

Recent Indian Space Missions : Update Feb 2014

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Mission Summary: 2013/2 – 2014/2

MISSION THEME

(prev. Missions)

- **SPACE EXPLORATION**
 - *(Chandrayaan-1- 2008)*
- **EARTH OBSERVATIONS**
 - *RISAT-1(2012), MeghaTropiques (2011), Resourcesat-2(2011), Oceansat-2(2009),...*
- **NAVIGATION**
 - *GAGAN Payload*
- **LAUNCH VEHICLE DEV.**
- **OPERATIONAL MISSIONS : Satellite Communication, EO Applications**

REALIZED

(Under fabrication/ testing)

- **MARS ORBITOR MISSION**
 - *(Astrosat, Chandrayaan-2, Aditya)*
- **SARAL, INSAT-3D**
 - *(RS-2A, Cartosat-2E, GISAT, ...)*
- **IRNSS-1A, GAGAN-Operational**
- **GSLV D5**
 - *GSLV MkIII*



MARS ORBITOR MISSION (MOM)



- **Technology demonstrator for orbiting & acquiring scientific observations from Mars** [*First Interplanetary Mission*]
- **Launched 5 Nov 2013 / PSLV C25**
 - **Trans Mars Injection 1 Dec 2013**
 - **Mars orbit insertion 24 Sep 2014**
- **MOM Payloads**
 - Mars Colour Camera (MCC)
 - Thermal Infrared Imaging Spectrometer (TIS)
 - Methane Sensor for Mars (MSM)
 - Mars Exospheric Neutral Composition Analyser (MENCA)
 - Lyman Alpha Photometer (LAP)

Payloads



Lyman Alpha Photometer (LAP)

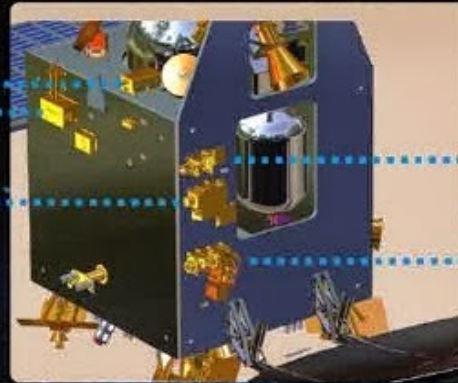
Lyman Alpha Photometer (LAP) is an absorption cell photometer. It measures the relative abundance of deuterium and hydrogen from Lyman-alpha emission in the Martian upper atmosphere (typically Exosphere and exobase). Measurement of D/H (Deuterium to Hydrogen abundance Ratio) allows us to understand especially the loss process of water from the planet.



Methane Sensor for Mars (MSM)

MSM is designed to measure Methane (CH_4) in the Martian atmosphere with PPB accuracy and map its sources. Data is acquired only over illuminated scene as the sensor measures reflected solar radiation. Methane concentration in the Martian atmosphere undergoes spatial and temporal variations.

Atmospheric studies



Mars Exospheric Neutral Composition Analyser (MENCA)

MENCA is a quadruple mass spectrometer capable of analysing the neutral composition in the range of 1 to 300 amu with unit mass resolution. The heritage of this payload is from Chandra's Altitudinal Composition Explorer (CHACE) payload

Particle environment studies



Mars Color Camera (MCC)

This tri-color Mars Color camera gives images & information about the surface features and composition of Martian surface. They are useful to monitor the dynamic events and weather of Mars. MCC will also be used for probing the two satellites of Mars – Phobos & Deimos. It also provides the context information for other science payloads.



Thermal Infrared Imaging Spectrometer (TIS)

TIS measure the thermal emission and can be operated during both day and night. Temperature and emissivity are the two basic physical parameters estimated from thermal emission measurement. Many minerals and soil types have characteristic spectra in TIR region. TIS can map surface composition and mineralogy of Mars.

Surface Imaging Studies

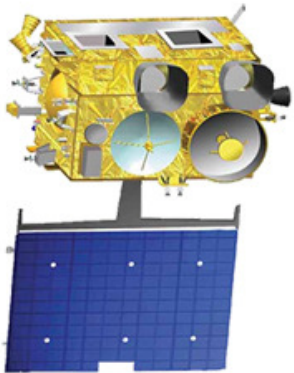
SARAL



- India-France joint mission for ocean altimetry
- Satellite for **AR**gos and **AL**tika
- Payloads (CNES)
 - **ARGOS-3 and ALTIKA (4 sensors)**
 - Ka-band (35.75 GHz, BW 500 MHz) radar altimeter
 - Dual-frequency microwave radiometer (23.8 & 37 GHz)
 - DORIS
 - Laser Retro-reflector Array
- Spacecraft (IMS-2 bus), launch & satellite operations (ISRO)
- Launched – 25 Feb 2013 (SHAR, India; PSLV C20)
 - Lift-off Mass 407 kg
 - Orbit 781 km polar Sun synchronous
 - Orbit Inclination 98.538° / 35 days repeat cycle
 - Local Time of Equator 18:00 hours crossing
 - Onboard data storage 32 Gb

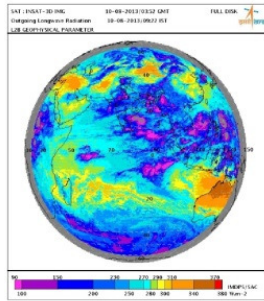
INSAT-3D

- Advanced weather satellite of India configured with improved Imaging System and Atmospheric Sounder
- Launch : July 26, 2013 (Ariane-5 VA-214)
- Geostation : 82 deg E Longitude
- 19 Channel Sounder & 6 Channel Imager

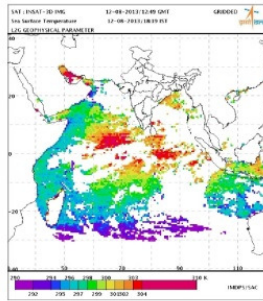


INSAT-3D APPLICATIONS

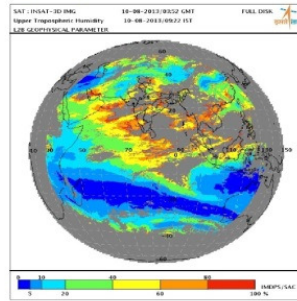
INSAT-3D Imager Geo-Physical Parameters (L2)



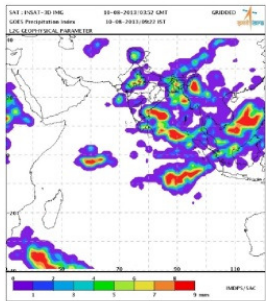
OLR



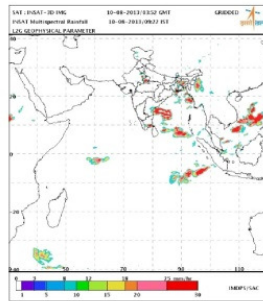
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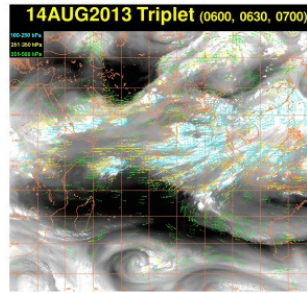
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Precipitation Index

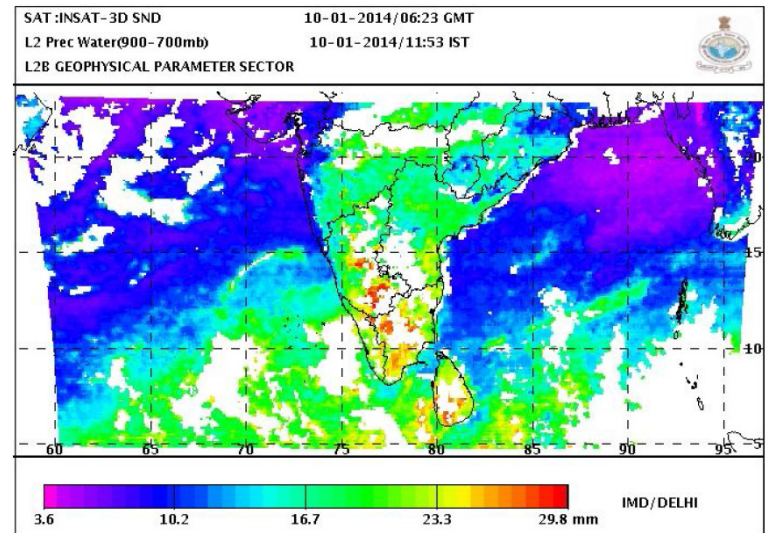
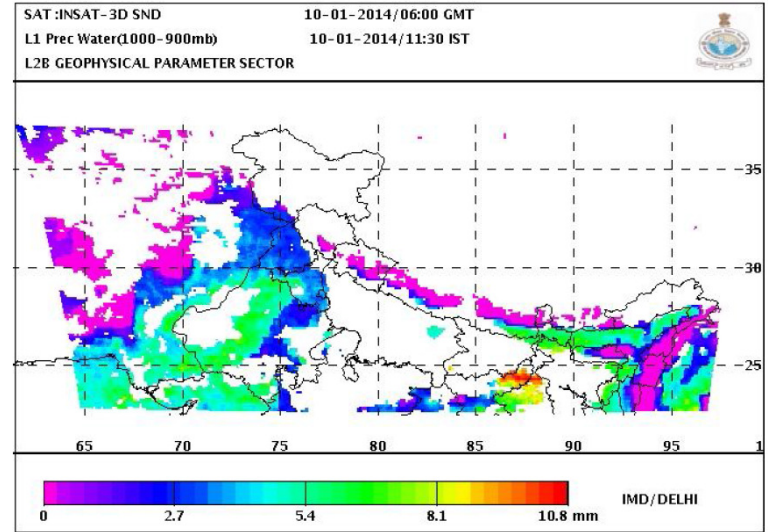


IMSRA (Rainfall)



WV Wind

Low and Mid Level Precipitable Water Vapor

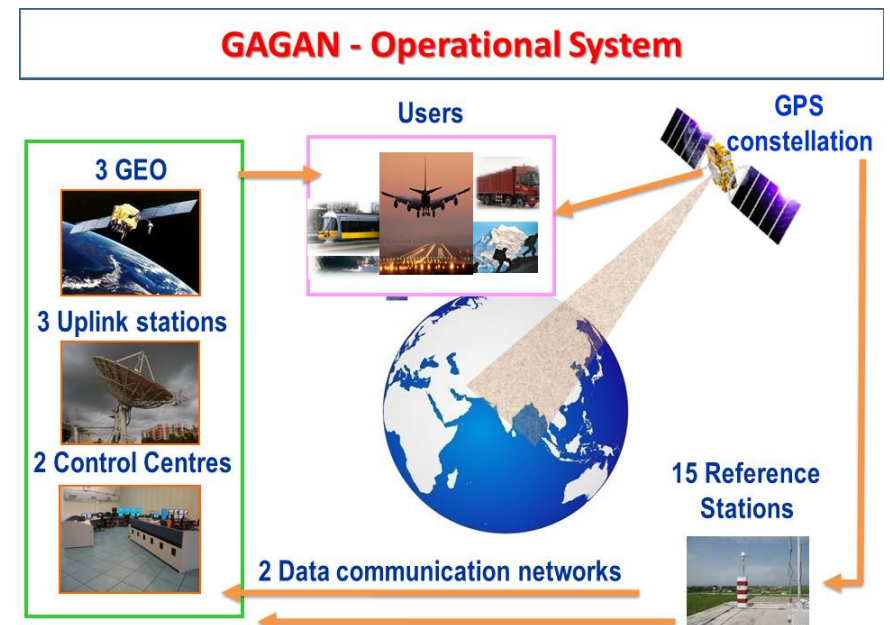
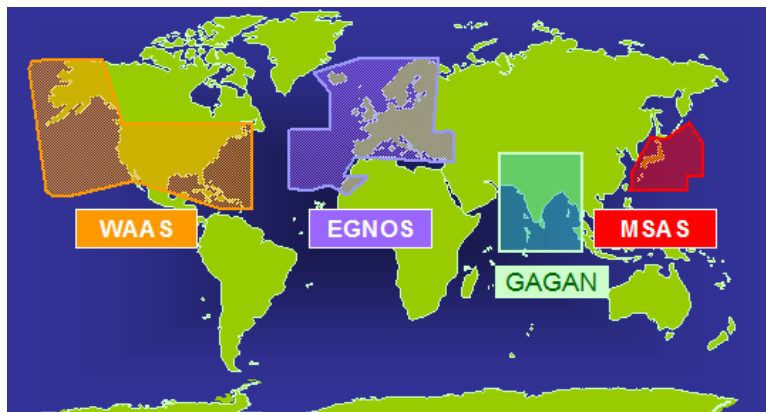


INSAT-3D SOUNDER PRODUCT



GAGAN : Augmented Navigation

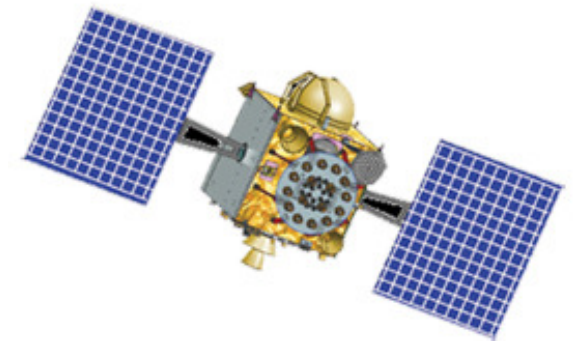
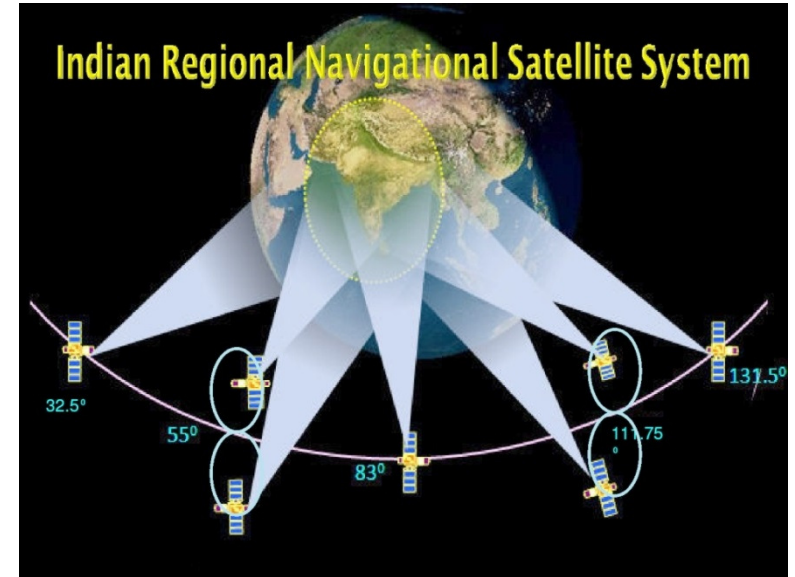
- **GAGAN : GPS Aided GEO Augmented Navigation**
 - Jointly implemented by ISRO & Airports Authority of India
- **Configuration**
 - **Ground Component (15 ref st; 3 uplink stn, 2 control stn)**
- **Certification**
 - Indian aviation regulator DGCA issued certification for RNP0.1 (Required Navigation Performance, 0.1 Nautical Mile) service level on December 30, 2013.
- **Part of interoperable global system**





Indian Regional Navigation Satellite System

- Regional system of 7 satellite constellation
- Signals: L5 band (1176.45 MHz) & S band (2492.028 MHz)
- C-band transponder, Cube retro-reflector
- IRNSS-1A
 - Launched : July 1, 2013 (PSLV C22)
 - Mass 1425 kg
 - Orbit : Geosynchronous, 55° E, 29° inclination
 - Signal in space qualified



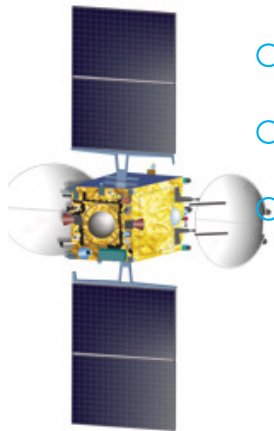


GSLV-D05 Mission

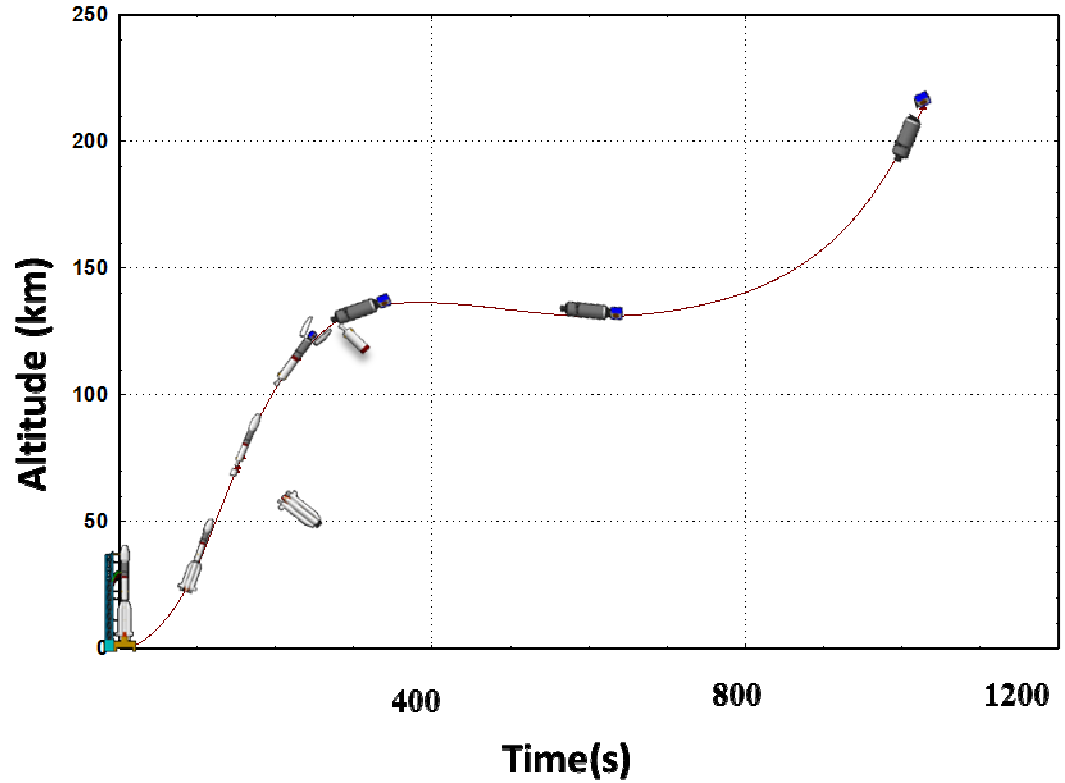
- Configuration
- *Indian Cryogenic Engine*

- Launch
 - January 5, 2014; 1618 IST

- Spacecraft : **GSAT-14**
 - 12 Transponders – 6 ext C, 6 Ku
 - 2 Ka band beacons
 - Mass 1982 kg; Power 2600 w
 - GSAT-14 has reached the designated orbital slot (74° E) on 18th January, 2014



GSLV-D05 Performance



	GSAT-14 Orbit	
	Spec	Achieved
Perigee/km	180 ± 5	179.5
Apogee/km	35975 ± 675	35945
Inclination	19.3 ± 0.1°	19.34°

	CUS ignition	
	Target	Achieved
Ht/km	132.95 ± 0.3	132.081
Vel m/s	5398.34 ± 5.62	5402.851



Space Exploration : Future missions

- **ASTROSAT**
 - **Astronomical Observatory in space**

- **CHANDRAYAN-2**
 - **Revisit moon with lander, rover and a orbiting surface observing sensors**

- **ADITYA** (*under planning*)
 - **Scientific mission to understand solar corona**
 - **Spacecraft in Lagrangian-1(L1) orbit**

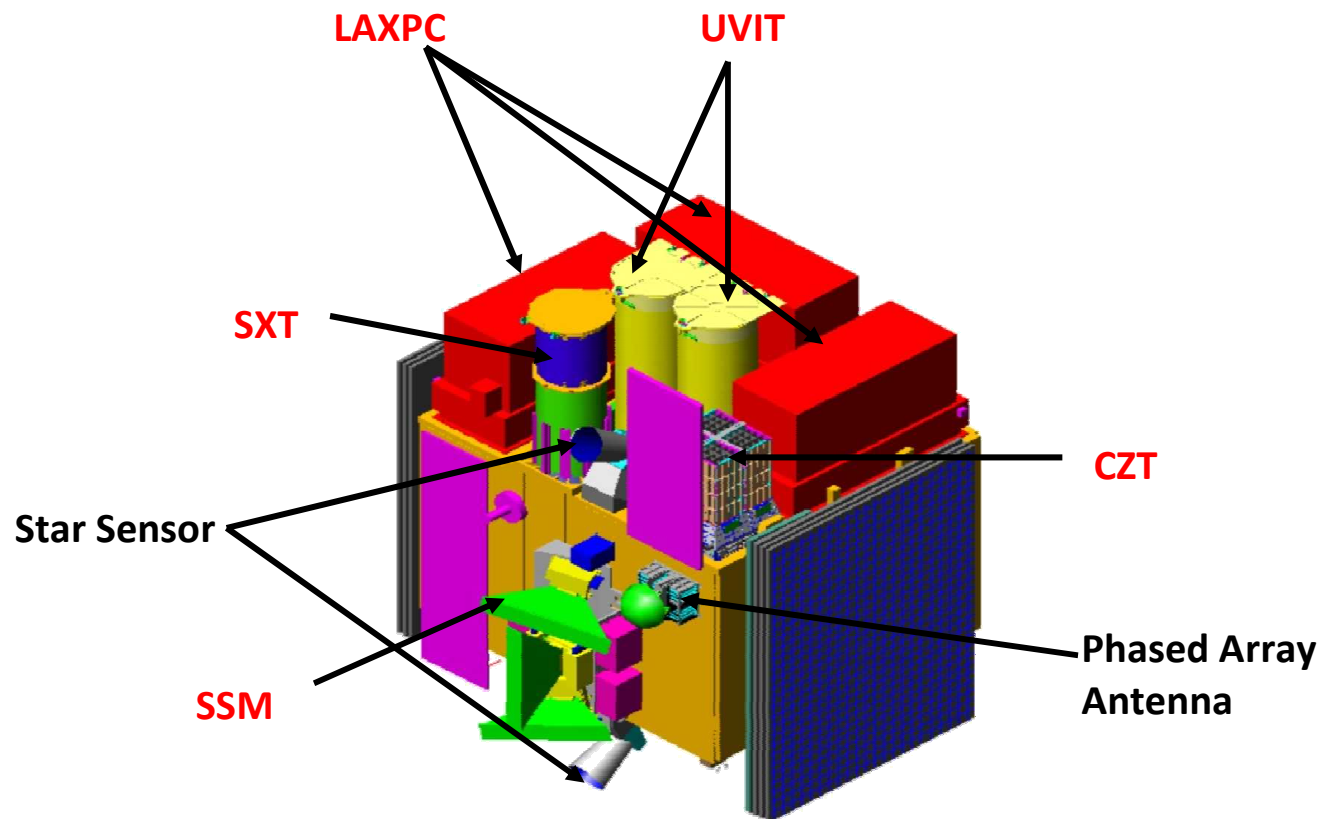


Scientific Instruments on ASTROSAT

- **LAXPC (Large Area Xenon-filled Proportional Counters)**
 - 3 nos, 3-80 keV band for precision timing and spectral studies
- **CZT (Cadmium Zinc Telluride) array with coded mask aperture**
 - for hard X-ray imaging and spectral studies in 10-150 keV band
- **SXT (Soft X-ray Telescope)**
 - CCD camera for timing & variability studies in X-ray bandwidth of 0.3 to 8 keV.
- **SSM (Scanning X-ray Sky Monitor)**
 - X-ray transients & large changes in luminosity of known sources in 2-10 keV band
- **UVIT (Ultra Violet Imaging telescope)**
 - Visible, near ultra violet and far ultra violet bands.
- **CPM (Charge Particle Monitor)**
 - to detect charge particle background and alert the instrumentation from possible damage.

ASTROSAT : Spacecraft

- Launch: 2014 – 15 (PSLV - XL)
- Weight / altitude: ~ 1500 kg / 650 km
- Orbital inclination: ≤ 8 deg to equatorial plane





Earth Observation : Future missions

- **Continuity Missions**

- **Resourcesat-2A**

(ISRO is also committed to ensure continuity in data availability from other missions such as Oceansat-2, RISAT-1, INSAT, ...)

- **New Missions**

- **Cartosat-2E**

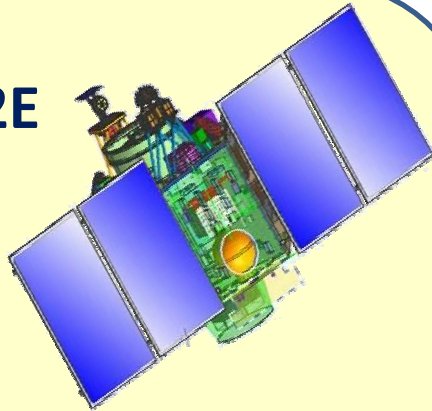
- Cartography applications

- **GISAT**

- Continuous EO observation from geostationary platform

Future EO Missions

CARTOSAT-2E



To provide continuity to Cartosat-2

PAN (0.65m) & 4B MX (2 m)

Swath : 10 km

Radiometric Resolution: 11 bit

Steering up to $\pm 26^\circ / \pm 45$

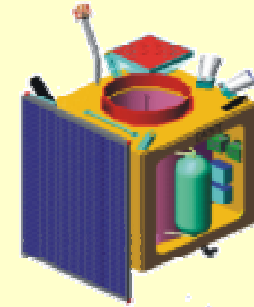
Altitude: 500 km

Solid State Recorder: 600 Gb

Local time: 0930 hrs

Revisit : 5 days

GISAT



*Multiple acquisition capability
from a Geosynchronous Orbit*

Payloads

- High resolution multi-spectral VNIR (HRMX-VNIR): 50m Res.
- Hyper spectral VNIR & SWIR: 320m and 192m Res.
- High resolution Multi-spectral (HRMX-TIR): 1.5km Res.

Status

- Launch by PSLV during 2016-17



Launch Vehicle Development : GSLV Mark III

- **Geostationary Launch Vehicle Mark III**
 - 4 Ton to GTO orbit
 - Configuration : 2 S200 + L110 + C25 LOX/LH2 cryo
 - Lift off weight – 630 t
 - Height – 42.4 m
- **Status**
 - S200 qualified
 - L110 qualified
 - C25 subsystem qualification
 - Mockup Integration
- **GSLV MkIII – X Mission (2014)**
 - Experimental launch with passive upper stage
 - To characterize vehicle behavior in atmospheric phase of flight





Thank You

<http://www.isro.gov.in>

