

CHANDRAYAAN-1

INDIA'S FIRST MISSION TO MOON

Expanding scientific knowledge about the moon,
upgrading India's technological capability
and providing challenging opportunities
for planetary research to the younger generation



Spacecraft:

Physical	: 1.5 m cuboid-shaped main body with a mass of about 600 kg in 100 km lunar orbit
Control	: 3-axis stabilised using reaction wheels and attitude control thrusters; sun sensors, star sensors, and miniaturised DTGs for orientation reference
Power	: Single sided solar array to generate 700 W, 36Ah Li-Ion battery for eclipse operations
Propulsion	: Bi-propellant system for transferring from Initial (Earth) Orbit to Lunar Orbit and for orbit and orientation maintenance
Communication	: TTC in S-band and scientific payload data transmission in X-band
Mission Life	: 2 years

Mission Profile:

- Launched on October 22, 2008 into 250 km x 23,000 km Initial (Earth) Orbit by PSLV-C11
- Solar panel deployment
- Multiple perigee manoeuvres to achieve 380,000 km apogee [Lunar Transfer Trajectory (LTT)] 17 days in Earth Bound Orbits prior to lunar encounter
- Earth and moon imaging by TMC and RADOM Switch ON
- Lunar capture and Spacecraft in 504 km x 7502 km orbit of the moon
- Orbit Manoeuvres to reduce lunar orbit height to 100 km circular polar
- MIP separation and impact (November 14, 2008)
- Payloads switch ON followed by beginning of normal phase
- Orbit Manoeuvres to raise the spacecraft to 200 km high lunar orbit

Scientific Objective:

High resolution remote sensing of moon in the visible, near infrared, microwave, low and high energy X-ray regions for:

- Preparing 3-dimensional atlas of the lunar surface
- Chemical mapping of entire lunar surface

Indian Scientific Payloads:

- Terrain Mapping Camera (TMC) with stereo imaging capability and 5 m spatial resolution
- Hyper-Spectral Imager (HySI) operating in 0.4-0.95 micrometre band with a spectral resolution of 15 nanometre, spatial resolution of 80 m
- Lunar Laser Ranging Instrument (LLRI) with a height resolution of 5 m
- High Energy X-ray Spectrometer (HEX) operating in 30-270 kilo electron Volts (keV)
- Moon Impact Probe (MIP) to prove technology elements for future landing missions

ESA Payloads:

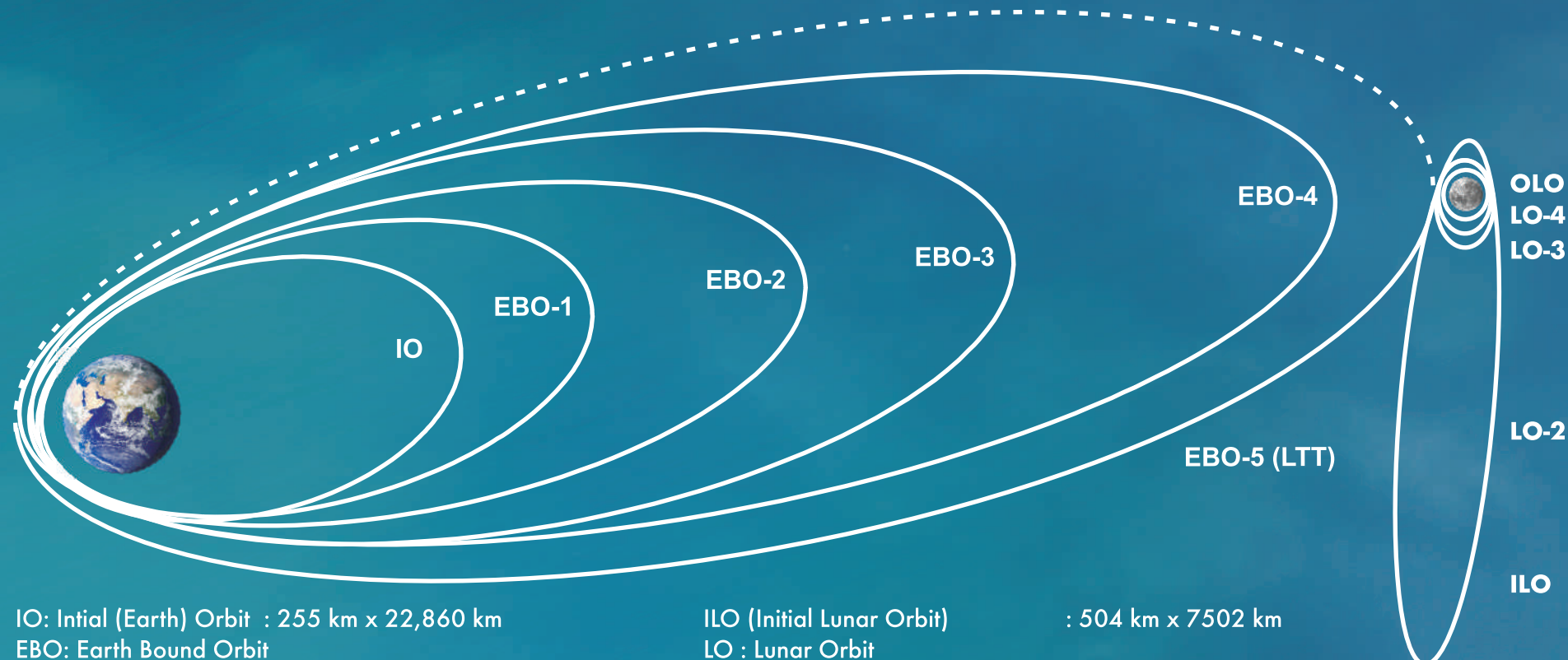
- Chandrayaan-1 Imaging X-ray Spectrometer (CIXS) from Rutherford Appleton Laboratory, UK and ISRO Satellite Centre operating in 1-10 keV
- Smart near Infrared Spectrometer (SIR-2) from Max-Planck Institute of Aeronomy, Germany operating in 0.9-2.4 micrometre band
- Sub keV Atom Reflecting Analyser of Swedish Institute of Space Physics (SARA), with contribution from Vikram Sarabhai Space Centre

US Payloads (Through NASA):

- Miniature Synthetic Aperture Radar (Mini-SAR) from APL, Johns Hopkins University and Naval Air warfare Centre
- Moon Mineralogy Mapper (M3) operating in 0.7-3 micrometre band from Brown University and JPL, NASA

Bulgarian Payload:

- Radiation Dose Monitor (RADOM) from Bulgarian Academy of Sciences



IO: Initial (Earth) Orbit : 255 km x 22,860 km
EBO: Earth Bound Orbit
EBO-1 : apogee at 37,900 km
EBO-2 : apogee at 74,715 km
EBO-3 : apogee at 164,600 km
EBO-4 : apogee at 267,000 km
EBO-5 (LTT-Lunar Transfer Trajectory): apogee at 380,000 km

ILO (Initial Lunar Orbit) : 504 km x 7502 km
LO : Lunar Orbit
LO-2 : 200 km x 7502 km
LO-3 : 182 km x 255 km
LO-4 : 100 km x 183 km
OLO (Operational Lunar Orbit) : 100 km x 100 km

Polar Satellite Launch Vehicle (PSLV-C11)

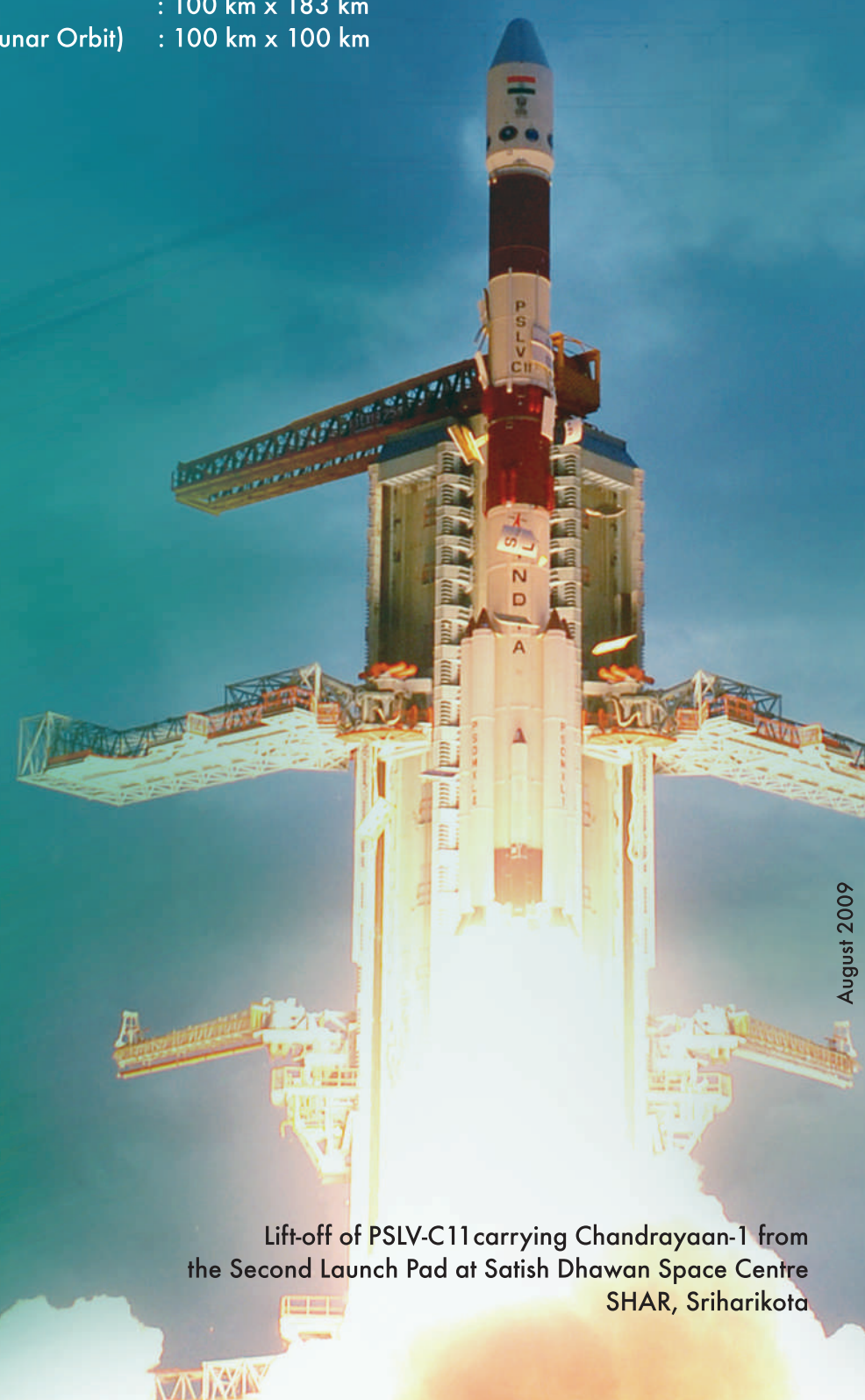
- Lift-off weight : 320 tonne
- Height : 44.4 m
- 13 consecutive successes of PSLV by October 2008
- Demonstrated multiple satellite launch capability
- Launched Satellites to Sun Synchronous, Geosynchronous Transfer, Low Earth and Highly Elliptical Earth Orbits

Payload capability:

- 600 kg into 100 km lunar orbit
- 1380 kg into initial earth Orbit (250 km x 23,000 km)

New Facilities:

- Indian Deep Space Network located near Bangalore with 18 m and 32 m diameter X/S-band antennas
- Indian Space Science Data Centre to process and archive scientific data
- Spacecraft Control Centre at ISRO Telemetry, Tracking and Command Network



Lift-off of PSLV-C11 carrying Chandrayaan-1 from the Second Launch Pad at Satish Dhawan Space Centre SHAR, Sriharikota