



Future Exploration Missions of ISRO

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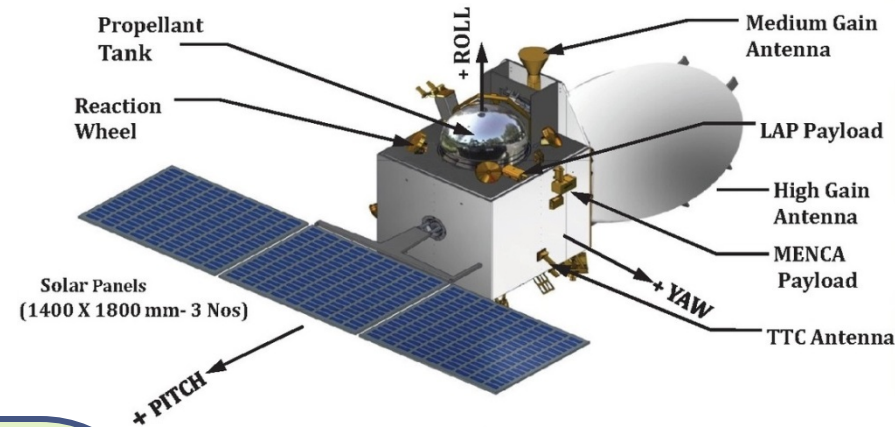
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Missions in Operation



Mars Orbiter Mission

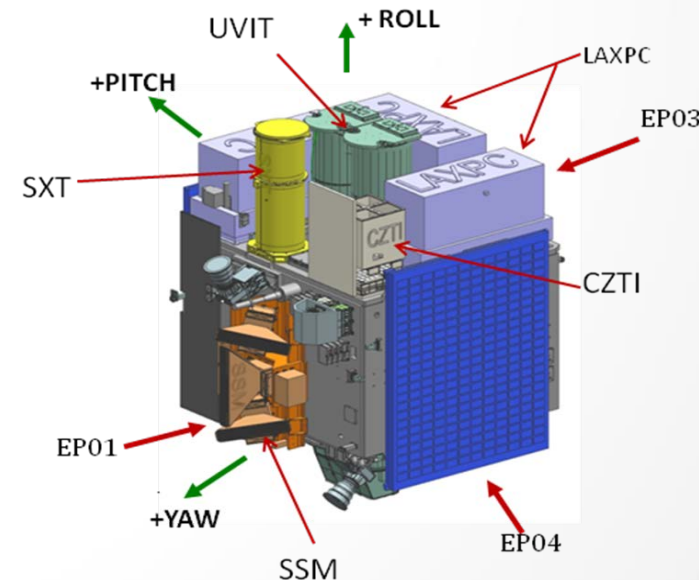
- India's first interplanetary mission
- Orbiting Mars since September 2014
- Completed 32 months in Orbit
- First year Science data released
- 200 GB data downloaded by 1100 users



View from +Yaw/+Pitch

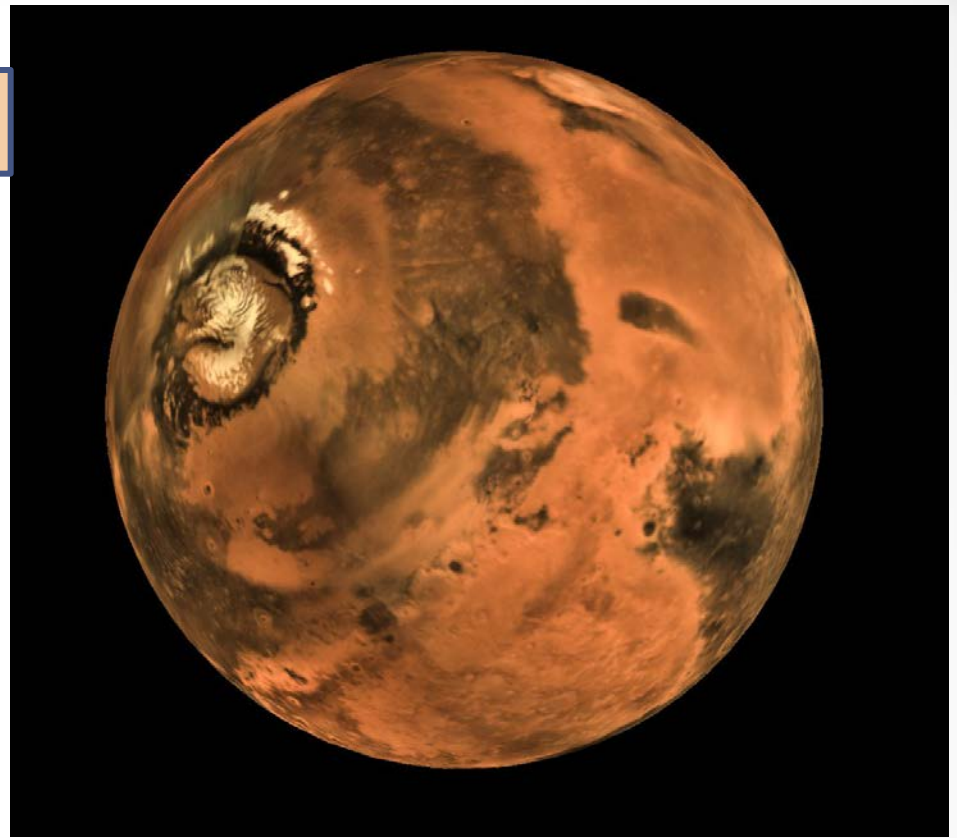
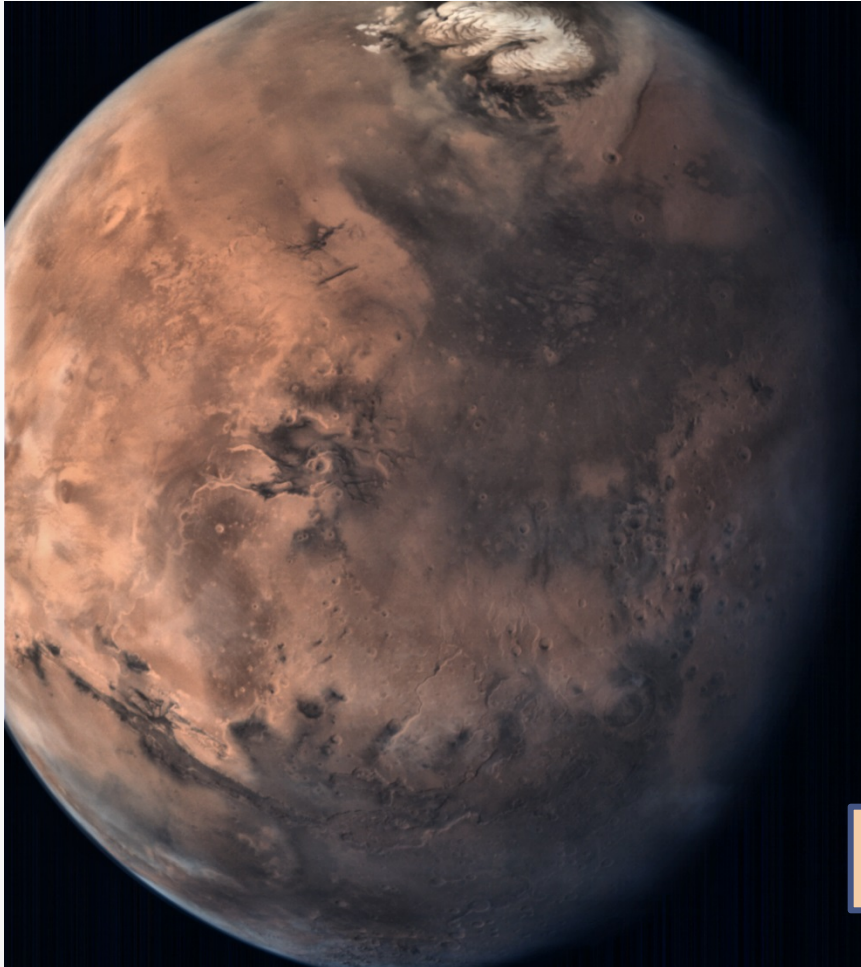
ASTROSAT

- First Indian ASTROnomy SATellite
- Simultaneous, Multi wavelength Observations
- Launched in September 2015
- Completed 20 months in Orbit
- Payloads from Indian Academia, UK & Canada
- Open to Scientists/Researchers



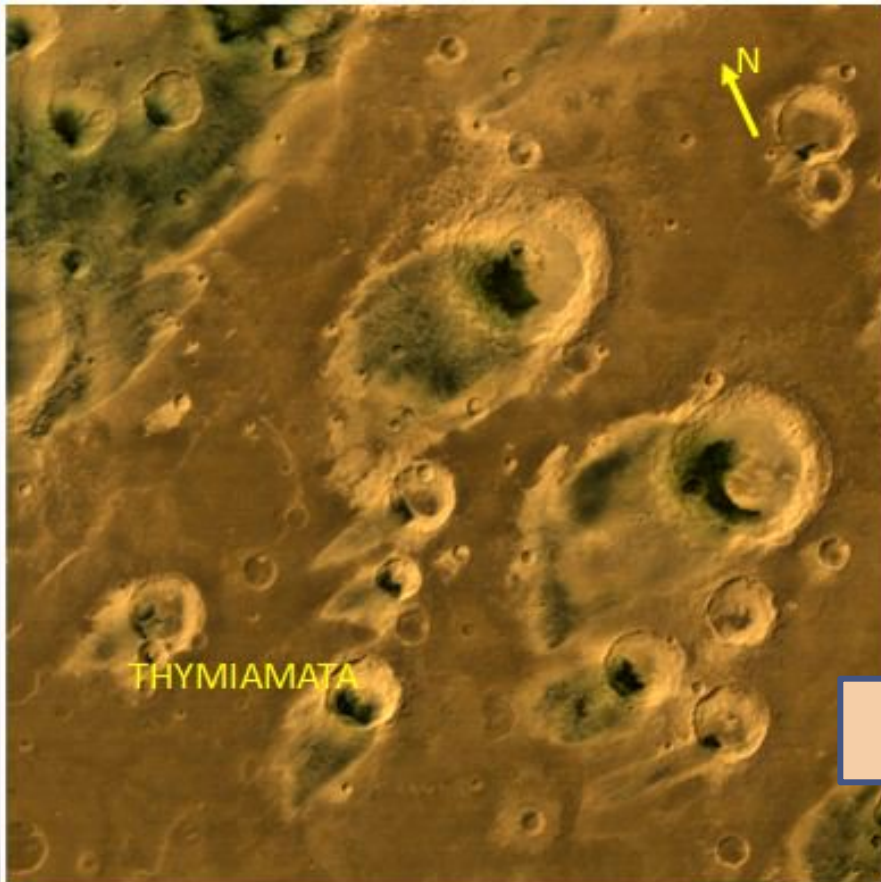
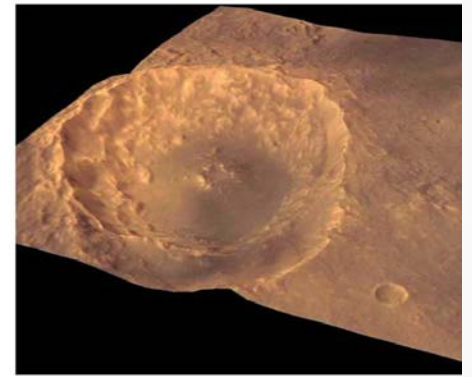
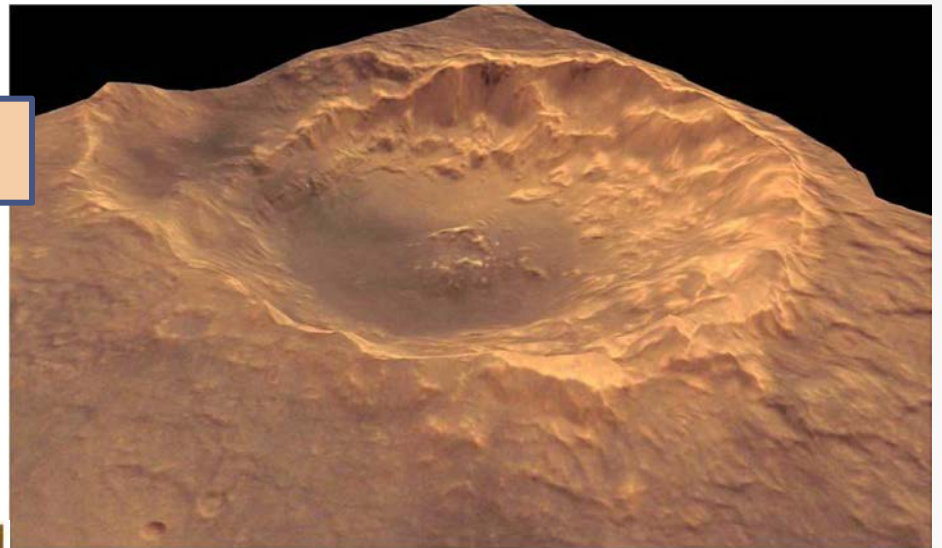
<http://astrosat.iucaa.in/>

Image from Mars Global
Mosaic



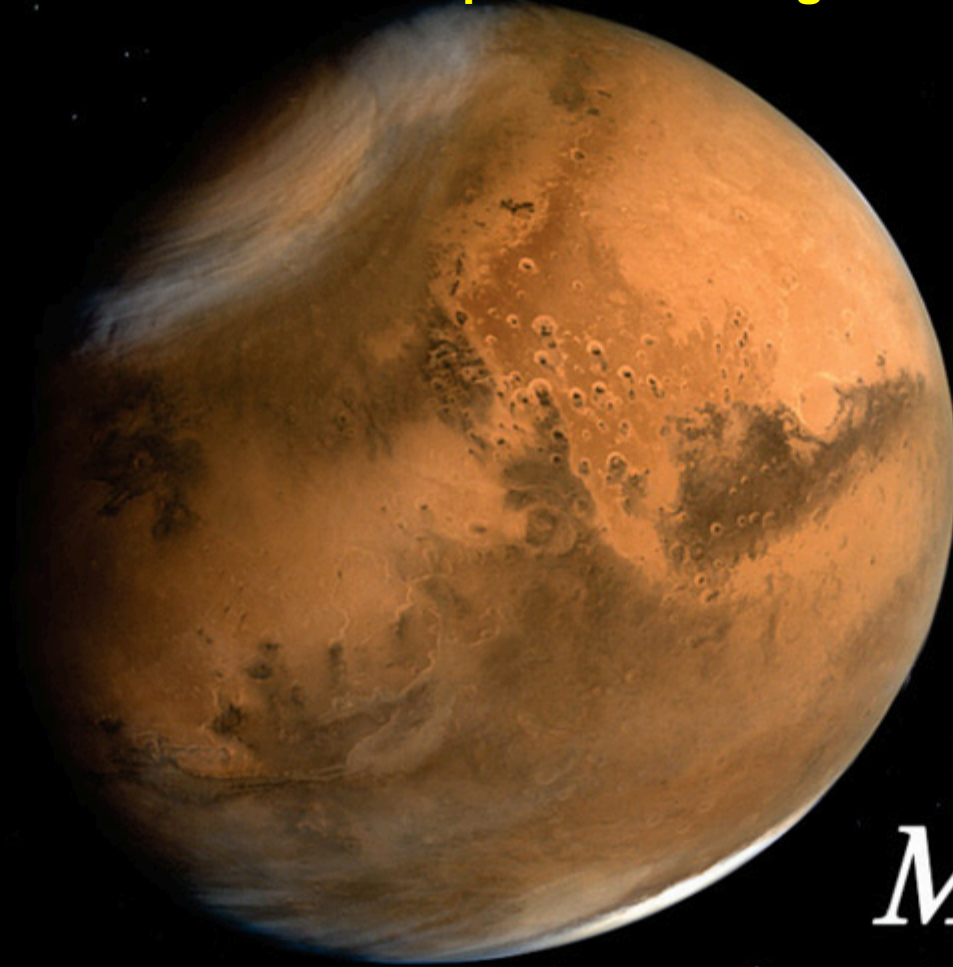
Mars Full disc image

Impact crater located SW of
Huygens crater



Martian Desert region –
Thymiamata

<http://www.issdc.gov.in/docs/mr1/Mars-atlas-MOM.pdf>



Mars Orbiter Mission (MOM)

Mars Atlas

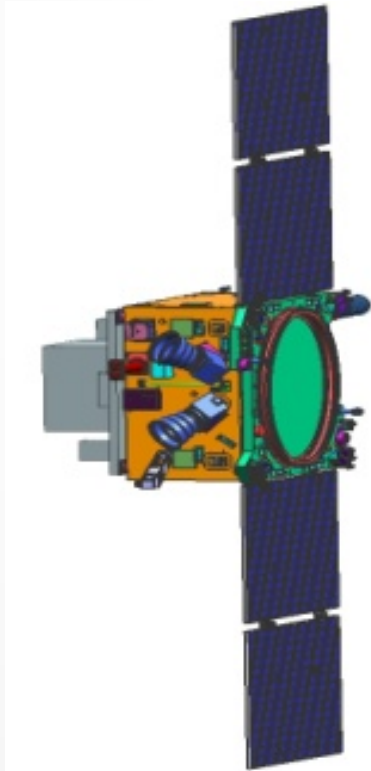


Space Applications Centre
Indian Space Research Organisation

Future Science & Exploration Missions

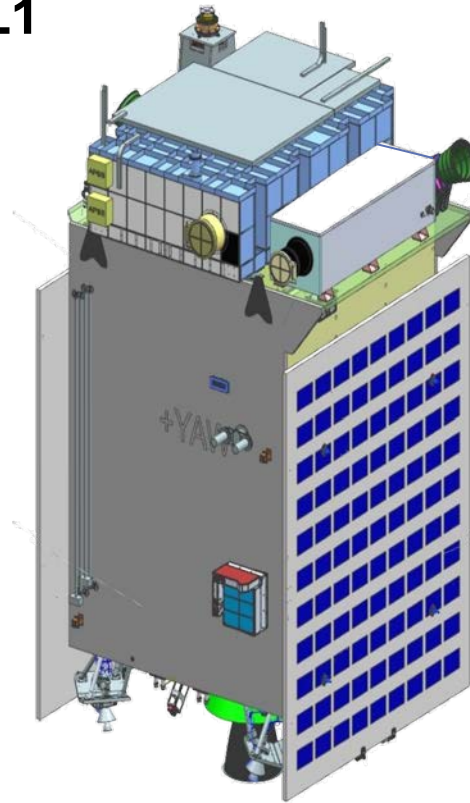


XPoSat



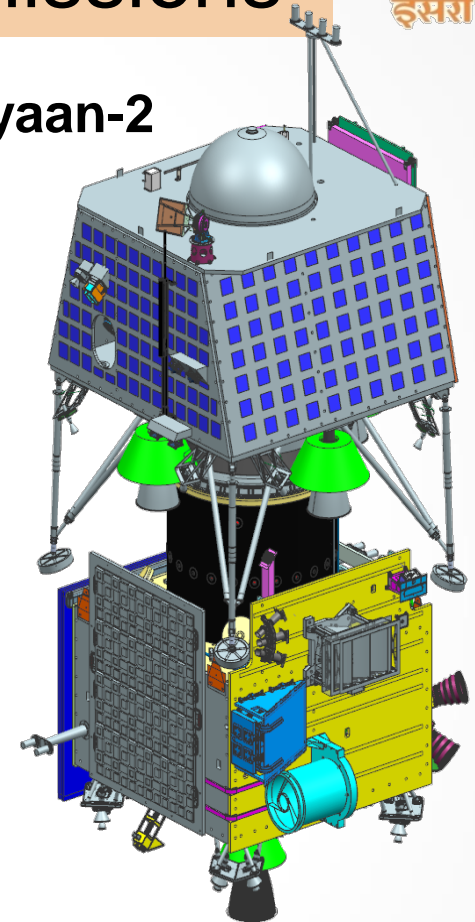
•Launch: II quarter 2021

Aditya-L1



Launch: I quarter 2020

Chandrayaan-2

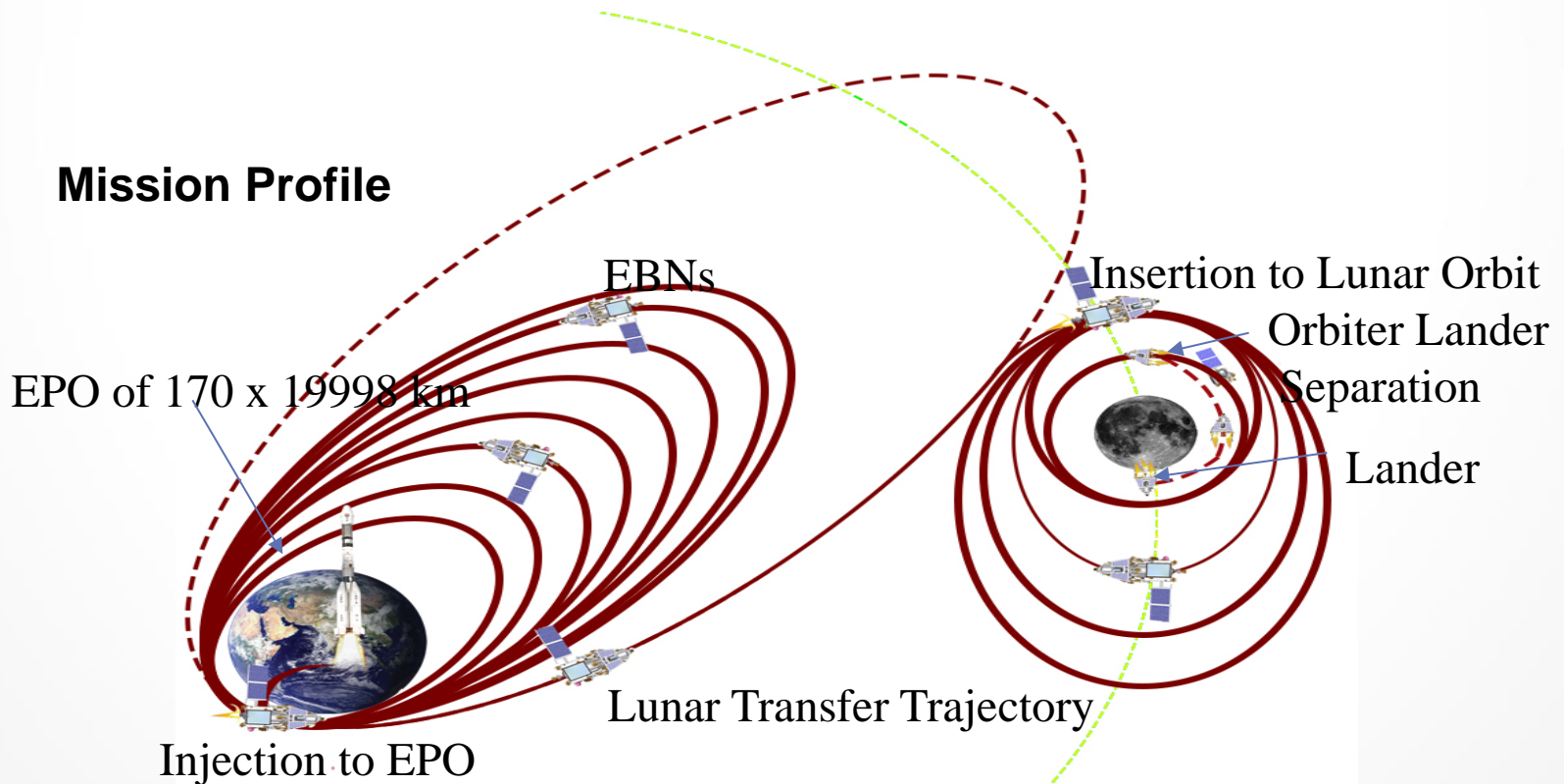


Launch: I quarter 2018

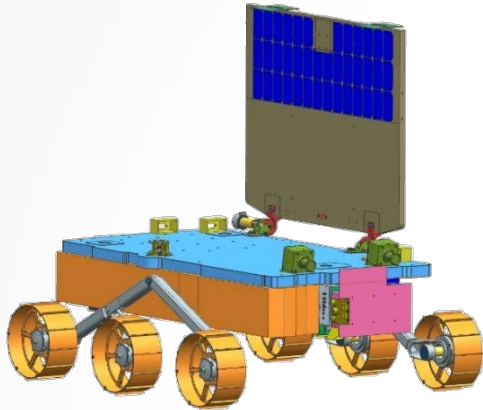
Chandrayaan – 2 Objectives



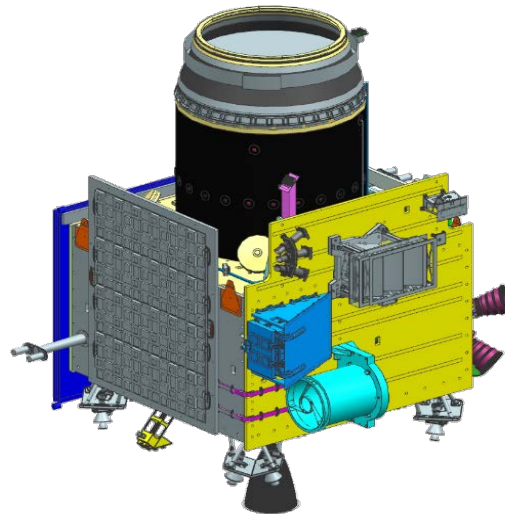
- Expand technologies from Chandrayaan-1 & demonstrate newer technologies for future planetary missions.
- Deploy a Lunar Lander-Rover capable of soft landing on a specified lunar site and deploy a Rover to carry out in-situ analysis of chemicals.
- Carry payloads in the Orbiter craft to enhance the scientific objectives of Chandrayaan-1 with improved resolution.



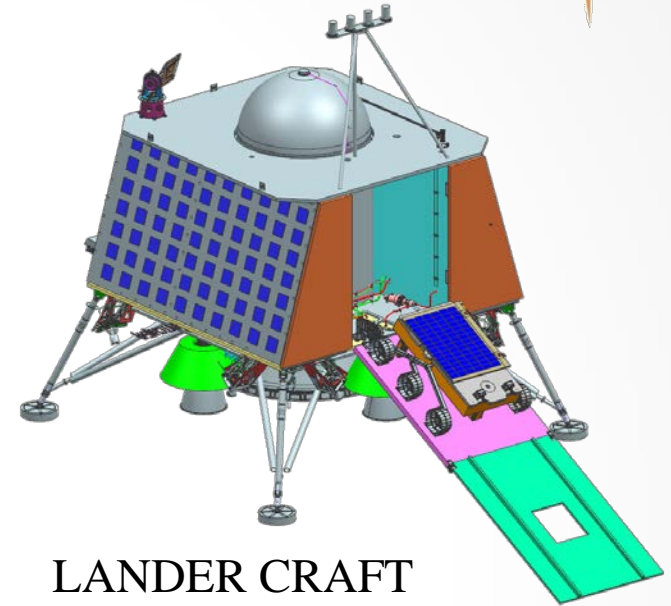
Chandrayaan – 2 Configuration



ROVER

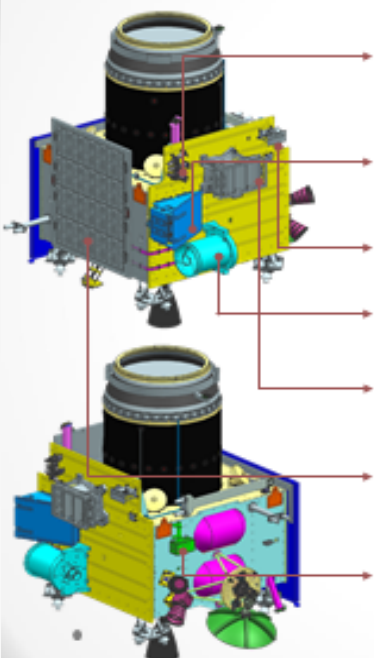


ORBITER CRAFT



LANDER CRAFT

Launch vehicle	GSLV MK-II
Mass	Composite - 3320 kg
Orbiter	100 km Lunar orbit, Mission life - 1 year Orbiter to communicate with IDSN & Lander
Lander	Soft Landing on Moon Mission life of one lunar day (≈ 14 Earth Days) Communication with IDSN /Orbiter/Rover



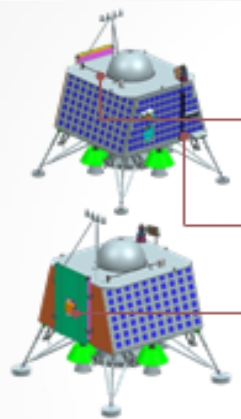
Payloads	Science Objectives
TMC -2	Prepares a detailed three dimensional map of the lunar surface.
CLASS	Maps the abundance of major rock forming elements Mg, Al, Si, Ca, Ti and Fe on the lunar surface .
XSM	Observe the X-rays emitted from the sun and Sun corona and supports CLASS.
OHRC	Provides high resolution image of Landing site
IIRS	Identifies the minerals & signatures of hydroxyl (OH) and water (H ₂ O) molecules in polar regions.
SAR	Maps lunar craters and other features especially in the polar regions.
CHACE -2	Neutral Mass Spectrometer which will carry out a detailed study of the lunar exosphere.
RAMBHA	To measure total electron content (TEC)

Chandrayaan – 2 Payloads

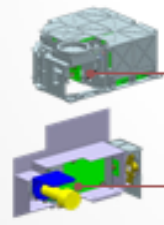
Orbiter

Lander

Rover



Lander Payloads	Science Objectives
RAMBHA (LP+DFRS)	Measure TEC of the lunar ionosphere and its morphology. Measure near surface plasma density and its changes with time
ChaSTE	Measurement of thermal properties of lunar regolith near polar region.
ILSA	Measure lunar seismicity around the landing site and structure of the lunar crust & mantle.



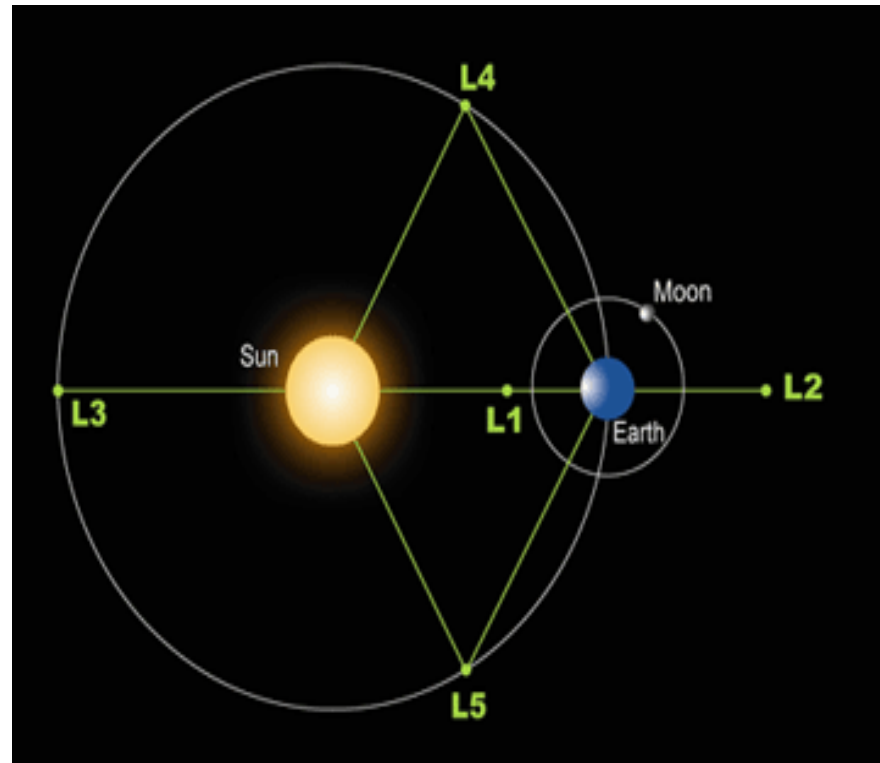
Rover Payloads	Science Objectives
LIBS	Derive the chemical composition and infers – mineralogical composition on lunar surface
APXS	Determine the elemental composition of lunar rocks and soil

Aditya-L1 Mission Objectives



- Realization and launch of a satellite in a Halo orbit around L1.
- Understanding Solar upper atmospheric (chromosphere and corona) dynamics
- Study of chromospheric and coronal heating, Physics of the partially ionized plasma and initiation of the CMEs and flares
- Observe the in-situ particle and plasma environment providing data for the study of particle dynamics from the Sun

Sun-Earth Lagrangian points



Aditya-L1 Mission Profile



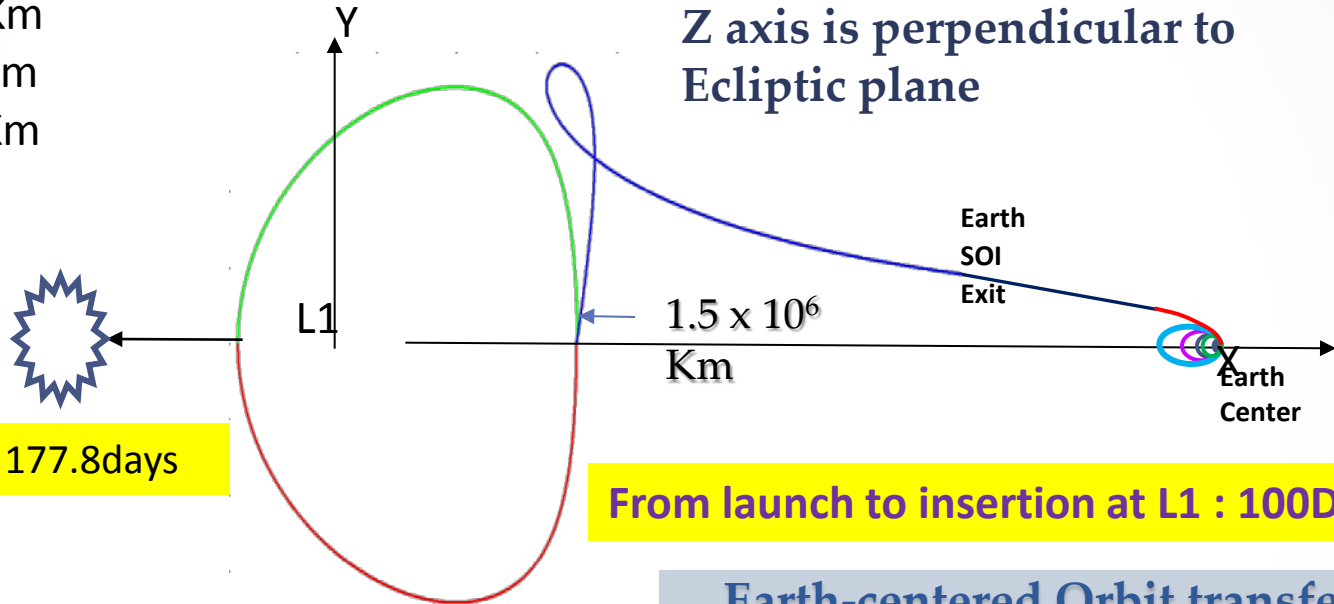
Halo orbital parameters

AX : 208951 Km

AY : 670024 Km

AZ : 120000 Km

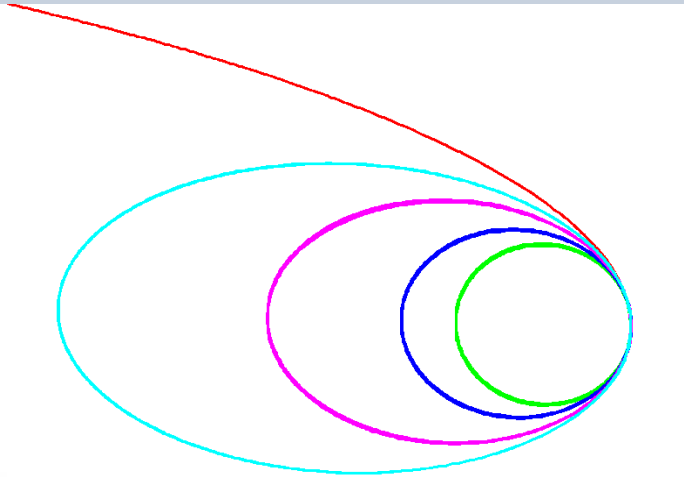
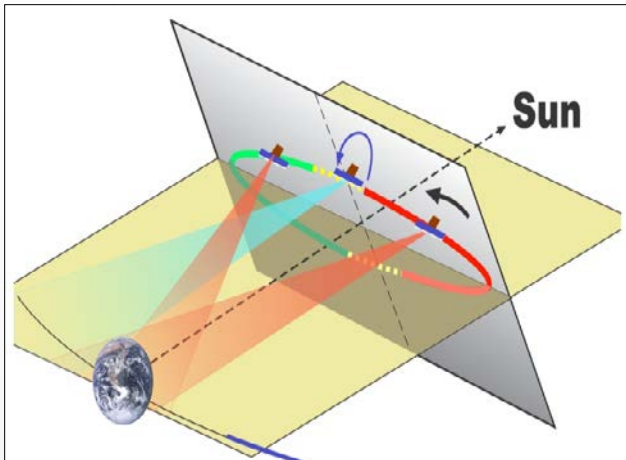
X-Y is Ecliptic plane
Z axis is perpendicular to
Ecliptic plane



Orbital period : 177.8days

From launch to insertion at L1 : 100Days

Earth-centered Orbit transfers



Aditya-L1 Payloads



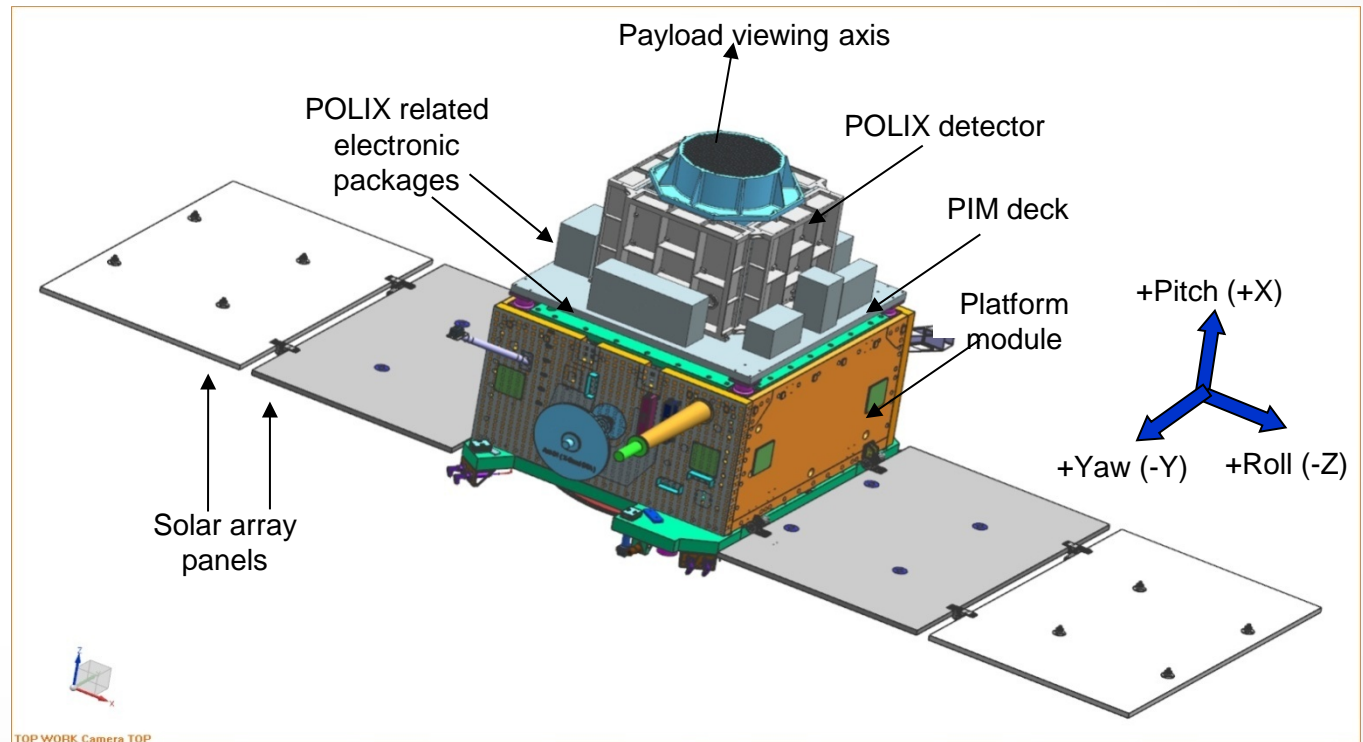
Payloads	Science/Capability
Visible Emission Line Coronagraph (VELC)	Corona/ Imaging , Spectroscopy, Spectro polarimetry
Solar Ultraviolet Imaging Telescope (SUIT)	Photosphere and Chromosphere/ Imaging
Aditya Solar wind Particle Experiment (ASPEX)	Solar wind/ Particle Analyzer In-situ measurement
Plasma Analyser Package For Aditya (PAPA)	Solar wind/ In-situ measurement
Solar Low Energy X-ray Spectrometer (SoLEXS)	Soft X-ray/ In-situ measurement
High Energy L1 Orbiting X-ray Spectrometer (HEL1OS)	Hard X-ray/ In-situ measurement
Advanced Triaxial High Resolution Digital Magnetometers	Measure Magnetic Field/ In-situ measurement

XPoSat Mission Objectives



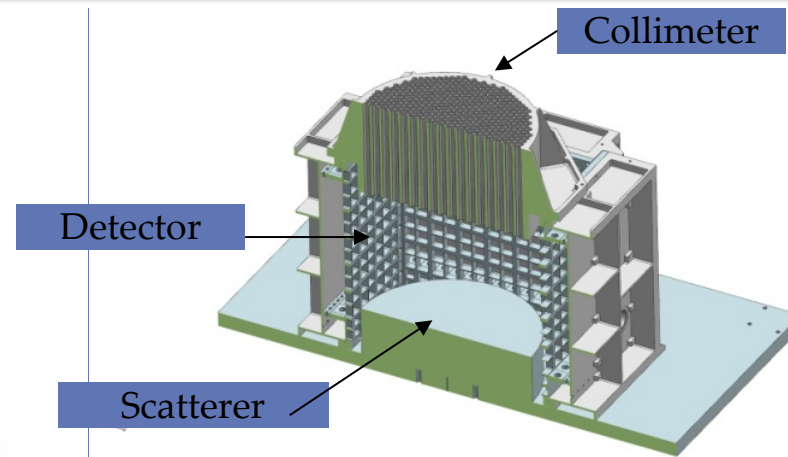
- To measure polarization (degree and direction) of X-ray photons from ~50 potential celestial sources of interest in the energy band of 5-30 keV.
- Mission Life – 5 years, Platform – Modified IMS-2 Bus
- Payload – Polarimeter Instrument in X-rays (POLIX) from Raman Research Institute
- Orbit – Circular LEO (500-700 km), Inclination $\leq 30^\circ$

Deployed View of XPoSat



XPoSat Payload specifications

Photon collection area	640 cm ²
Energy range	5-30 keV
Detectors	Proportional counters
Total weight	~125 kg
Overall dimension	~ 650 x 650 x 600 mm ³ (excluding electronics)
Data generation rate	6 Gbits per day (maximum)
Scattering element	Beryllium / Lithium
Rotation (rate)	0.2 rpm
Pointing accuracy	0.1 deg



POLIX payload detector inner view

Other Missions being Considered



- **Mission to Venus** - Announcement of Opportunity for experiments to study Venus. Payload capability of 175 kg with 500 W of Power. Initial orbit of around 500 x 60,000 km around Venus.
- **Follow on Mars Mission** – Study team formed to address Science and Technology interests. Mission definition to be formulated.
- **Follow on Astrosat Mission** – Studies in IR, UV and sub-mm wavelengths with next generation optics and detectors.
- **Space Weather Mission** – Mission to Sun-Earth Lagrangian point L5 to observe large-scale Solar disturbances that affect earth.

THANK YOU