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Space Technology and its Applications for National Development

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GEO4SDGs
THEME: GEO-KNOWLEDGE CONDUIT TO SDGs SUCCESS
Geospatial World Forum, January 18-19, 2018
HICC, Hyderabad
Indian EO Missions – Current & Planned

**LAND & WATER**
- RESOURCESAT-2, 2A
- RISAT-1
- CARTOSAT-2; 2A; 2B; 2S
- RISAT-2
- CARTOSAT-1

**HIGH RESOLUTION**
- OCEANSAT-2
- SARAL
- SCATSAT-1

**OCEAN**
- SCATSAT-1

**WEATHER; CLIMATE**
- INSAT-3A
- KALPANA
- MEGHA-TROPIQUES
- INSAT-3D, 3DR

Cartosat-3, Oceansat-3, Resourcesat-3, RISAT, GISAT in 2017-18 for continuity of services and new capabilities

**Imaging Capability**

**Ground Infrastructure**
- Automatic Weather Station (AWS)
- Doppler Weather Radar (DWR)
  - Continuous monitoring of severe weather events
  - Radar network for entire coastal areas, NE region, major cities, ...

**Comm. devices**
- CWDS/DCWDS
- Satellite Phone
- Hand-held Mobile Messaging Terminal
Satellite Navigation

NavIC (IRNSS)

- An Indigenous navigation system of 7 satellite constellation - for providing position, navigation, timing services over Indian region

GAGAN: GPS Aided Geo Augmented Navigation

- Jointly implemented by ISRO & Airports Authority of India

Estimated positional accuracy of 10m

Coverage area is about 1500 km beyond Indian territory

GAGAN has been certified for Approach with Vertical Guidance (APV) 1.0 aircraft landing
Over the decades, the Indian Space Programme has progressed through increasing in-house capabilities, industry partnerships and collaborative efforts with academia.

Space applications, derived through synergistic use of earth observation, communication & navigation satellites and complemented with ground based observations play a key role in harnessing the benefits of space technology for socio-economic security, sustainable development, disaster risk reduction and efficient governance.

The space applications, space infrastructure and space transportation system are realized, sustained and enhanced through capacity building involving development of skilled human resources, establishment of state of the art facilities, industry & academia participation, development of new technologies and cooperation with other space-faring nations.
Geo-Spatial Technology Applications

Indian Space Research Organisation

- Monitoring of dwelling construction
- Site suitability & Building typology
- e-health services
- Site suitability for medicinal plants
- Forewarning of vector borne diseases & risk zone mapping

Food
- Availability of food & fodder
- Improving Production
- Storage & Distribution

Health
- e-health services
- Site suitability for medicinal plants
- Forewarning of vector borne diseases & risk zone mapping

Socio-Economic Security
- Planning of infrastructure
- Monitoring of infrastructure
- communication & navigation solutions

Water
- Availability
- Improve Availability
- Distribution

Shelter
- Monitoring of dwelling construction
- Site suitability & Building typology

Energy
- Renewable energy potential
- Site Suitability
- Near real-time information
- Prospecting

Infra-structure
- Citizen advisories
- Tele-education
- Information Systems
- Secure e-commerce
- SatCom/ Nav applications for Internet of Things (IoT)

Information
Crop mapping and distribution

- Checks area discrepancy
- To identify the potential area for increasing coverage

Composite yield index (yield proxy)
(based on rainfall, NDVI, soil water holding capacity and irrigation)

- For improving CCE and crop yield estimation

Crop intensification
(Post Kharif rice fallow lands for growing pulse crops in Rabi season)

B. Rabi Cropped Area
C. Kharif Rice + Rabi Crop

Suitability Map for Mango Plantation Nuzvid Mandal, A.P.
Infrastructure Security

Indian Space Research Organisation

Railway Line Alignment Along Akola-amlakhurd Section

- To propose a suitable railway line alignment as per stipulated criteria set by SCR. To achieve this:
  - Carry out Geo-technical studies using high-resolution Satellite data.
  - Carry out Terrain Analysis using CARTOSAT DEM.

Bhuvan-GAIL: Gas Pipe Line Surveillance

- Develop Geospatial solution
- Near real-time Bhuvan Application for surveillance.

Amrut Cities - Gis Based Formulation Of Master Plans

- GIS Based Master Plan
- Water Supply Systems
- Sewerage
- Septage
- Storm Water Drainage
- Urban Transport
- Green Space and Parks
- Reforms mgmt & support
- Capacity Building

National Urban Information System (NUIS) – 152 Towns

- Geospatial Governance Application for Master Plan Preparation.
- Geospatial database on Bhuvan and access to all ULBs / State Govt. and TCPO/MoUD.
- Operational use of Remote Sensing and GIS technology in many ULBs and UDAs for Master Plan Preparation.
EO Data utilisation: India’s Sustainable Water Management

**Irrigation**
- 103 projects (2008-2012)
- Dedicated AIBP monitoring system deployed on BHUVAN
- 150 projects by 2017
- IP Utilisation studies

**WR Info. Products**
- Near real time pan India water & snow, 3x3 min, 15 day products from RISAT-1 & AWIFS
- NRT capacity assessment of major reservoirs
- Climate quality databases for NICES

**Operational Hydro. Services**
- Modelling framework at 9x9 min grids
- Daily basis run (1976-2005) & since June 2014
- Near Real Time Runoff, Soil Moisture, ET products since June 2014
- Extension to SEA region

**Hydrological Modelling & Flood Forecasting**
- FF models: Godavari & Mahanadi – developed
- Integration into NRSC-DSC
- Event based modelling
- FF Development for 5 basins
- Dev. of Spatial Flood Early Warning Systems
- Forecasts through BHUVAN

**GL&WB Inventory**
- Monitoring (Jun-Oct):>50 ha (464 No’s) 2010,11,12,13 & 14 completed.
- GL hazard threats/GLOF Early warning Sys.

**SM Runoff Modelling**
- Seasonal Forecast (3 months): 2012, 13, 14 & 2015
- Short term (16 days) forecasts: 2013, 2014 & 2015 in 5 Himalayan river basins
- Extension to Eastern Himalayan rivers

**Water Resources Assessment**
- Basin-wise WR Assessment: 2 basins
  - Godavari * Baitarani-Brahmani
- Re-assessment of WR in 20 basins

**WR Project Planning**
- Feasibility Studies: Riverlinking Projects
  - Ken-Betwa, Daman Ganga –Pinjal, Par Tapi Narmada
- Similar such feasibility studies & River linking projects
Energy Security

- Real-time instantaneous & daily solar energy
- South-East Asia at 8 km spatial resolution using Kalpana-1, Terra MODIS, GTOPO5
- 3D City Modelling for harnessing Solar Energy
Disaster Management Support

Indian Space Research Organisation

- Disaster Communication Network
- Decision Support Centre
- National Database for Emergency Management
- North Eastern Regional Node for Disaster Risk Reduction

Daily Fire Alert

FLOODS
- Inundation Mapping
- Hazard Zonation
- Early Warning

CYCLONE
- Damage Assessment
- Landfall Prediction
- Early Warning

FOREST FIRE
- Fire Detection
- Fire Alert (within 30 min. of acquisition)

LANDSLIDE
- Inventory
- Early Warning

EARTHQUAKE
- Damage Assessment

Kedarnath - 2013
Kashmir Floods - 2014

February 2, 2018
Sustainable Development

Agriculture

Urbanization

Bio-resources conservation

Coastal ecosystem management

Managing fragile ecosystems

Climate change induced impacts

Geo-sphere Bio-sphere interactions

Managing fragile ecosystems
Sustainable Development

Indian Space Research Organisation

Waste Land Development

- Wasteland to solar power generation,
- Charanka solar park Radhanpur,
- one among 44 such projects in Gujarat State

M&E of IWMP Water Shades

- Mobile App for Geo-tagging
- Web based Change detection & Impact Assessment

Site Suitability Analysis Map For Solid Waste Disposal

Monitoring LULC Change Trajectories in Hotspots of India

- Sonpur-Bazari Coal mine
- Unradin Coal mine
- Andal Airport
- D.V.C Thermal Power Plant
Towards Integrated Space Technology Solutions

Geo-Platforms - Suite of Applications for National Development

Digital Elevation Model

Optical & Microwave (Multi-Spectral Multi-Spatial, Multi-Temporal)

Ortho Image

GAGAN enabled solutions

Mobile Data Collection

In-situ measurements