



## ISRO Science Data Archive: Chandrayaan-1 (and sample imagery)

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## Chandrayaan-1 Payloads

- Indian Payloads
  - Terrain Mapping Camera (TMC)
  - Hyper Spectral Imager (HySI)
  - High Energy X-ray spectrometer (HEX)
  - Lunar Laser Ranging Instrument (LLRI)
  - Moon Impact Probe (MIP)
- AO Payloads
  - Moon Mineralogy Mapper (M3)
  - MiniSAR
  - Infrared Spectrometer (SIR-2)
  - Radiation Dose Monitor (RADOM)
  - Sub-keV Atom Reflecting Analyser (SARA)
  - Low Energy X-Ray payload (CIXS)

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## Chandrayaan-1

- Chandrayaan-1 was launched on 22<sup>nd</sup> October 2008
- Payload data is being received at ISSDC since 14<sup>th</sup> November 2008, TMC was switched on enroute moon on 29<sup>th</sup> October 2008
- Data from 'imaging season one' for imaging instruments were collected till 14<sup>th</sup> Feb 2009
- Currently 'imaging season two' is on and the data is being received regularly at ISSDC

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## Indian Space Science Data Center (ISSDC)

- Indian Space Science Data Centre (ISSDC) is setup at Bangalore, which is the custodian of all the science data from the Indian science missions; Chandrayaan-1 is the first among all such missions, where the active archive of payload data is being created.
- ISSDC is responsible for the Ingest, Archive, and Dissemination of the payload and related ancillary data.
- The primary users of this facility are PIs of the science payloads till the lock-in period.

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## Data Products at ISSDC

- Basic data product levels (all instruments) at ISSDC are
  - Level-0: Time tagged raw instrument data along with the ancillary information
  - Level-1: Instrument calibration along with seleno referencing (wherever applicable)
- Higher levels: Instrument specific (limited)
- Dissemination is initially limited to the concerned PIs and the release to the other specific users will be after a lock-in period.

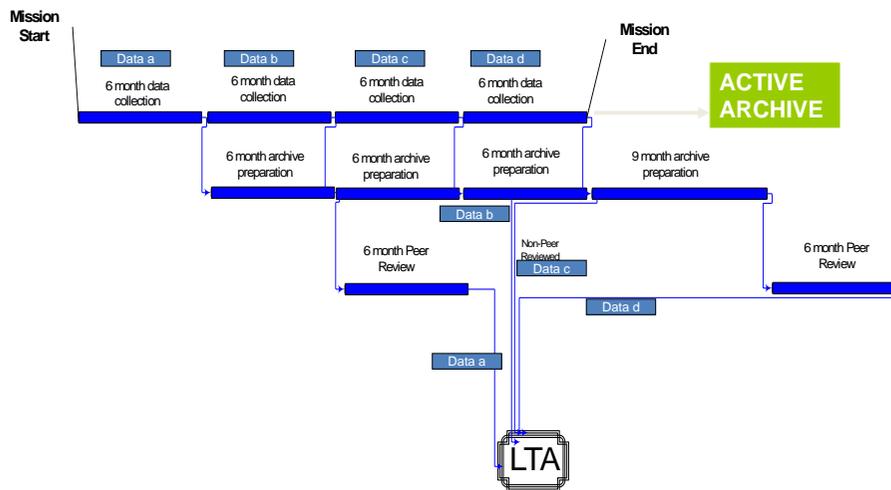
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## ISRO Science Data Archive (ISDA) Characteristics

- The ISDA for Chandrayaan-1 will be an archive holding the data from all science instruments. Currently it is under preparation
- The underlying standard of the ISDA is the Planetary Data System (PDS) from NASA and it is aimed to be fully PSA compatible

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## Science Data Archive Schedule



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## Peer Reviews and Archive Validation

- Initial Peer Review: The first data sets containing data acquired during first 6 months data collection period will be peer reviewed within 6 months after delivery. **Currently the first data set is being prepared for the delivery at ISSDC for peer review**
- Final Peer Review: All data sets together will be reviewed within 6 months after the final delivery expected 15 months after the end of the Chandrayaan-1 mission.
- Arising problems will be resolved by the concerned experiment/PI teams, and the ISDA team through **Chandrayaan-1 Science Data Archive Working Group (CSDAWG)**.

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## Archive Development Status

- Archive Plan and Archive Conventions are prepared and agreed by all instrument PIs/Scientists after one level of iteration.
- EAICD updations were completed for most of the instruments and active archive is being created at ISSDC for the acquired data
- New key words, specific to Chandrayaan-1 are worked out especially for TMC, HySI and LLRI
- The first data set is being prepared for the delivery at ISSDC towards peer review
- Peer review teams are to be identified, CSDWG to be formed and peer review is to be carried out.

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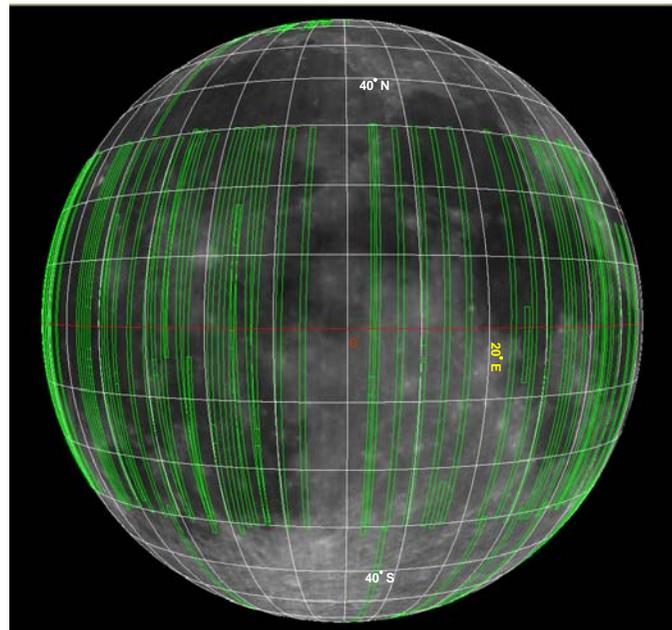
## Utilities/tools Developed

Basic tools are developed for data browsing and dissemination for internal teams

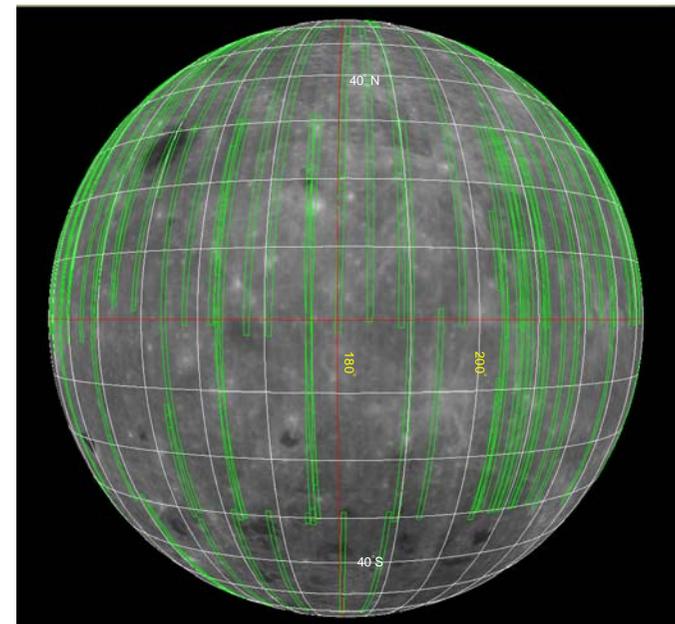
- PDS viewer
  - Taking into account various imaging modes
    - Ascending and descending nodes of data collection
    - Yaw flip for every six months
- PDS verifier
- Data selection (browse) and workorder generation
  - Through corner coordinates
  - Through date of imaging or orbit etc
- Initial version of data dissemination

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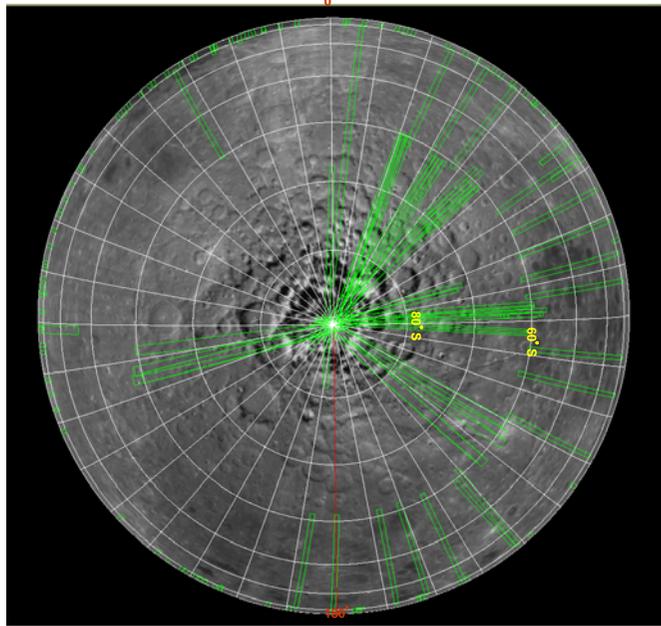
TMC COVERAGE - NEAR SIDE (WITH GRID)



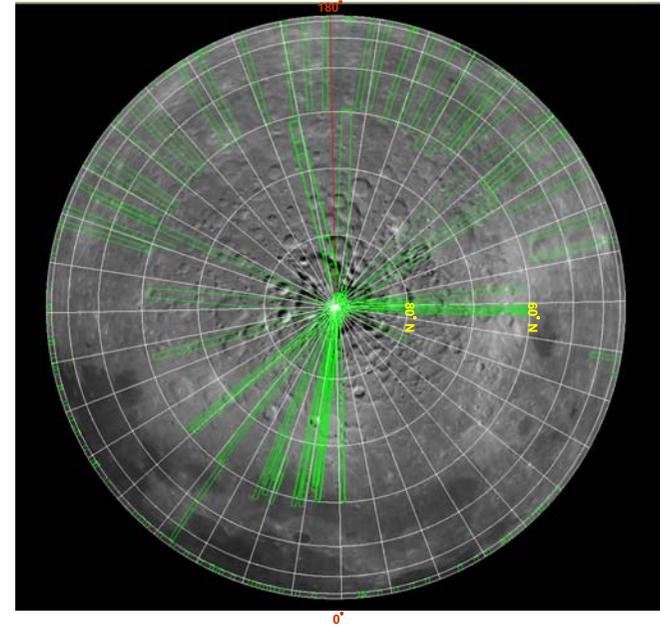
TMC COVERAGE - FAR SIDE (WITH GRID)



SOUTH POLE TMC COVERAGE

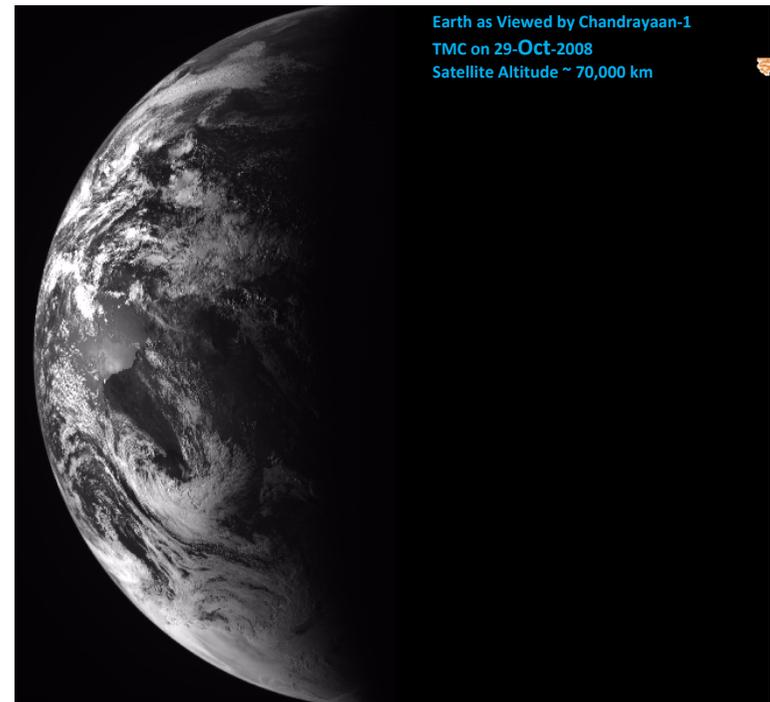


TMC COVERAGE - NORTH POLE

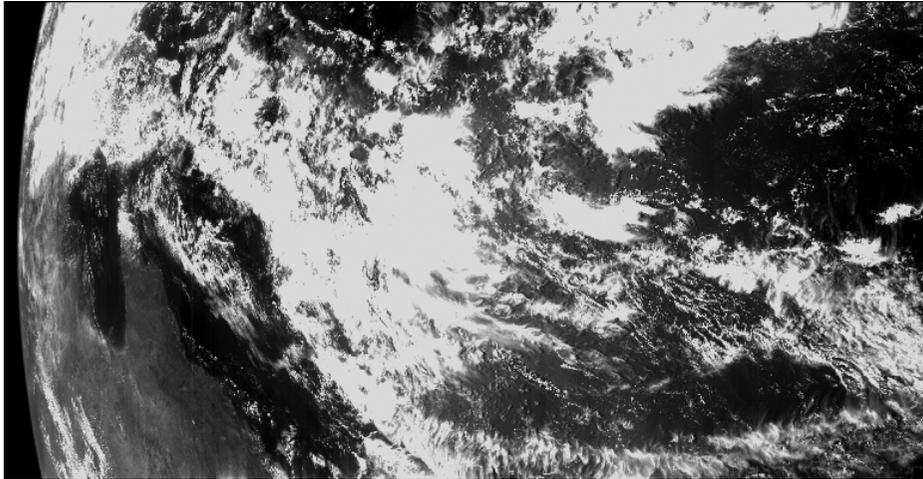


## Some Initial Images of Chandrayaan-1 TMC, HySI and MIP

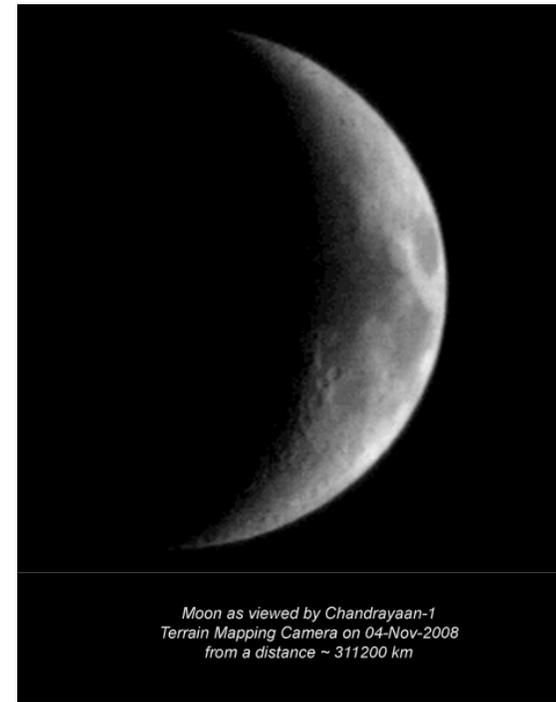
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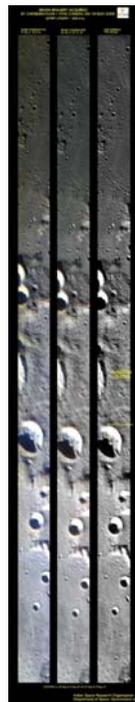
Earth as Viewed by Chandrayaan-1 TMC on 29-Oct-2008  
Satellite Altitude ~ 9000 km



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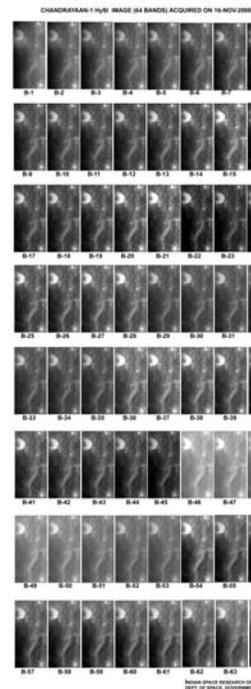
Moon as viewed by Chandrayaan-1  
Terrain Mapping Camera on 04-Nov-2008  
from a distance ~ 311200 km



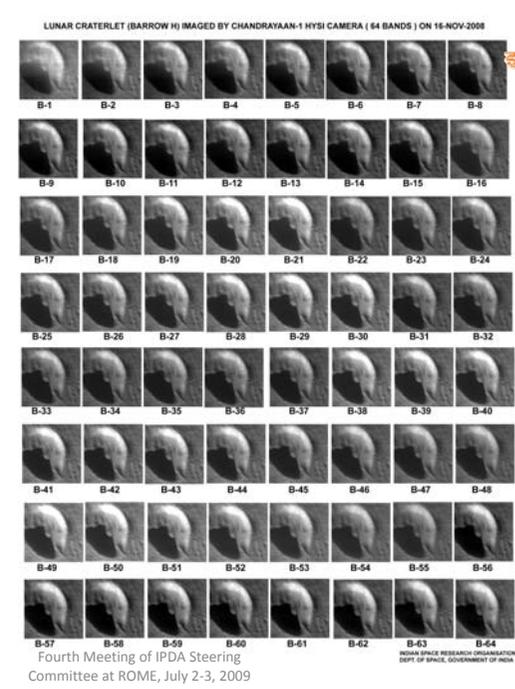
HySI Imagery of 16-11-08 along with TMC  
sub-sampled NADIR image for comparison



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CHANDRAYAAN-1 HYSI IMAGE (64 BANDS) ACQUIRED ON 16-NOV-2008

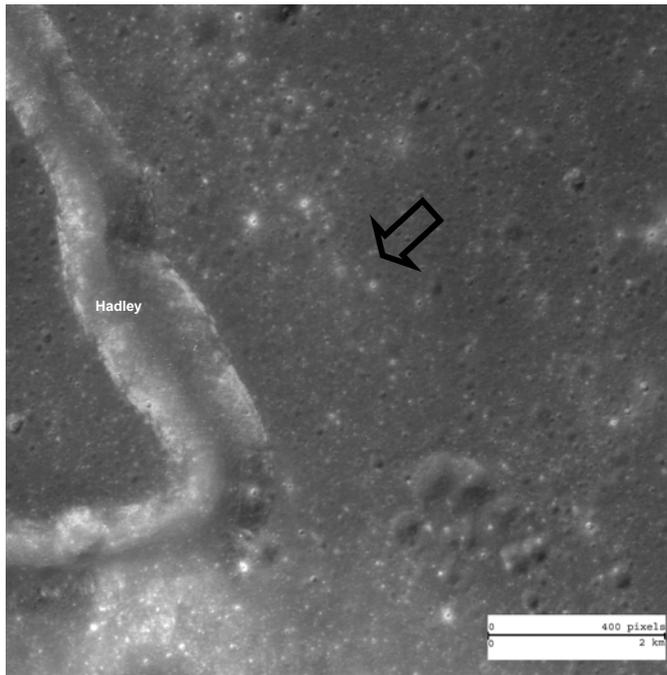


LUNAR CRATERLET (BARROW IG) IMAGED BY CHANDRAYAAN-1 HYSI CAMERA ( 64 BANDS ) ON 16-NOV-2008

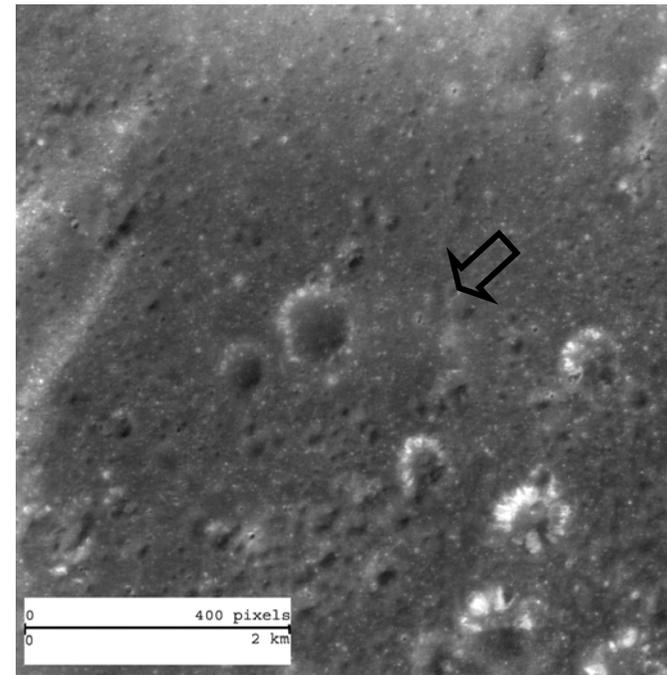


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INDIAN SPACE RESEARCH ORGANIZATION,  
DEPT. OF SPACE, GOVERNMENT OF INDIA

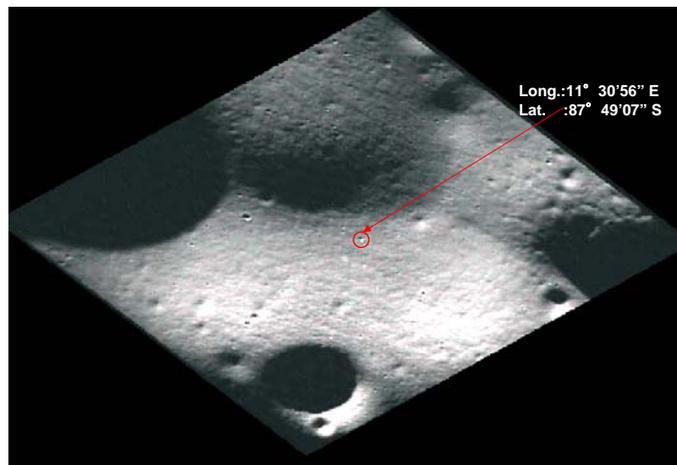


Apollo 15   
 Landing Site Viewed by Chandrayaan-1  
 Terrain Mapping Camera (TMC) on 7 Jan 2009

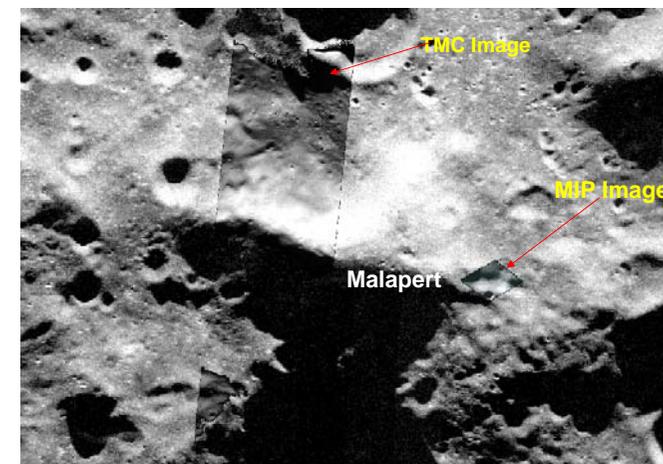


Apollo 17   
 Landing Site Viewed by Chandrayaan-1  
 Terrain Mapping Camera (TMC) on 9 Jan 2009

MIP Image (Frame No. 3020) over Malapert Mountain 



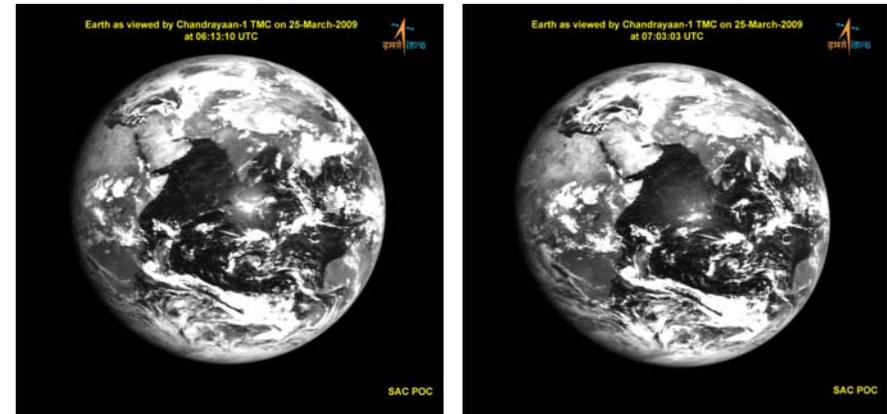
Scale  
 0 1.5 km  
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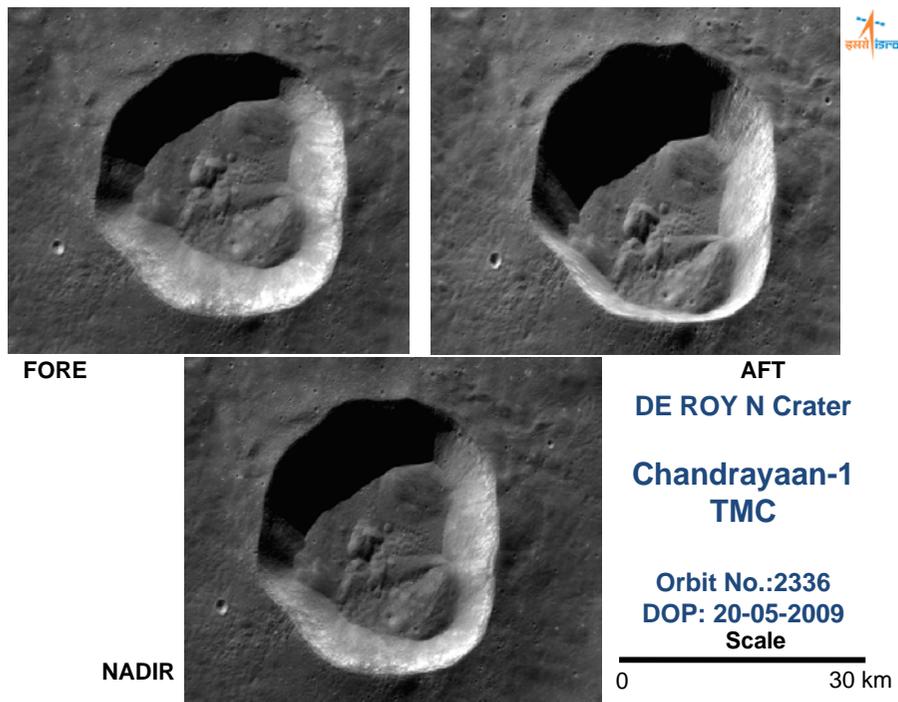
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## Recent Images

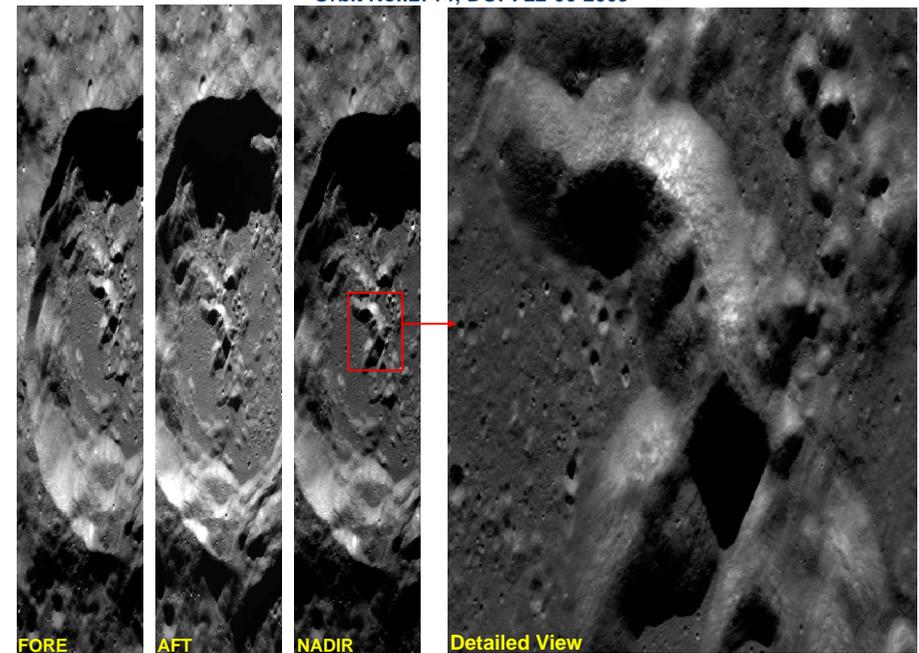
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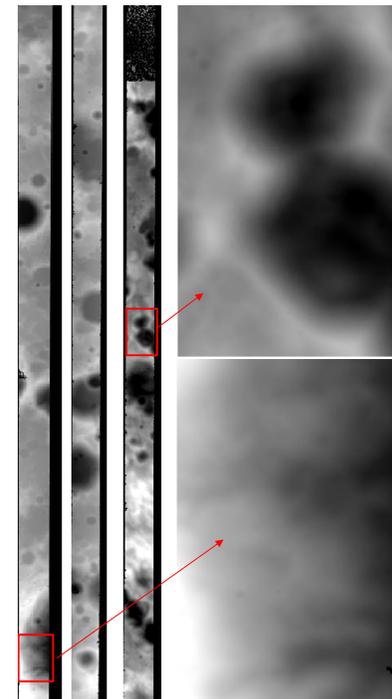
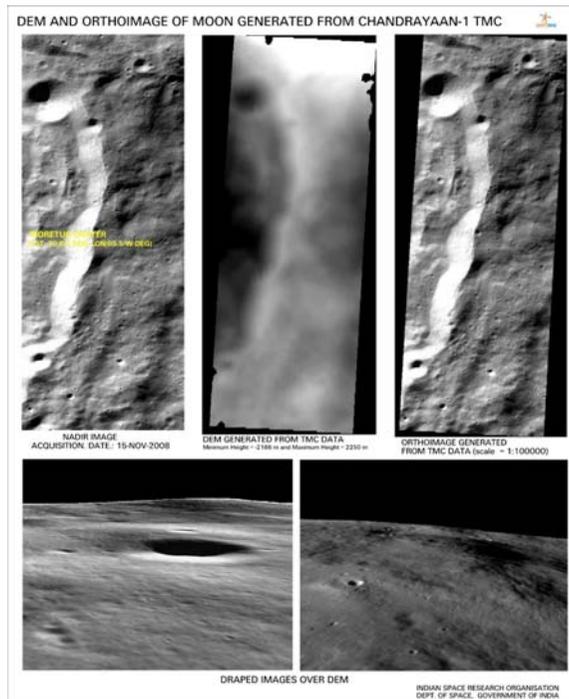
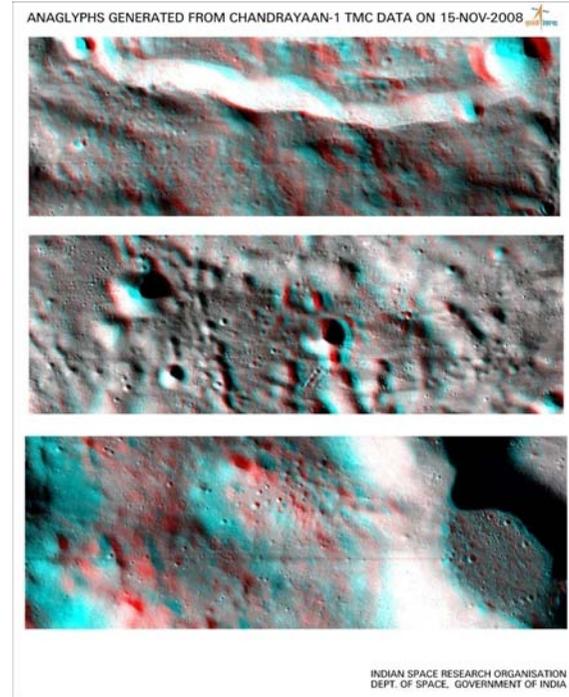


Part of RICCO Crater (North Polar Region) Viewed by Chandrayaan-1 TMC  
Orbit No.:2714; DOP: 22-06-2009



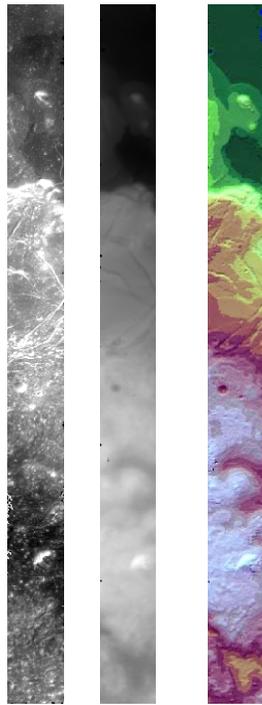
# DEM and Visualisation

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Overview & Full resolution (in box) of DEM generated for three strips of 600 km each

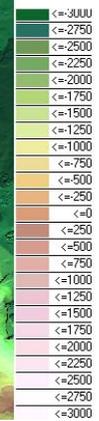
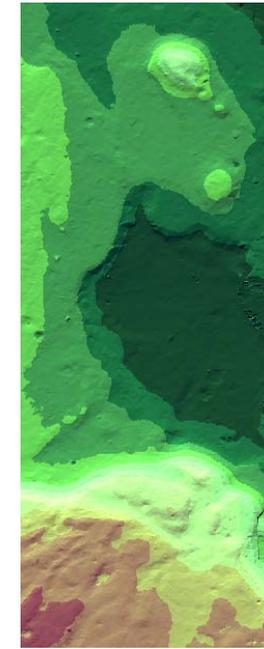
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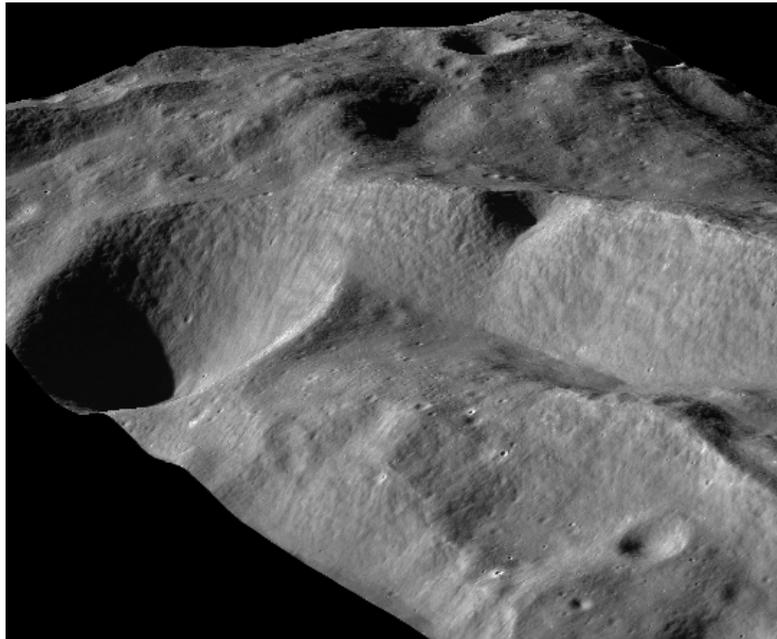
**Chandrayaan-1 TMC Imagery over  
 Part of Mare Orientale (date:22-11-08)  
 Strip Length: 250 km  
 Orthoimage, DEM and color coding**



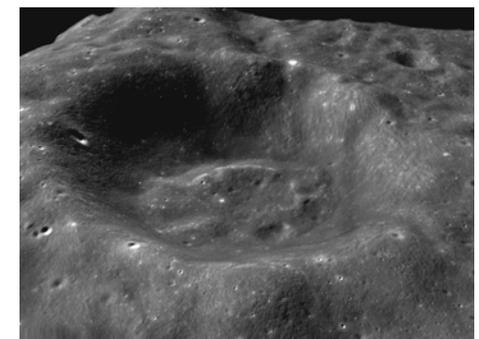
**Part of Mare Orientale (date:22-11-08); Strip Length: 65 km**



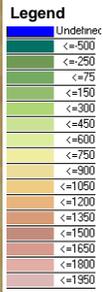
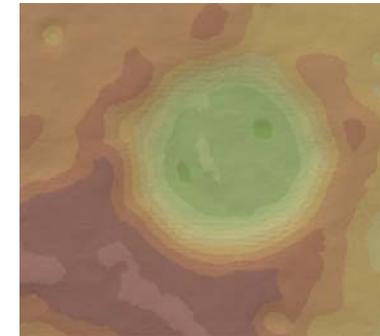
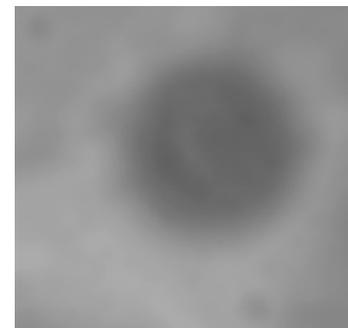
**Part of Moretus Crater of Moon as Viewed by Chandrayaan-1 TMC Camera on 15-Nov-2008**

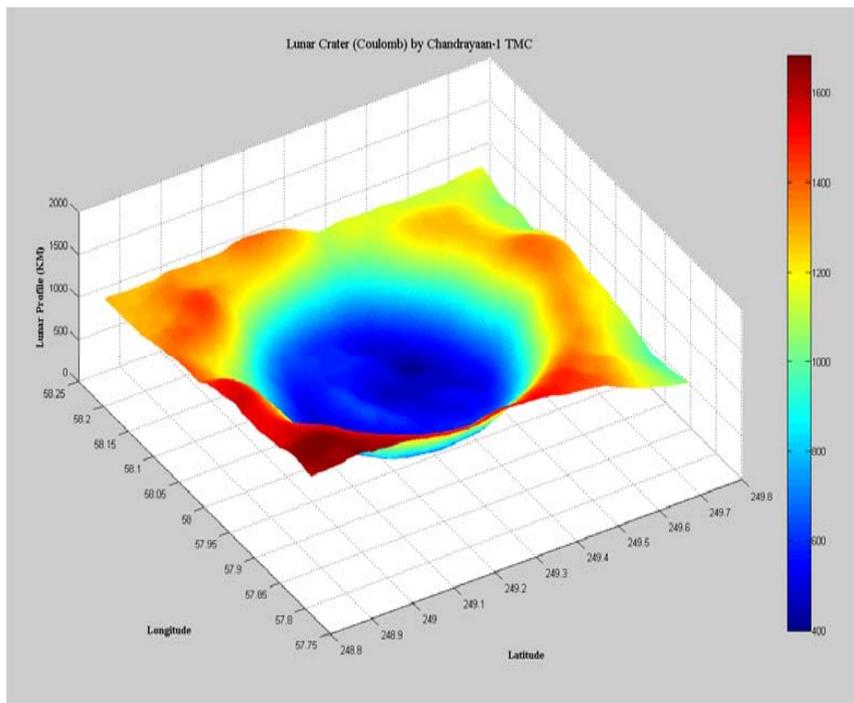


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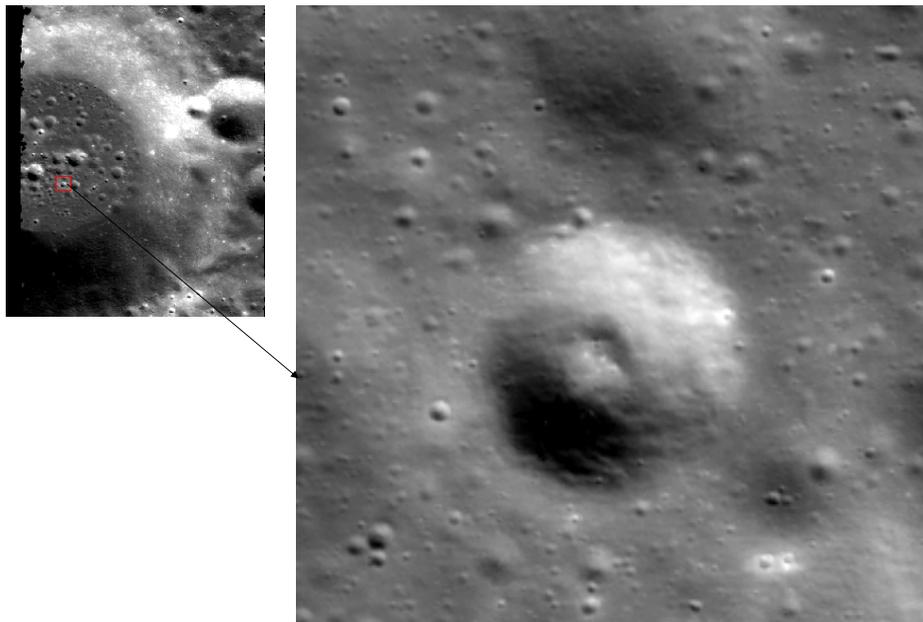
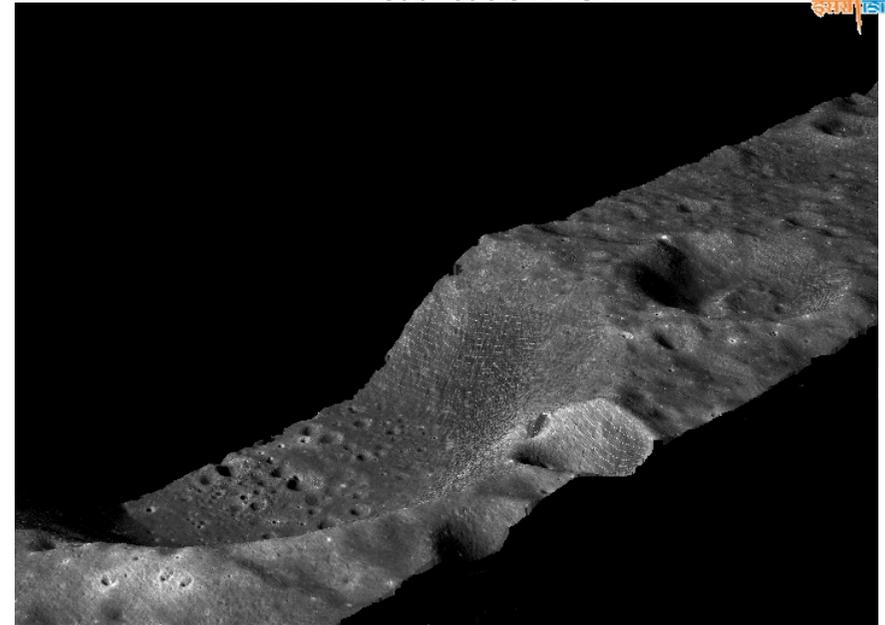


DEM  
 VISUALIZATION

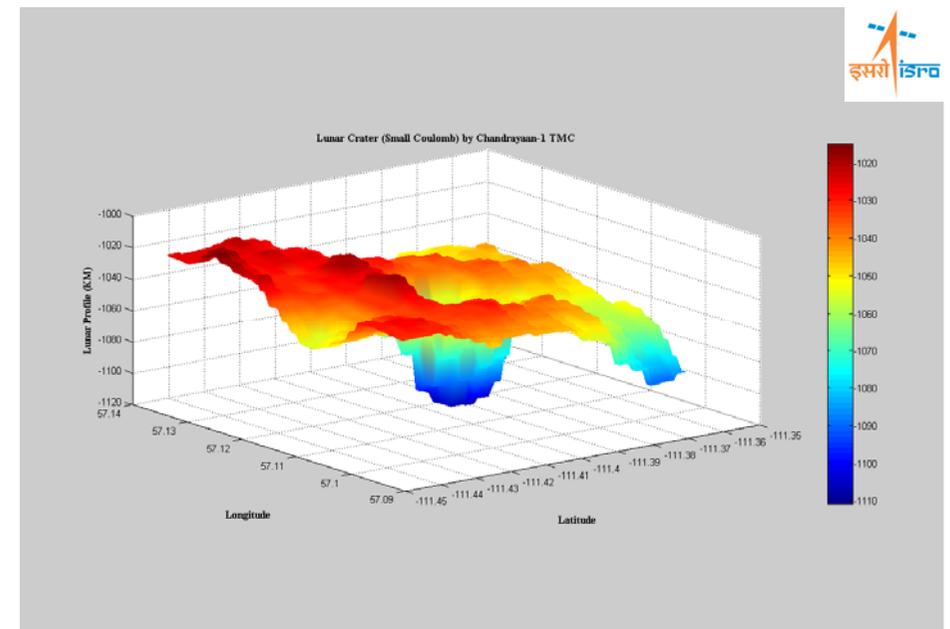




## DEM Visualisation 2.5D

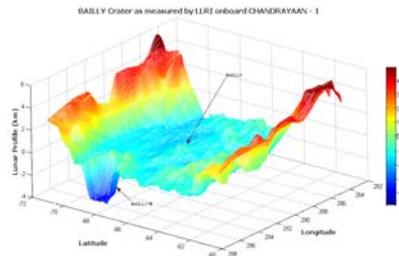


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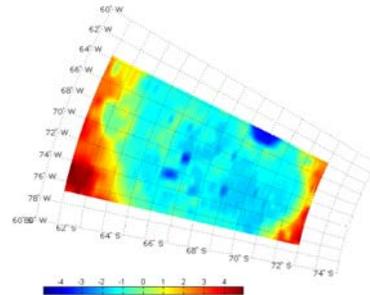


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## LLRI Datasets: Bailly Crater



Height Profile in 3D



Height Color Coding in 2D

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## Points for Discussion

- Implementation of IPDA guidelines and standards, when and how to start?
- Availability of sample data sets from other missions who has already in compliance with IPDA standards, for the new implementation as an example
- Availability of tools to the IPDA members, developed under projects

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# Thank You

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