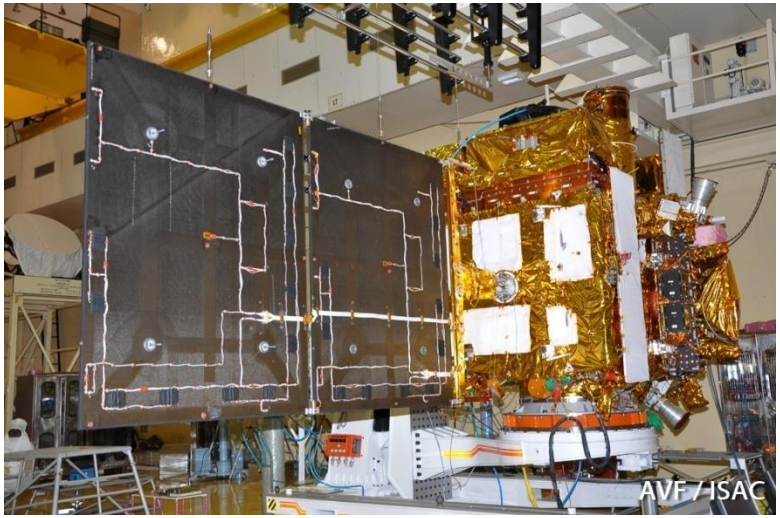
PSLV GSLV GSLV-MkIII

ONGOING PROJECTS @ ISITE CLEANROOM

GSAT-6: GLIMPSE OF ACTIVITIES

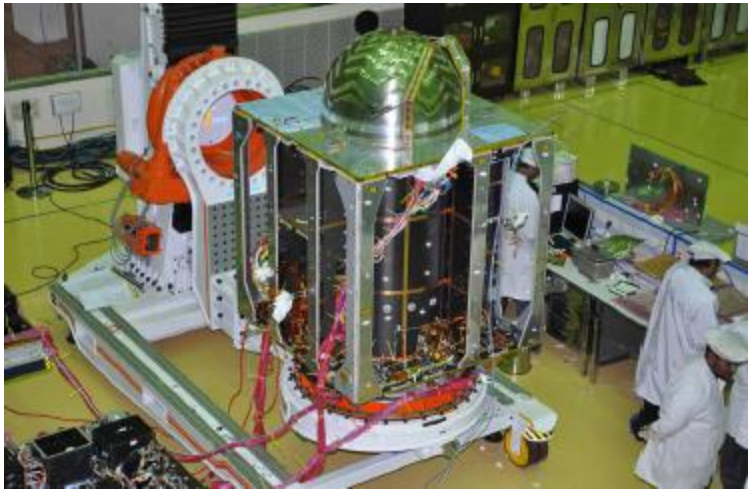
ONGOING PROJECTS @ ISAC CLEANROOM

ASTROSAT: POST THERMOVAC ACTIVITIES IN PROGRESS



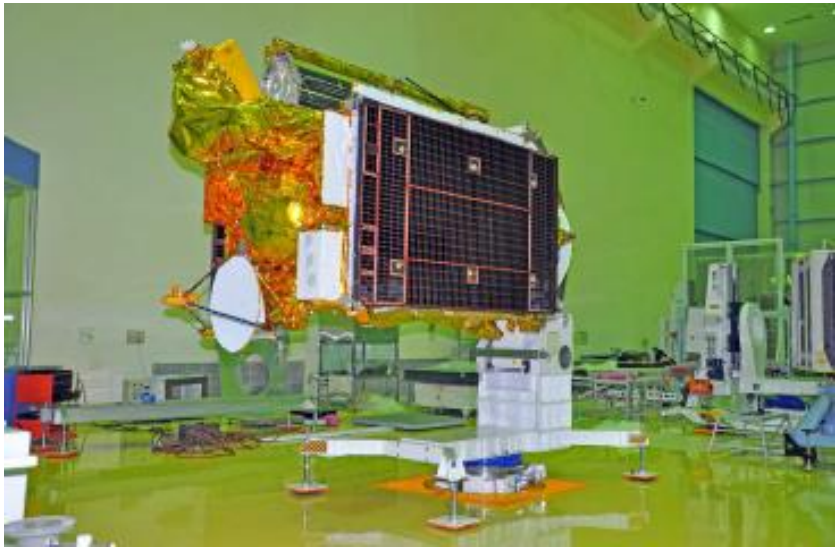
ONGOING PROJECTS @ ISITE CLEANROOM

IRNSS-1E:POST THERMOVAC ACTIVITIES IN PROGRESS



ONGOING PROJECTS @ ISITE CLEANROOM

GSAT-6: POST THERMOVAC ACTIVITIES IN PROGRESS



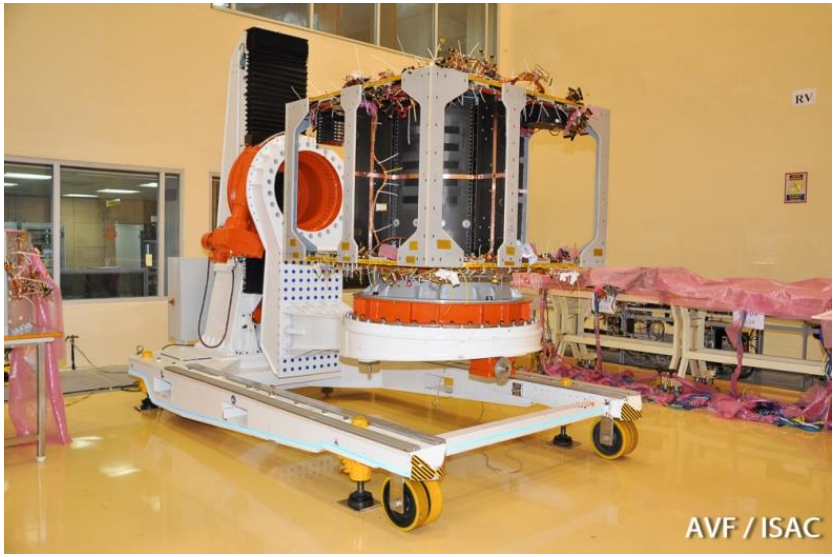
ONGOING PROJECTS @ ISITE CLEANROOM

GSAT-15: SPACECRAFT POST THERMOVAC PHASE IN PROGRESS

ONGOING PROJECTS @ ISAC CLEANROOM

CARTOSAT-2C: AIT ACTIVITIES IN PROGRESS

RESOURCESAT-2A: AIT ACTIVITIES IN PROGRESS



INFRASTRUCTURE DEVELOPMENT

Hypersonic Wind Tunnel Test Facility

Plasma Wind Tunnel Facility

Multi Object Tracking Radar

Li-ion battery

Titanium Sponge Plant

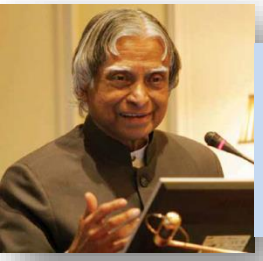
Wind Profiler

Conclusions

Space Programme in India began with a vision as ....

"... we are convinced that 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." - *Dr Vikram A Sarabhai*

- Today, Indian Space Programme has been providing **"Solutions to the problems of Common man"** and the future missions have a special focus on varied applications.
- Indian Space systems have been serving the key utility sectors of the economy thus enabling solutions to socio economic problems.
- India is one among the few space fairing nations in the world.
- In the endeavour of nation building, Indian space assets hold a key to the future



All the Scientists & Technologists should work in appropriate region, specifically rural technologies to transform Indian Rural Sector.

Dr. A P J Abdul Kalam

THANK YOU