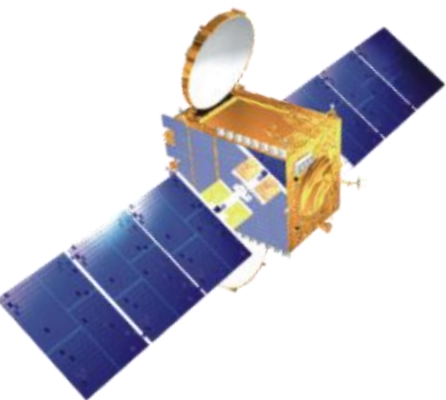




Government of India
Department of Space

Touching Lives : Satellite applications for services to Society

By

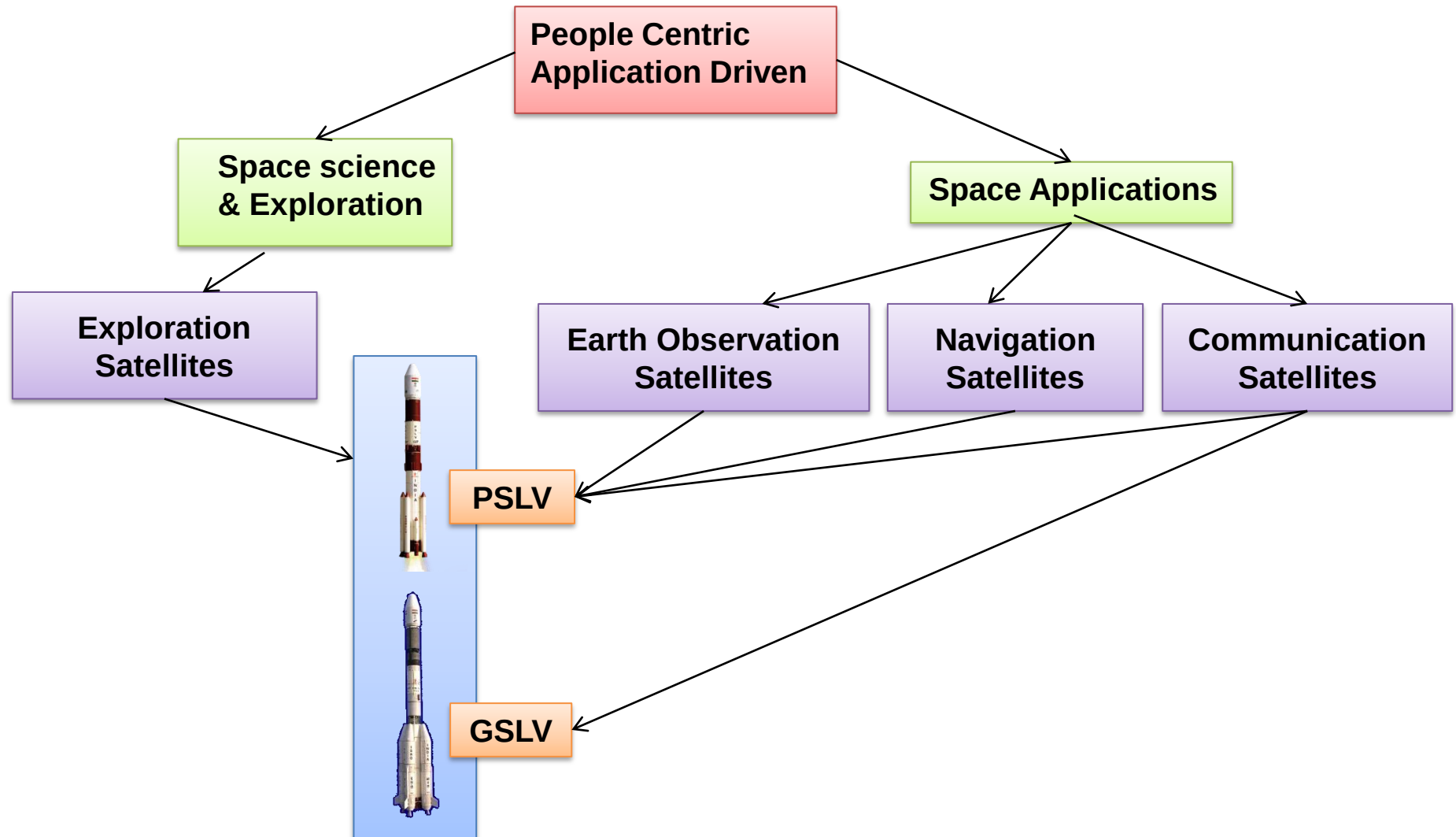
Dr. SV Sharma

Deputy Director, SPA, ISRO Satellite Centre



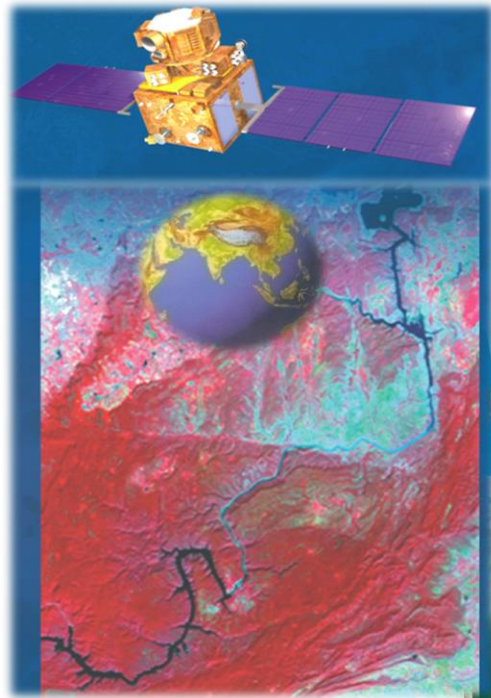
Indian Space Programme

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



Application Driven EO Programme

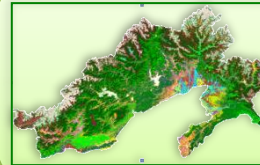
in support of National Priorities.....



Food Security



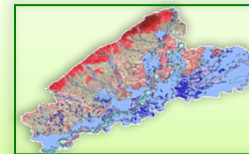
Water Security



**Environmental &
Energy Security**



**Infrastructure &
Developmental
Planning**



**Disaster
Management**



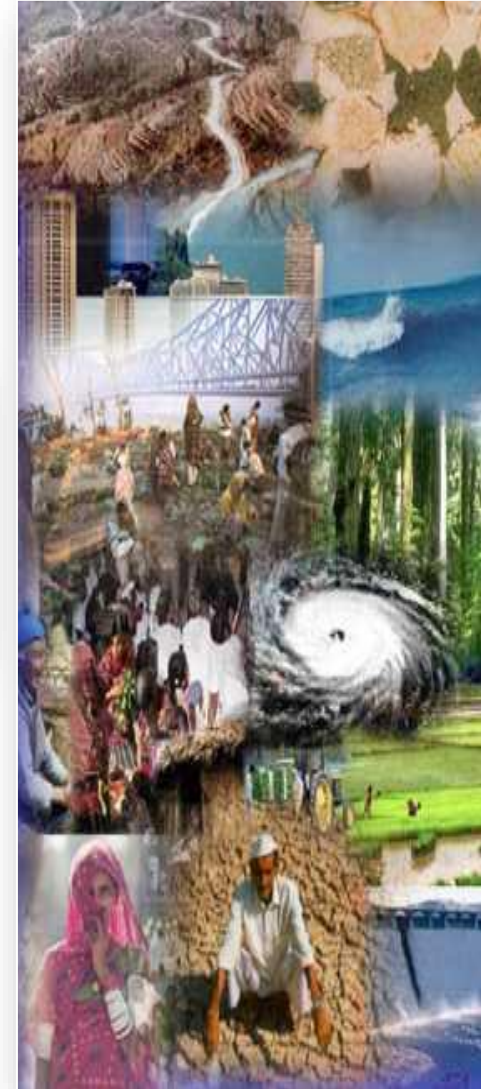
**Weather &
Climate**



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 (Sericulture Information Linkages & Knowledge Systems)** Developed by ISRO - Identification of Potential areas for development of silkworm food plants

Agriculture

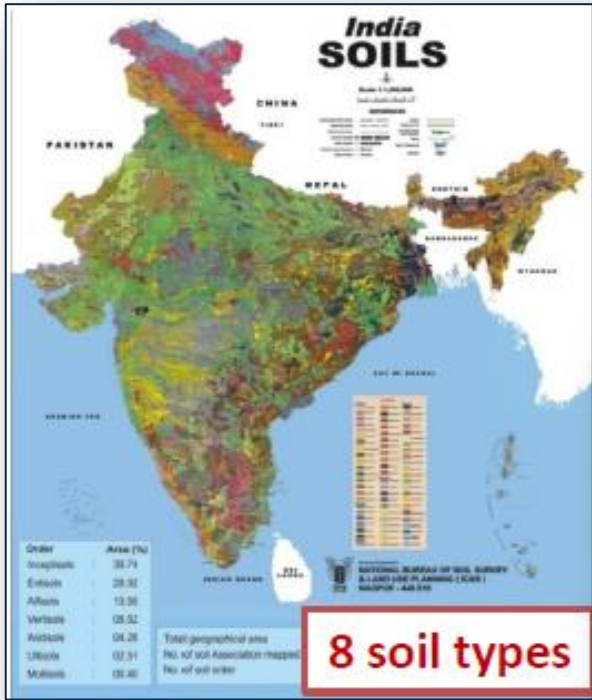


Silkworms



Satellite Benefits : Agriculture

Soil Mapping



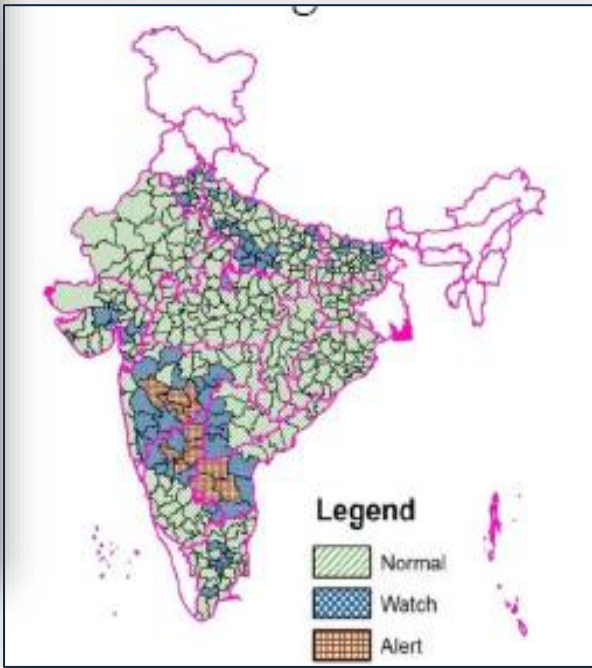
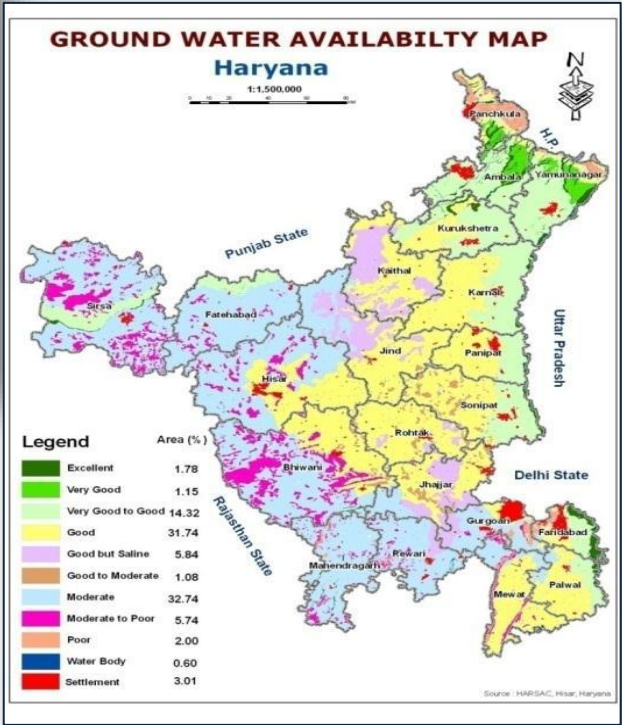
Crop acreage & production estimation



Agricultural Drought Assessment Mapping



Ground Water Availability mapping



Satellite Benefits : **Energy & Environment**

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

1. Natural resource management :

- Forest & wildlife
- Biodiversity and bio-prospecting
- Desertification
- Snow and glaciers
- Wetlands
- Climate change

Forest



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

5. Energy Sector:

- Wind Resource Atlas,
- capacity of reservoirs and rivers for hydro power projects

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

Power Sector



Energy Sector



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

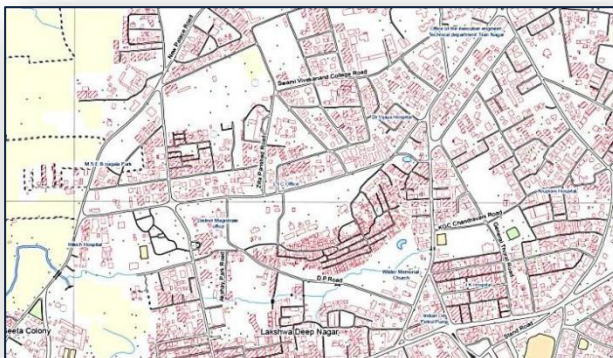
- Alignments in Project Design
- SATCOM for Communication

3. Road Transport & Highways

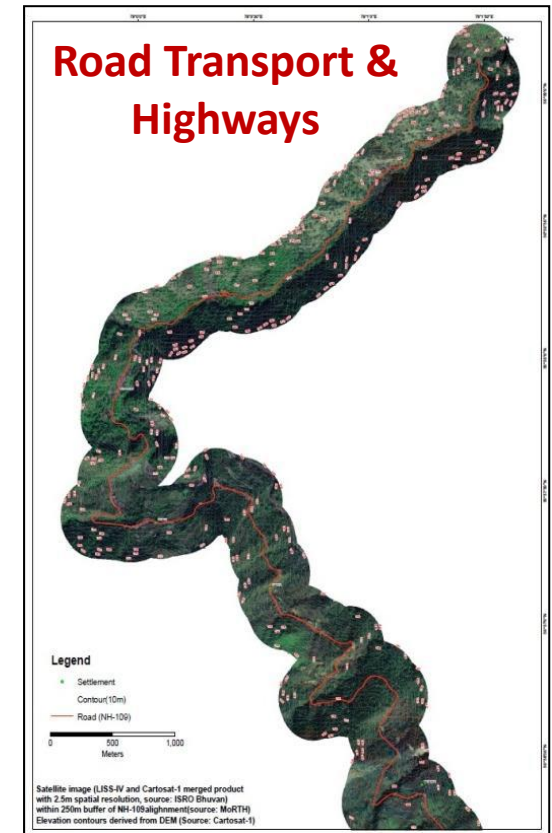
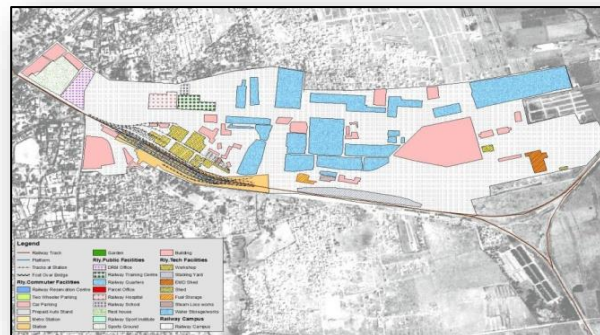
- Highway Alignments
- Designing Ring Roads and Bypasses

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

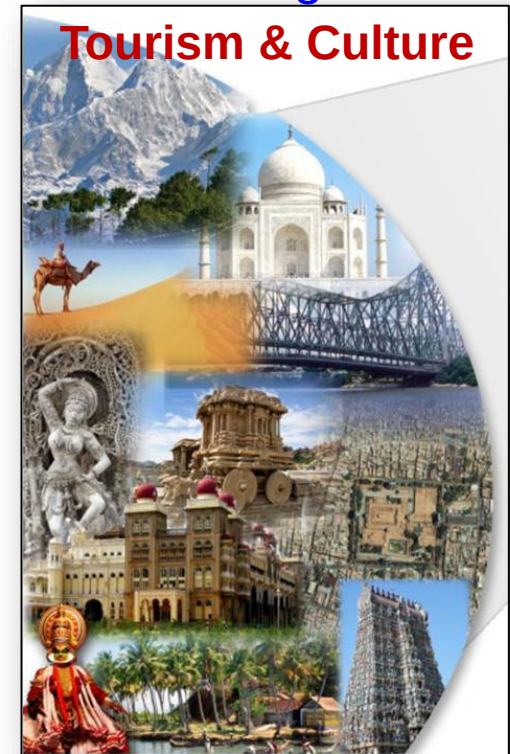
- GIS Based Tourism Information Systems
- World Heritage Site Management Plan (HAMPI, NALANDA)

5. Industrial Policy Promotion

- Infrastructure Planning for Industrial Nodes

6. Housing and Urban Poverty Alleviation.

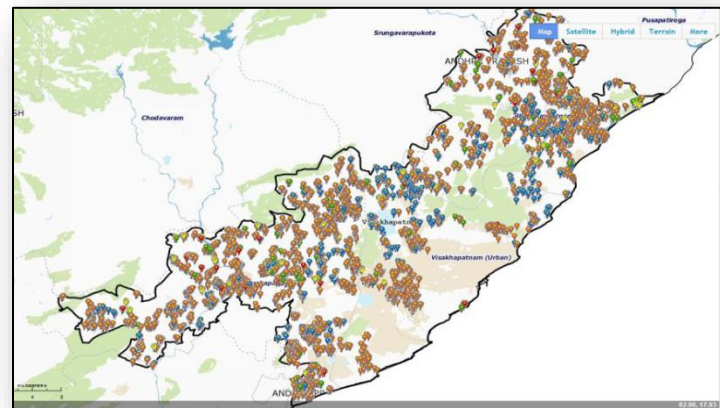
- Geo Spatial Support for Slum redevelopment



Industrial Planning



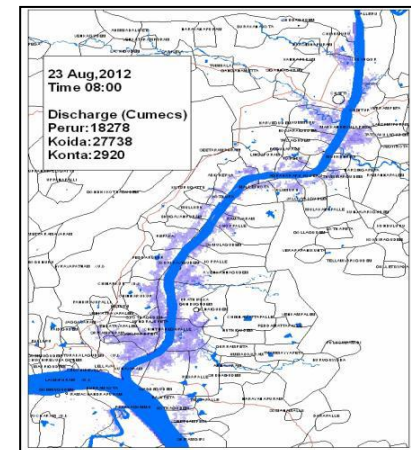
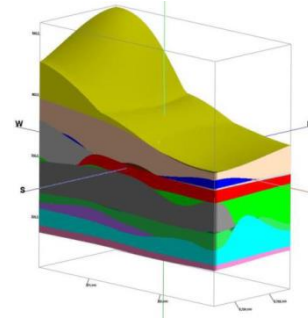
Urban poverty Alleviation



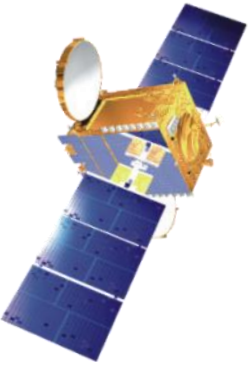
Satellite Benefits : Water Resources

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



COMMUNICATION

- Speech Circuits on Trunk Routes
- VSAT Connectivity



METEOROLOGY & OTHERS

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

Broadcast Services



Communication



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)



Positive Train Control



Fleet Management

Maritime



Aviation



Intelligent Vehicle Systems



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-meteorological 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

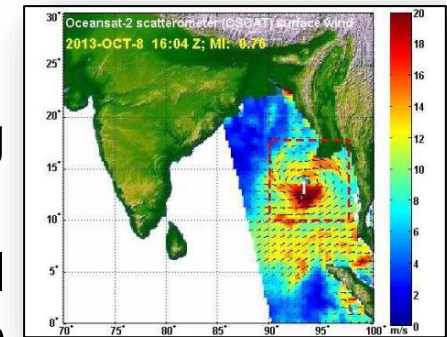
Landslides

- 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.

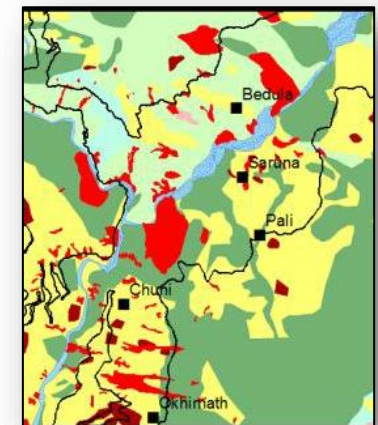
Cyclone



Flood



Landslides



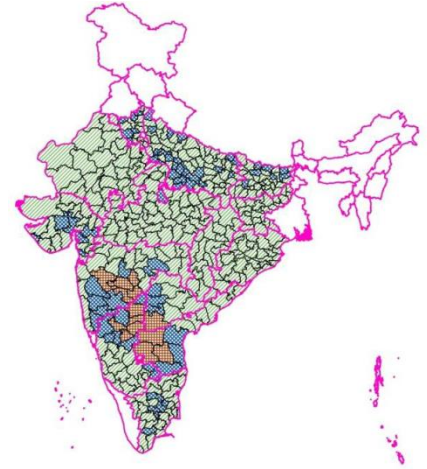
Satellite Benefits : Weather & Disaster Management

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

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

Drought Assessment Map



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

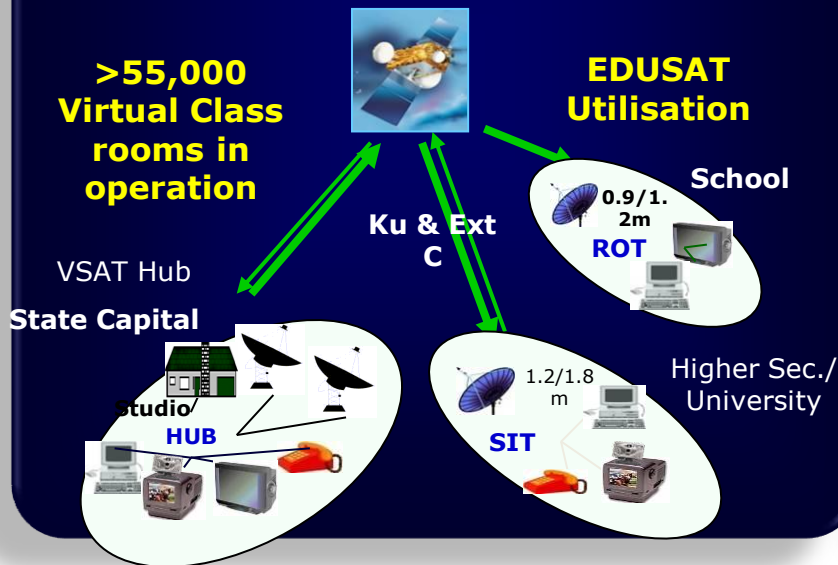
- Satellite data and flood inundation maps in GIS platform extensively used for Decision Support and pinpoint air dropping operation during floods.
- During Cyclone Phailin Satellite data helped in reducing the risks.



Satellite Benefits : Health & Education

Tele-Education

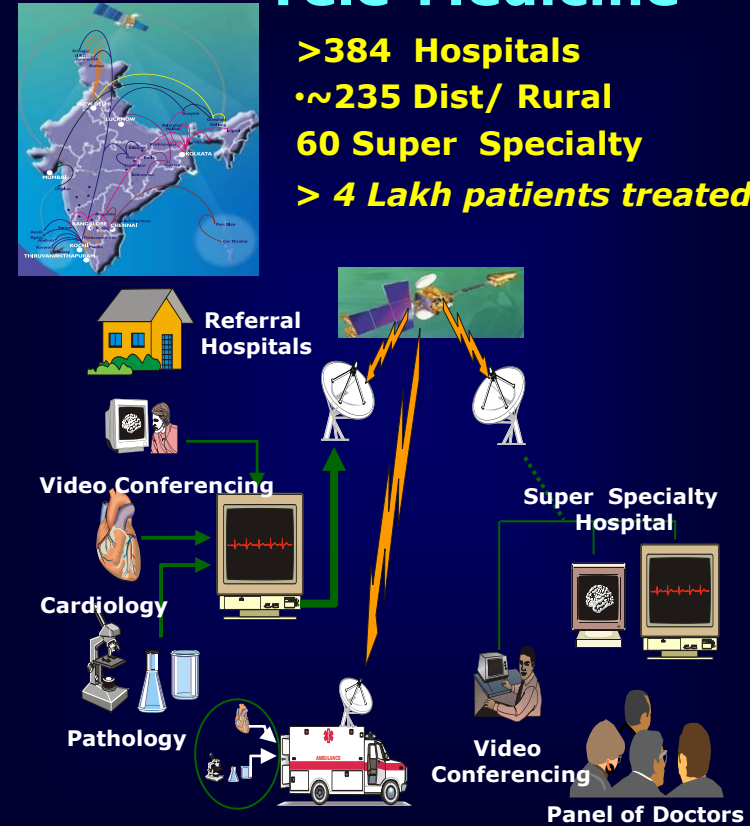
- Training & Development Communication Channel (TDCC - 1995)
- Jhabua Development Communications Project (JDCP - 1996)
- GRAMSAT Pilot Project (GPP)



10 Lakh students benefited across
26 states & 3 union territories

Tele-Medicine

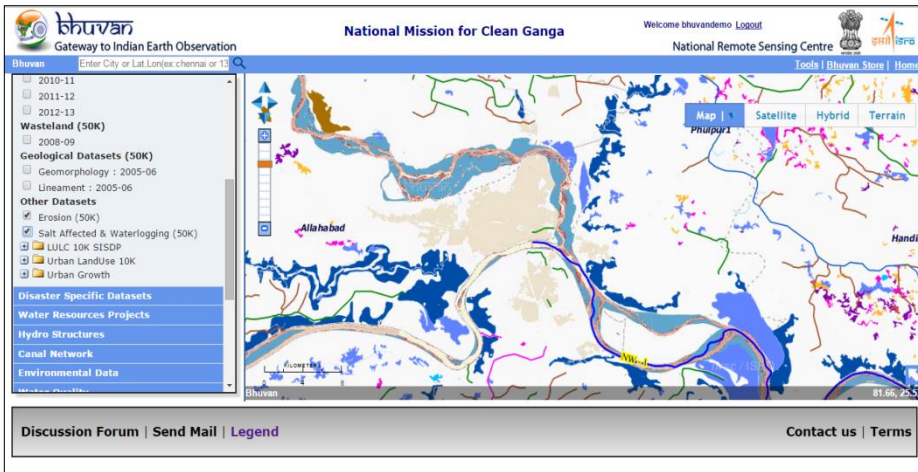
- >384 Hospitals
- ~235 Dist/ Rural
- 60 Super Specialty
- > 4 Lakh patients treated



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



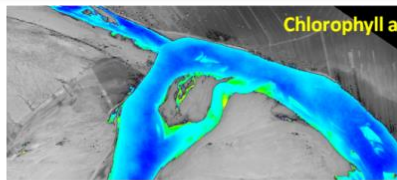
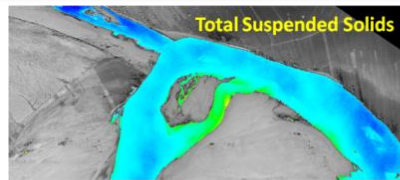
Comprehensive database for entire basin

Water Quality Monitoring and Evaluation

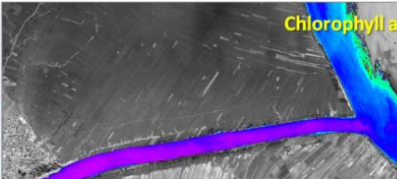
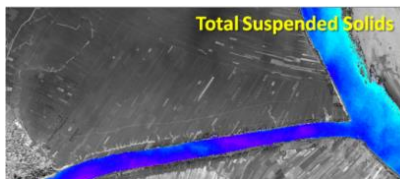
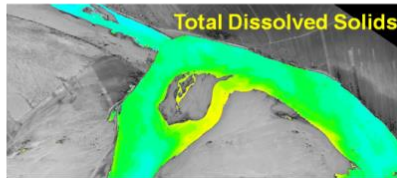
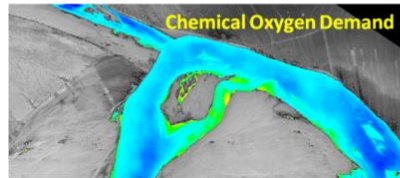
Geomorphological Monitoring & Evaluation

Hydrological Monitoring & Evaluation

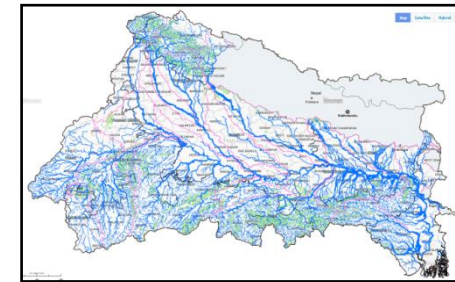
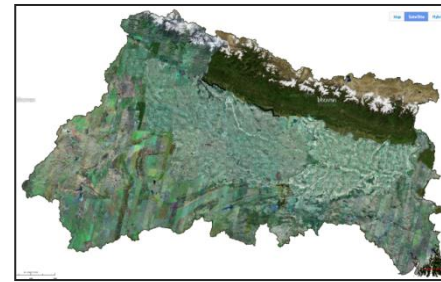
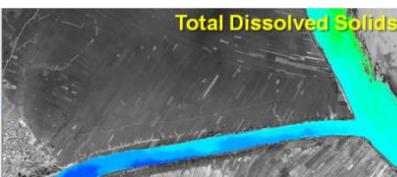
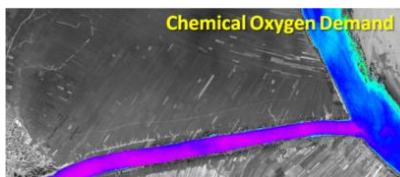
Bioresources Monitoring & Evaluation



Low High

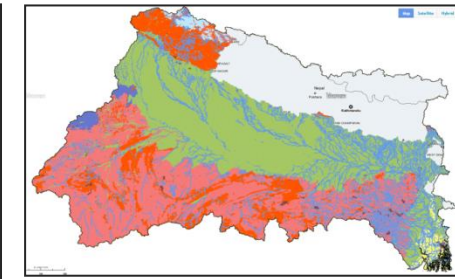
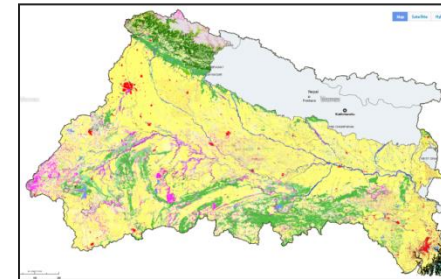


Low High



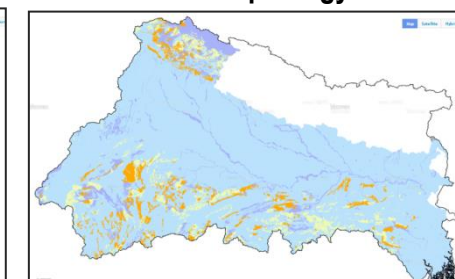
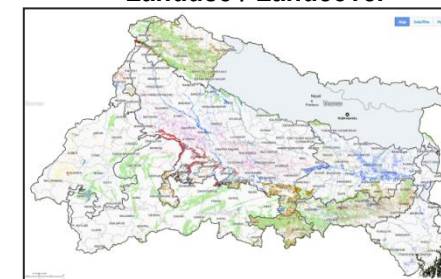
Satellite image

Drainage Network



Landuse / Landcover

Geomorphology



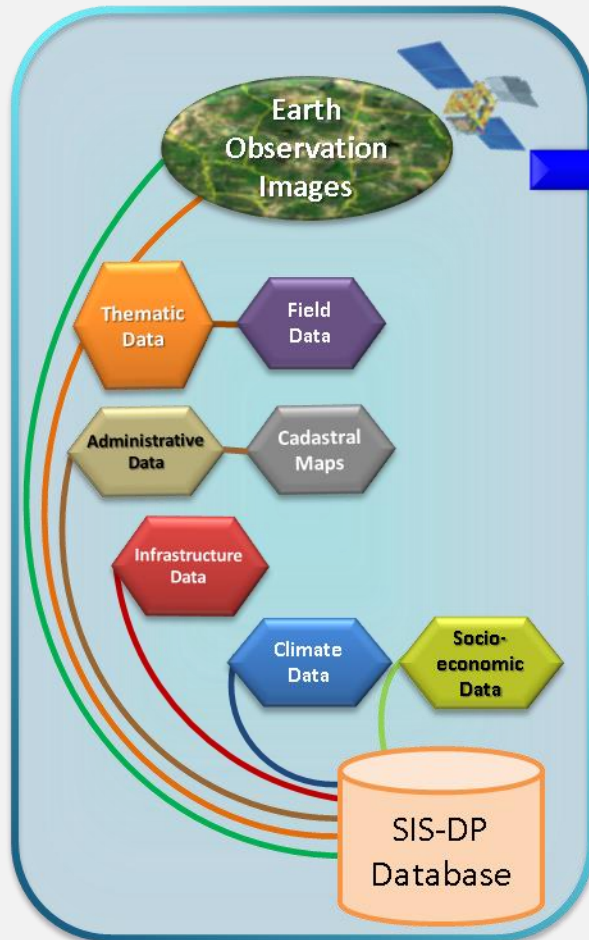
Erosion & Salt affected areas

Soil Depth

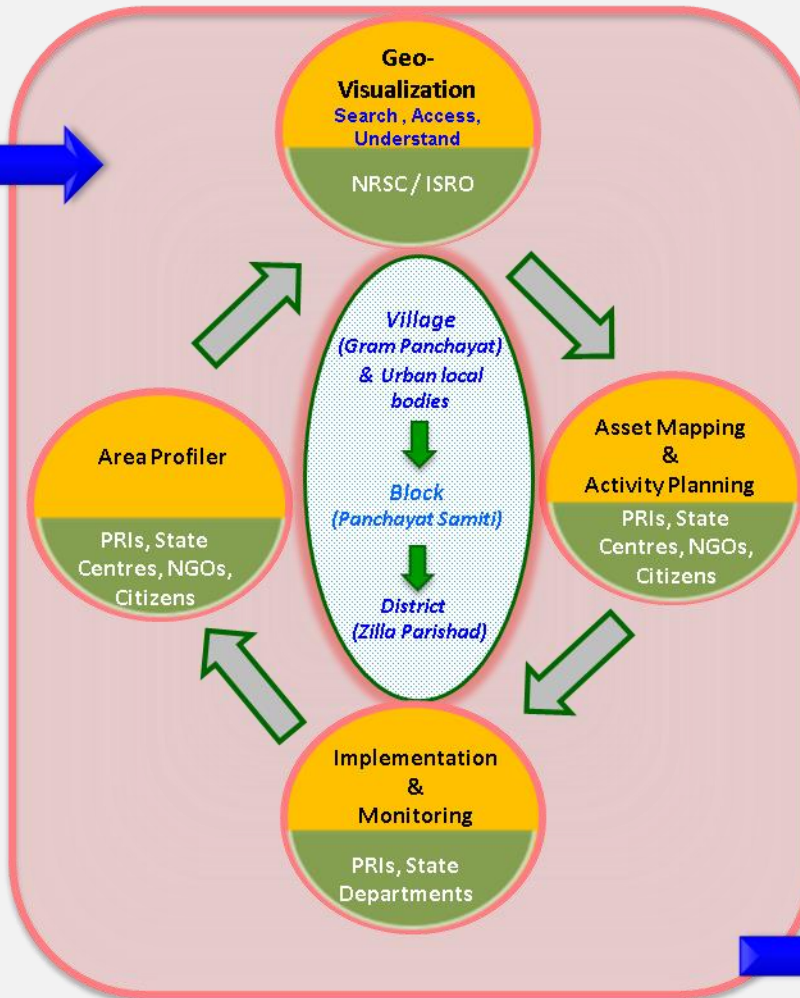
Water Quality

Space Based Information Support for Decentralized Planning (SIS-DP)

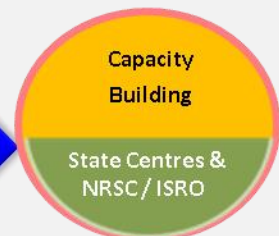
1. Database Generation and Organization
Spatial & non spatial data
NRSC & States Centres / partners



2. Enabling Environment for PRI's
Web Based System for PRI's – Four modules
NRSC / ISRO



3. Outreach
PRI's & Citizens
NRSC & Partners



SATCOM Applications and Services



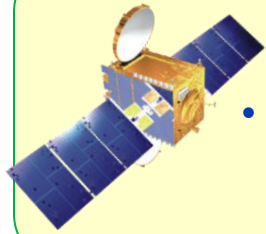
Telecom	2.30 Lakh VSATs
Television; DTH services	100% National Coverage (vs 13.7% in 1983) > 4.2 Cr DTH Subscriptions (DD +6 Providers)
News gathering	On-spot; Real-time news coverage
Radio-networking	415 AIR Stations
Mobile services	Emergency communication link
Search and Rescue services	13,800 Indian Beacons from Maritime and Aviation Agencies
MET DATA dissemination service	~1900 Automatic Weather Stations >1200 Automatic Rain Gauge Stations 40 Met Data Dissemination Stations
Tele-education	83 Networks , ~5000 Interactive classrooms, 55,000 Receive only Terminals, 26 States & 5 UTs covered
Tele-medicine	~400 Hospital with Telemedicine Facility; 60 Specialty Hospitals; > 300 Remote Hospitals; 18 Mobile Vans

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

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



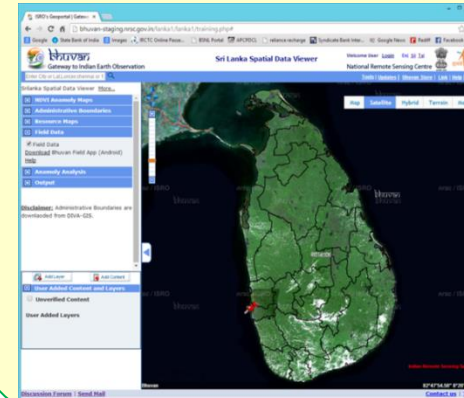
SAARC STROM (Severe Thunderstorms Observations and Regional Modeling)

- 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)



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





SPACECRAFT

NATIONAL SPACE SYSTEMS

LAUNCH VEHICLES

DIMENSIONS OF INDIAN SPACE PROGRAMME

Space Infrastructure

- Launch vehicles (PSLV, GSLV)
- Spacecrafts (LEO, GEO, Navigation & beyond) – INSAT, GSAT, IRS
- Sensors and Transponders

Ground Segment

Data acquisition, Processing, Calibration - Validation

- Fixed Satellite Services, Broadband Satellite Services, Mobile Satellite Services, Ground stations
- Deep Space Network , TTC Network

Applications

- Natural Resources Management
- Meteorology & Ocean Studies
- Satcom & Navigation
- Synergy: Earth Observation /Satcom/Navigation – Village Resource Centre

Capacity Building

- Formal education through Centre for Space Science & Technology Education in Asia & the Pacific , Indian Institute of Remote Sensing,...
- Indian Institute of Space Science & Technology

Institutionalization

- National Natural Resources Management System
- Involvement of stake-holders from the planning level
- Antrix

International Cooperation

- Bilateral and multilateral cooperation with various countries and international Organisations

126 MISSIONS

October
2015



30 successive
successful
flights



Indigenous
Cryo Stage

Heavy
Lift
Launcher



ACCOMPLISHMENTS IN SPACE

74 + 2

Remote Sensing
Communication
Navigation
Chandrayaan-1
Mars Orbiter
Commercial
Satellites



Satellites

49

SLV
ASLV
PSLV
GSLV
LVM3-X



Launch Vehicles



Space Capsule
Recovery Experiment

01



Crew Module Atmospheric
Re-entry Experiment

01



PSLV launched - 51 Satellites of 20 countries



SATELLITE APPLICATIONS



COMMUNICATION

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



NAVIGATION

- IMPROVED POSITION ACCURACY
- NAVIGATION APPLICATIONS FOR : AIRCRAFT, SHIPS, VEHICLE, FLEET MOVEMENT, ROUTING / ALIGNMENT
- SCIENTIFIC RESEARCH APPLICATIONS FOR ATMOSPHERIC STUDIES
- IONOSPHERIC SCINTILLATIONS



REMOTE SENSING

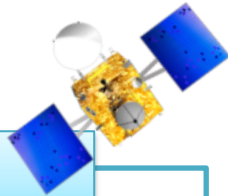
INFORMATION TO SOLUTIONS :

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

COMMUNICATION SATELLITE PROGRAMME

-Uniquely tailored to develop innovative grass root level applications

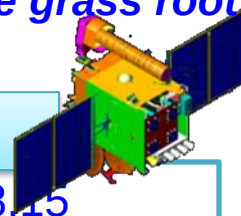
STANDARD ISRO SATELLITE BUS



I – 1K Bus

GSAT-12, 15.07.11
Kalpana-1, 12.09.02
IRNSS-1A, 01.07.13
IRNSS-1B, 04.04.14
IRNSS-1C, 16.10.14
IRNSS-1D, 28.03.15

I – 2K Bus



GSAT-6, 27.08.15
GSAT-14, 05.01.14
GSAT-7, 30.08.13
INSAT-3D, 26.07.13
HYLAS, 26.11.11
INSAT-4CR, 02.09.07
INSAT-3E, 28.9.03
INSAT-3A, 10.04.03
INSAT-3C, 24.01.02
INSAT-3B, 22.03.00

I – 3K Bus



GSAT-16, 07.12.14
GSAT-10, 29.09.12
GSAT-8, 21.05.11
W2M, 21.12.08
INSAT-4B, 12.03.07
INSAT-4A, 22.12.05

I – 6K Bus*

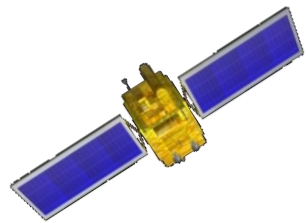
Developmental stage
2016-17

- C-band Fixed Satellite Service ; Ku-band Fixed Satellite Services ; Broadcast Satellite Services ; & Mobile Satellite Services
- World's largest domestic satellite communication system (250 transponders & growing)

Earth Observation Satellites

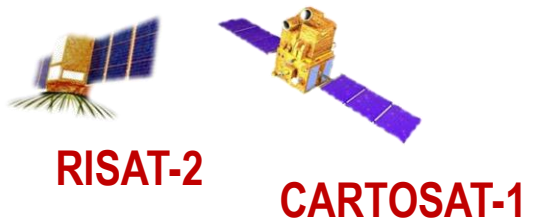
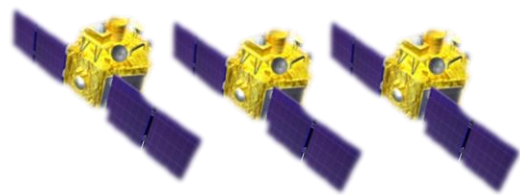
LAND & WATER

RESOURCESAT-2



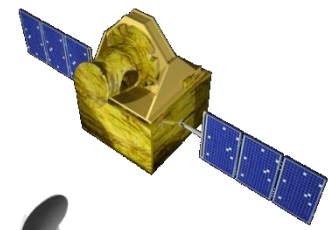
HIGH RESOLUTION

CARTOSAT-2; 2A; 2B

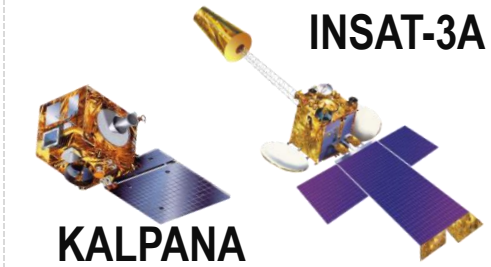


OCEAN

OCEANSAT-2



WEATHER; CLIMATE



Satellite Navigation

GAGAN

GPS Aided Geo Augmented Navigation



- RNP and APV-1 certification obtained from DGCA for Approach services for “**En-route Navigation**” over Indian Airspace
- India is the third country to offer safety of life navigation services to aviation sector

Applications

CIVIL AVIATION

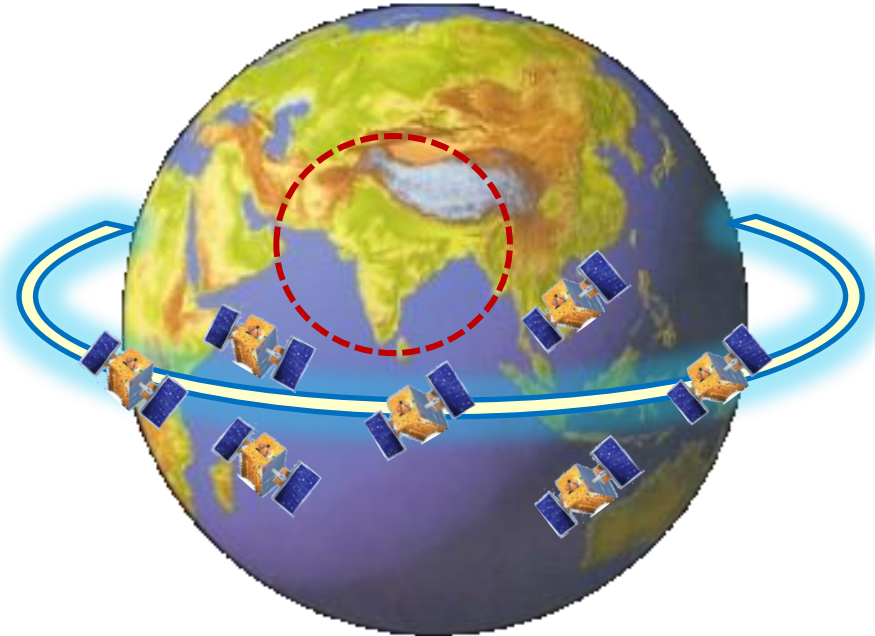
- Certified for Safety of Life Application
- Used by Aircrafts & Helicopters as En-route Navigation aid
- Procedure development & other activities in progress for Precision Approach applications

NON-CIVIL AVIATION

- Surveying
- Location Based Services
- Intelligent Transport System
- Maritime Applications, Railways
- Mapping services

IRNSS

Indian Regional Navigation Satellite System



- **7-Satellite Constellation**
- **4 Satellites (IRNSS-1A, IRNSS-1B, IRNSS-1C & IRNSS-1D) already in Orbit**
- **Full constellation by 2015-2016**
- **Coverage ~ 1500 km beyond Indian territory.**
- **Estimated horizontal position accuracy of 10-20 m in over India and adjoining areas.**



SPACECRAFT

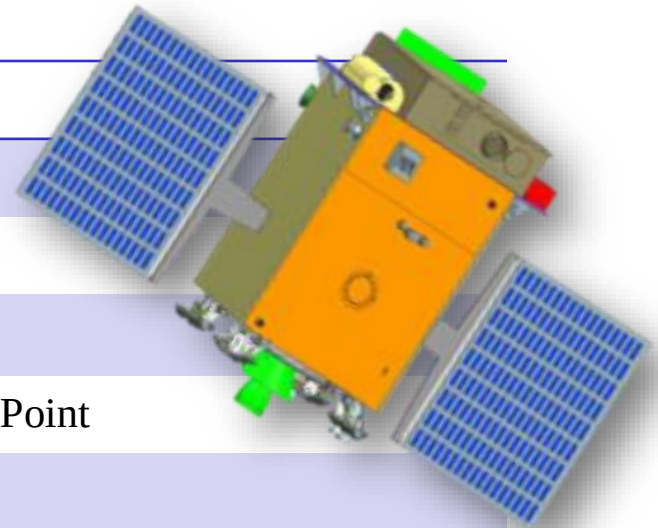
CHALLENGING MISSIONS

LAUNCH VEHICLES

CHALLENGING MISSIONS

ADITYA : The first Indian space based coronagraph intended to study the solar corona in visible and near IR bands. The main scientific objectives of the mission is to study the Coronal Mass Ejections (CME).The mission is also intended to obtain completely new information on the velocity fields and their variability in the inner corona which has an important bearing on the unsolved problem of ‘heating of the corona’.

Spacecraft Bus	IRS Bus
Mass	~ 1400 Kg
Power	1500 W
Mission Life	> 5 Years
Orbit	Halo Orbit about Sun- Earth L1 Point
Data Volume & Download Read out Rate	110 Gb, 4 MBPS
Payloads Proposed	1. Enhanced Visible Emission Line Coronagraph 2. High Energy L1 Orbiting X-ray Spectrometer 3. Plasma Analyser Package 4. Solar Wind & Thermal Ion Spectrometer 5. Solar Low Energy X-ray Spectrometer 6. Solar Ultraviolet Imaging Telescope



CHALLENGING MISSIONS

CHANDRAYAAN-2 : A follow on mission to the first Indian lunar mission with a capability to soft land at a specified lunar site and to carry out in-situ chemical analysis of the lunar surface and will have Orbiter Craft and Lander craft equipped with rover.

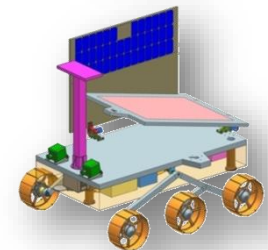
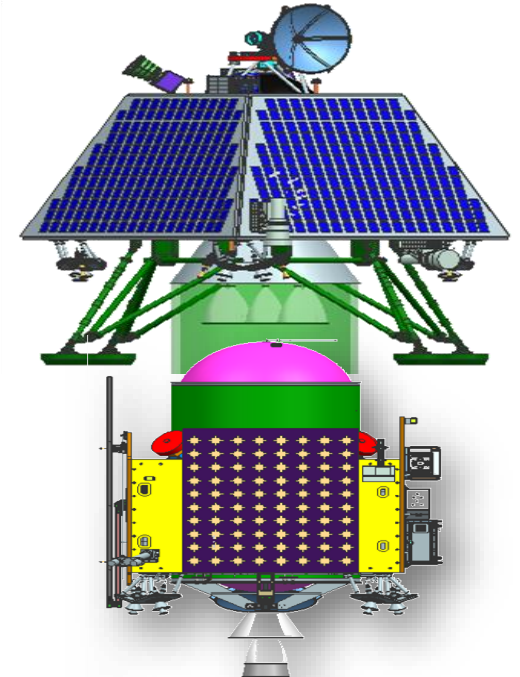
Orbit	: 170 x 17000km
Lift off mass	: 3200 Kg
Orbiter	: 2260 Kg
Lander	: 940 Kg

Lander payloads :

1. Rover – 25 kg (With LIBS and APIXS)
2. Radio Anatomy of Moon bound Hypersensitive Ionosphere & atmosphere
3. Lunar Electrostatic & Dust Levitation Experiment
4. Chandra's surface thermal experiment
5. MEMS based Seismometer

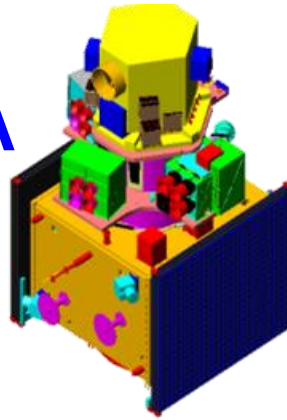
Orbiter Payloads:

1. CLASS- Chandrayaan-2 Large area soft X ray Spectrometer
2. SAR- Synthetic Aperture Antenna
3. IIRS - Imaging IR Spectrometer
4. ChACE 2- Chandra's Altitudinal Composition Explorer
5. TMC-Terrain Mapping Camera



CHALLENGING MISSIONS

RESOURCESAT-2A



Standard IRS Bus

Payloads:

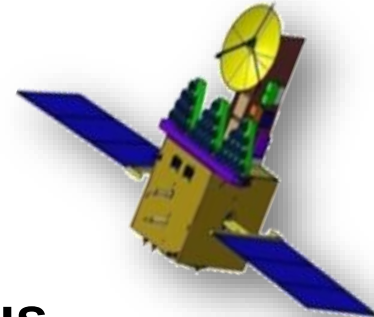
LISS-4, LISS-3, AWIFS

Orbit : 817 Km SSPO

LT :10.30 AM

Applications: Resource
applications

OCEANSAT-3



Standard IRS Bus

Payloads:

13 band OCM, Ku-band

SCAT, Sea Surface

Temperature Monitor

(SSTM)

Orbit: 720 Km SSPO

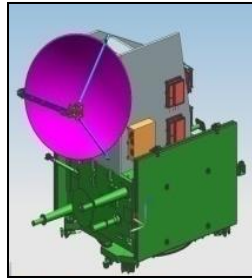
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Applications:

Oceanography

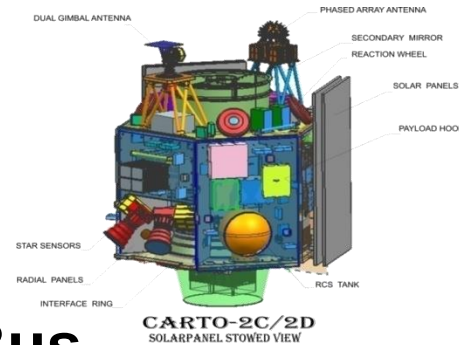
CHALLENGING MISSIONS

SCATSAT-1



Standard IMS-2 Bus
Payloads:
Scatterometer
Orbit: 720 Km SSPO
Mass: 360 Kg
Power : 280W
Applications:
Oceanography

CARTOSAT-2C/2D/2E/2F



Hexagonal Bus
Payloads: PAN, MX
Orbit: 500 Km SSPO
Mass: 650 Kg
Power : 1000W
Applications: High Resolution
Cartography with TDI Imaging

CHALLENGING MISSIONS

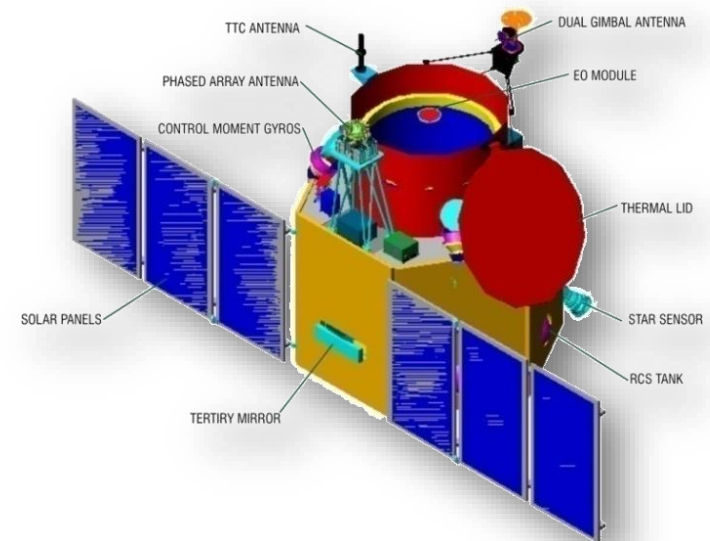
CARTOSAT-3 : Agile advanced satellite to obtain imagery with a very high spatial resolution of 0.25m in panchromatic & 1m in 4 band multi spectral and 12m in HySI .

PAYLOADS PROPOSED : Advanced High resolution Panchromatic Camera, Multispectral Camera, Hyperspectral

- Mass : 1500 Kg
- Power : 2000 W
- Orbit : 450 Km (SSPO)
- Mission life : 5 Years

NEW TECHNOLOGIES

- New spacecraft structure
- Advanced OBC
- High accuracy star sensors & gyros
- **Advanced Data handling and transmission system**
- 12-channel dual frequency SPS system
- New Dual Gimbaled Antenna



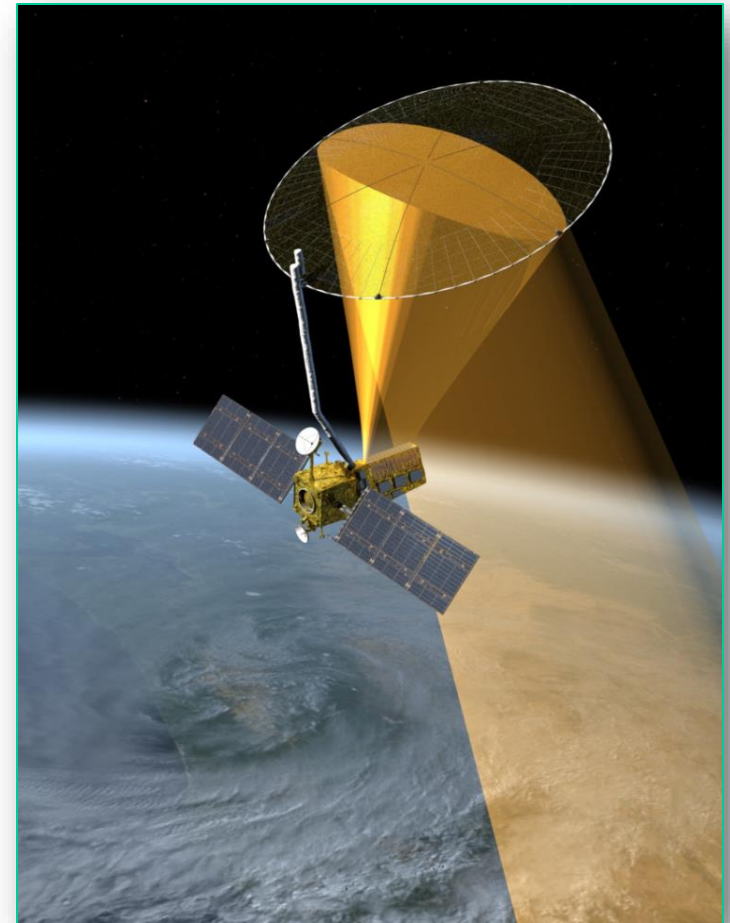
CHALLENGING MISSIONS

NASA-ISRO SAR

A Global mission for monitoring Deformation, Ecosystem Structure and Dynamics of Ice (DESDynI). It is a collaborative Mission between NASA/JPL & ISRO with World's First Dual Band (L & S) Synthetic Aperture Radar (SAR) for Earth Imaging.

SALIENT FEATURES

- New Sweep SAR Technology with large (12m) unfurlable reflector
- Payloads : L-Band SAR payload by NASA-JPL and S-Band SAR payload by ISRO-SAC
- Spacecraft Mainframe by ISRO-ISAC
- Launch: ISRO-GSLV
- Target Launch Date: 2019-20



INSAT-3D – Satellite for Meteorology

The Spacecraft is multipurpose with high resolution imager and sounder systems for storm warning and improved atmospheric observations and data dissemination capabilities. It also provides communication services. DRT SAS & R transponders will be providing continuity to some of the INSAT services.



SPACECRAFT SALIENT FEATURES

Orbital	: 82 Deg East
Location	
Bus	: I-2K Derived Bus
Payload	: 6 channel Imager, 19 channel Sounder and DRT, SAS&R payloads
Power	: 1100 Watts
Mass	: 2100 Kgs
Mission Life	: 7 Years

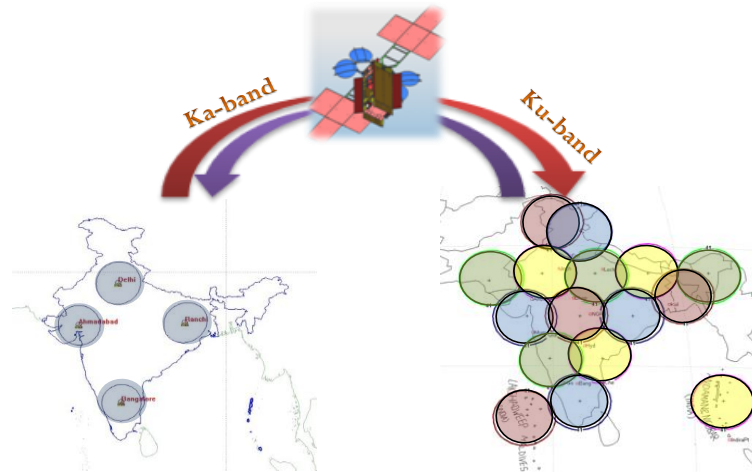


Weather Information



GSAT-11 , Advanced Communication Satellite

- Multi Beam Communication spacecraft
- Orbital location: 74°E
- New Modular, high power, high capacity bus
- Advanced concepts and new technological elements
- 32 user beams in Ku band and 8 hub beams in Ka band to provide a through put of 10 GBPS
- New communication architecture to support various telecom services and VSAT networks .
- Compatible ground support system to provide seamless connectivity .
- Bus Compatible with GSLV mark III & all commercial launchers.
- Workhorse for our future communication satellite programme.

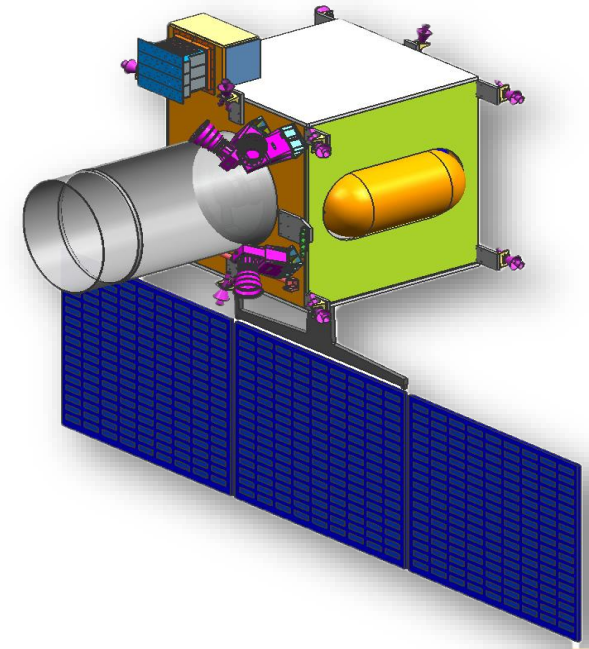


GISAT

GISAT is a geo imaging satellite at geostationary orbit with high temporal resolution. It has a multispectral imager operating in visible, near infra-red and thermal infrared bands and hyper-spectral imager operating in visible, near infra-red and short wave infra-red bands

SALIENT FEATURES

- Standard I-1K^{Plus} bus
- Power : 920 W Heat
- LOM :977kg
- Zero momentum biased 3-axis body stabilised [5xRWs]
- OBC with LEON-3 processor
- Star Sensors : Mark-3 type
- LIRU / FOG
- Single sided solar array with 3 panels, 2.15x1.6 m²
- Single 90Ah Li-ion battery

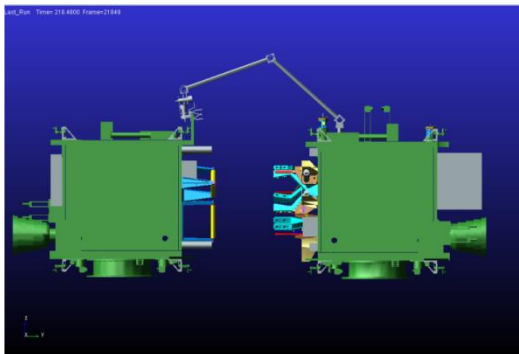
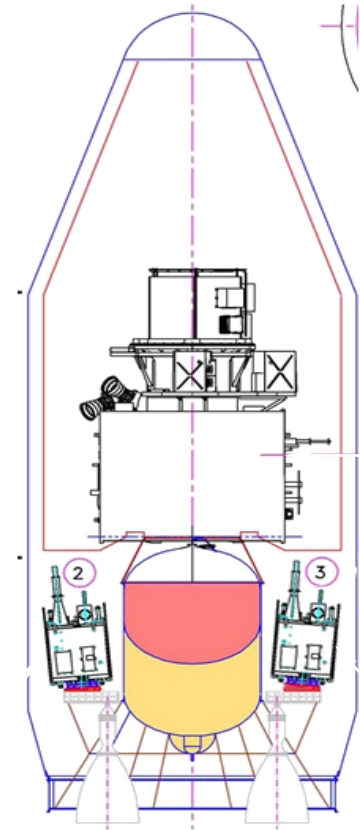


OPTICAL PAYLOADS: 700mm CARTO-2A type telescope Scanning through agile platform using Electronically steerable Antenna (PAA) with High Data rate transmission in Ku-band (200Mbps)

DOCKING EXPERIMENT

Objectives:

- Technology demonstration for rendezvous and docking, using two IMS (Youthsat) spacecraft - piggy-back on a single PSLV flight
- Demonstrate controllability of target spacecraft in docked condition, showing the possibility of extending target spacecraft life



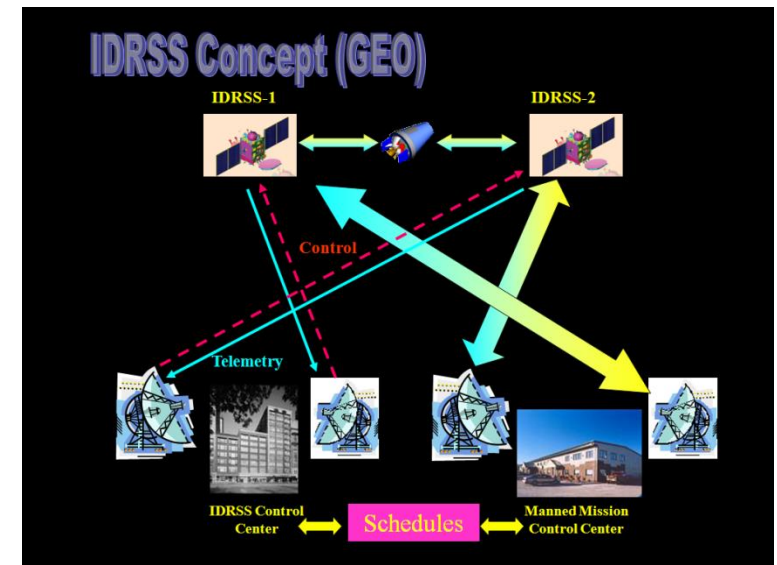
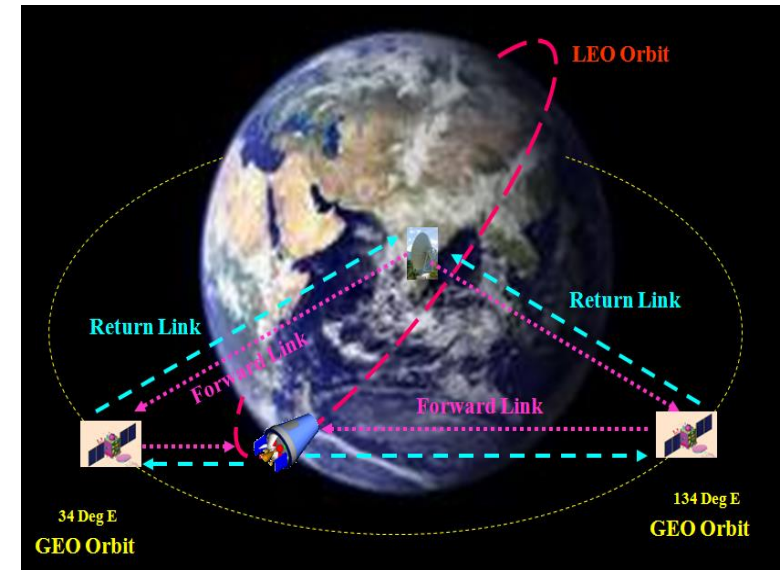
APPROACH & CAPTURE PHASE



DOCKED PHASE

INDIAN DATA RELAY SATELLITE SERVICES (IDRSS)

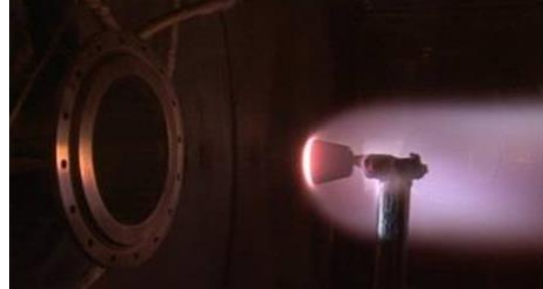
- IDRSS – Provides Tracking and Data Acquisition support for low altitude spacecraft, both manned and unmanned.
- IDRSS orbit : Geo-Synchronous orbit (34 deg E and 134 deg E) would serve as a communication/data link to LEO/Manned missions with nearly continuous visibility
- Remote sensing missions can benefit from IDRSS by way increasing the payload utility, better coverage for TTC purposes
- The data from ground from Mission control center will be transmitted to one of the IDRSS through which it reaches the Crew Module and vice versa.
- IDRSS shall cater
 - Low data rate from IRS for TTC
 - Medium Data rate from Manned mission TM/TC/Voice/Video
 - High Data rate from IRS payload



INFRASTRUCTURE DEVELOPMENT



Hypersonic Wind Tunnel Test Facility



Plasma Wind Tunnel Facility



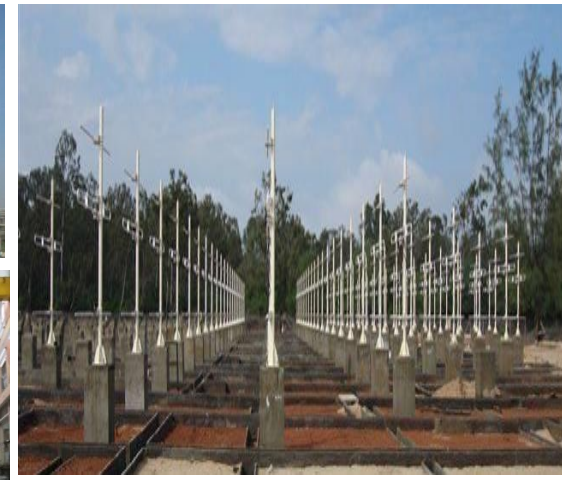
Multi Object Tracking Radar



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