CHANDRAYAAN – 1

India’s first Lunar mission

K. Radhakrishnan,
India
O Moon! We should be able to know you through our intellect; You enlighten us through the right path.

Rig Veda Part – I/91/1
Chandrayaan-the Indian initiative for Exploration Moon

Elaborate process of national consultation during May 1999 to April 2003

Prime Minister of India announced on August 15, 2003 on the nation’s decision to enter into a new era of planetary exploration
Chandrayaan—the Scientific Objectives

Understanding the origin and Evolution of the Moon

Physical Properties of the Moon
- Topography
- Gravity
- Magnetic Field
- Radiation Environment

The bulk chemistry of Moon
- Nature of the Lunar Crust
  - The Lunar Far-side: Rock types, Chemistry

Special Regions of Interest:
- Polar Regions,
- South Pole Aitken Region,
- Selected Basins and Craters with central uplift

Nature of the Magma Ocean and Lunar Interior

Nature of Volatile Transport on Moon (Water on Moon?)
## Main Scientific Payloads of Chandrayaan-1 Mission (being built by ISRO, TIFR, PRL)

<table>
<thead>
<tr>
<th>Payload</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terrain Mapping Stereo Camera</td>
<td>5 m spatial resolution</td>
</tr>
<tr>
<td>Hyper Spectral Imager</td>
<td>400-950nm band (15nm) spatial resolution of 80m</td>
</tr>
<tr>
<td>Lunar Laser Ranging Instrument</td>
<td>10 m height resolution</td>
</tr>
<tr>
<td>High Energy Spectrometer</td>
<td>20-250 keV energy region 40 km spatial resolution</td>
</tr>
<tr>
<td>Moon Impact Probe</td>
<td></td>
</tr>
<tr>
<td>Scientific Payloads of Chandrayaan-1 Mission (from international scientific community)</td>
<td></td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Low Energy X-Ray Spectrometer (1-10 KeV)</strong></td>
<td>ESA (UK) and ISRO</td>
</tr>
<tr>
<td><strong>Smart Near Infrared Spectrometer</strong></td>
<td>ESA (Germany)</td>
</tr>
<tr>
<td><strong>Sub KeV Atom Reflecting Analyser</strong></td>
<td>ESA (Sweden)</td>
</tr>
<tr>
<td><strong>Miniature Synthetic Aperture Radar</strong></td>
<td>NASA</td>
</tr>
<tr>
<td><strong>Moon Minerology Mapper</strong></td>
<td>NASA</td>
</tr>
<tr>
<td><strong>Radiation Dose Monitor</strong></td>
<td>Bulgaria</td>
</tr>
</tbody>
</table>
Chandrayaan: A Unique High Resolution Remote Sensing Mission

- Moon Minerology Mapper
- Smart Near Infrared Spectrometer
- Lunar Laser Ranging Instrument
- Miniature Synthetic Aperture Radar
- Hyper Spectral Imager
- Terrain Mapping Stereo Camera
- Low Energy X-Ray Spectrometer
- High Energy Spectrometer
- Radiation Dose Monitor
- Moon Impact Probe
- Sub KeV Atom Reflecting Analyser
- Neutral particles
Assembly and Testing of Chandrayaan Spacecraft at ISAC, Bangalore
13 Successive Successful Flights

PSLV - Launch Vehicle

1994

DEVELOPMENT

1994

13 Successive Successful Flights

DEVELOPMENT

2008

OPERATIONAL PSLV

PSLV

PSLV

CORE ALONE

PSLV – XL

PAYLOAD IMPROVEMENT PACKAGES

850 kg

(SSPO)

1600 kg

(SSPO)

1100 kg

(SSPO)

1750 kg

(SSPO)
A View of Mission Control Centre
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: 182 km x 100 km
OLO (Operational Lunar Orbit): 100 km x 100 km
# Chandrayaan Payload Commissioning

<table>
<thead>
<tr>
<th>Payload</th>
<th>Date of Commissioning</th>
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</thead>
<tbody>
<tr>
<td>Radiation Dose Monitor</td>
<td>22.10.08</td>
</tr>
<tr>
<td>Terrain Mapping Camera (TMC)</td>
<td>29.10.08</td>
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<tr>
<td><strong>Moon Impact Probe (MIP)</strong></td>
<td><strong>14.11.08</strong></td>
</tr>
<tr>
<td>Lunar Laser Ranging Instrument (LLRI)</td>
<td>16.11.08</td>
</tr>
<tr>
<td>Hyper Spectral Imaging Camera (HYSI)</td>
<td>16.11.08</td>
</tr>
<tr>
<td>Mini SAR</td>
<td>17.11.08</td>
</tr>
<tr>
<td>Moon Mineralogy Mapper (M3)</td>
<td>18.11.08</td>
</tr>
<tr>
<td>InfraRed Spectrometer (SIR-2)</td>
<td>19.11.08</td>
</tr>
<tr>
<td>Chandrayaan-1 X-ray Specrometer (C1XS)</td>
<td>20.11.08</td>
</tr>
<tr>
<td>High Energy X-ray (HEX)</td>
<td>05.12.08</td>
</tr>
<tr>
<td>Sub keV Atomic Reflecting Analyser (SARA)</td>
<td>08.12.08</td>
</tr>
</tbody>
</table>
CRATER MORPHOLOGY from
Chandrayaan-1 Terrain Mapping Camera (November 16, 2008)
Analysis of Orientale Basin data: Chandrayaan-1 HySI

Clementine 750 nm

Mare Orientale

Part of Orientale basin

HySI data coverage Nov 23, 2008

Chandrayaan-1 HySI bands

454 nm

756 nm

947 nm
Apollo 15 Landing Site

Rima Hadley Rille

Apollo 15 Tracks

Chandrayaan TMC data 9 Nov 2009
100 Days of Chandrayaan Mission (January 30, 2009)
Chandrayaan-1, the beginning of a new era

Thank you for the kind attention