Abstract:

Lunar Mapping and Modeling Project – S. Noble, R. French, M. Nall, K. Muery

The Lunar Mapping and Modeling Project (LMMP) has been created to manage the development of a suite of lunar mapping and modeling products that support the Constellation Program (CxP) and other lunar exploration activities, including the planning, design, development, test and operations associated with lunar sortie missions, crewed and robotic operations on the surface, and the establishment of a lunar outpost. The project draws on expertise from several NASA and non-NASA organizations (MSFC, ARC, GSFC, JPL, CRREL and USGS). LMMP will utilize data predominately from the Lunar Reconnaissance Orbiter, but also historical and international lunar mission data (e.g. Apollo, Lunar Orbiter, Kaguya, Chandrayaan-1), as available and appropriate, to meet Constellation's data needs. LMMP will provide access to this data through a single, common, intuitive and easy to use NASA portal that transparently accesses appropriately sanctioned portions of the widely dispersed and distributed collections of lunar data, products and tools. LMMP will provide such products as DEMs, hazard assessment maps, lighting maps and models, gravity models, and resource maps. We are working closely with the LRO team to prevent duplication of efforts and ensure the highest quality data products. While Constellation is our primary customer, LMMP is striving to be as useful as possible to the lunar science community, the lunar education and public outreach (E/PO) community, and anyone else interested in accessing or utilizing lunar data.

The Lunar Mapping and Modeling Project

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Project Background and Overview

- LMMP was initiated in 2007
  - to help in making the anticipated results of the LRO spacecraft useful and accessible to Constellation
  - the MSFC Lunar Precursor Robotic Program Office (LPRP) was given management responsibilities
- The LMMP is managing and developing a suite of lunar mapping and modeling tools and products that support the Constellation Program (CxP) and other lunar exploration activities
- In addition to the LRO Principal Investigators, relevant activities and expertise that had already been funded by NASA was identified at ARC, CRREL (Army Cold Regions Research & Engineering Laboratory), GSFC, JPL, & USGS
- LMMP is a cost capped, design-to-cost project
  - Project budget was established prior to obtaining Constellation needs

Customers

- Main customer is the Constellation program
The information provided through LMMP will assist them in:
  - planning tasks in the areas of landing site evaluation and selection
  - design and placement of landers and other stationary assets
  - design of rovers and other mobile assets
  - developing terrain-relative navigation (TRN) capabilities
  - assessment and planning of science traverses

- Other customers
  - Science community
  - Commercial community
  - Education/Public Outreach community

Data Sources

- LRO
- M3
- Kaguya (gravity model)
- Apollo (metric & panoramic cameras)
- Clementine
- Prospector
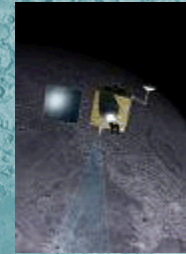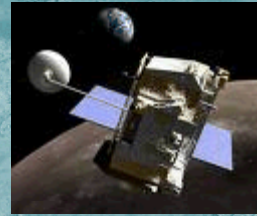
Data Products

- "Passthrough"
  - e.g. LOLA DEM, Clementine, Prospector, gravity model, lighting model
- Modify
  - e.g. mosaicking basemap, georeferencing local images
- Create
  - DEMs
    - Regional (Apollo metric camera)
    - Local (LROC NAC)
  - Hazards
    - Craters and Boulders
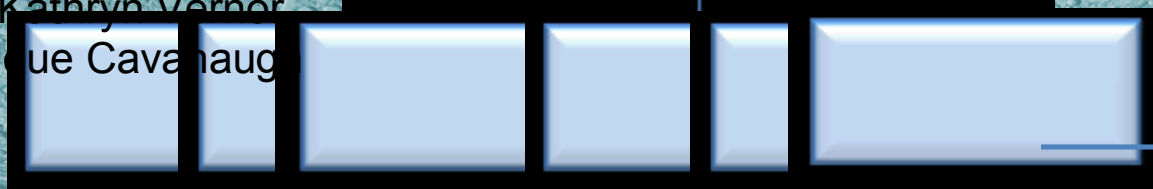   - Slopes
    - Surface Roughness

Management
Structure Post LPRP

FY 2

Director
Advanced Capabilities
Division
ESMD

Director
Directorate Integration
Office
ESMD

Director
Marshall Space Flight
Center

Engineering and Safety
and Mission Assurance
Technical Authority
MSFC

Lunar Geodesy and
Cartography Working Group
(LMMP/CxP/LRO/International)

Manager
Lunar Mapping and

LSOS
(CxP/DIO/JPL)

MSFC Team:
Project Manager: Mark Nall
Project Integration Lead: Ray French
Project Development Lead: Kim Muery
Project Scientist: Dr. Sarah Noble

S&MA TA: Rosalynne Stricklan
Scheduling: Kathryn Verner
Risk: Dominique Cavanaug

ARC
Lead

GSFC
Lead

JPL
Lead

CRREL
Lead

USGS
Lead

ASU

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LMMP Team

ARC
- Regional Apollo visible base imagery mosaics
- Regional DEMs
- EPO web-based neo-geography interfaces

USGS
- Local/site visible base imagery mosaics
- Regional/polar visible base imagery mosaics
- Local/site DEMs

JPL
- Visualization system infrastructure, web portal and interoperable GIS infrastructure
- Local/site DEMs (stereo photoclinometry)
- Local/site albedo maps
- Hazard assessment maps (including slope maps)

ASU
- Local/site DEMs

CRREL
- Web-based visualization system digital overlay tools

GSFC
- Desktop visualization client – Integrated Lunar Information Architecture for Decision Support (ILIADS)

Lunar Mapper (pre-beta)

Lunar Mapper in Global Mode

Lunar Mapper (pre-beta)

Lunar Mapper in Search Mode

Integrated Lunar Information Architecture for Decision Support (ILIADS) (pre-beta)
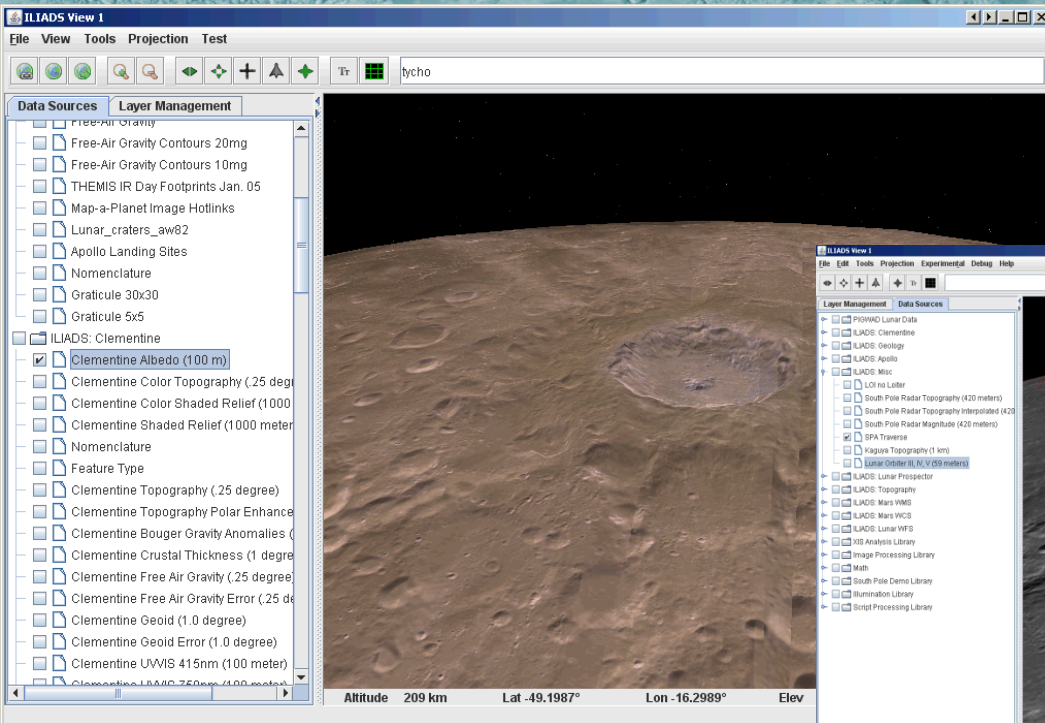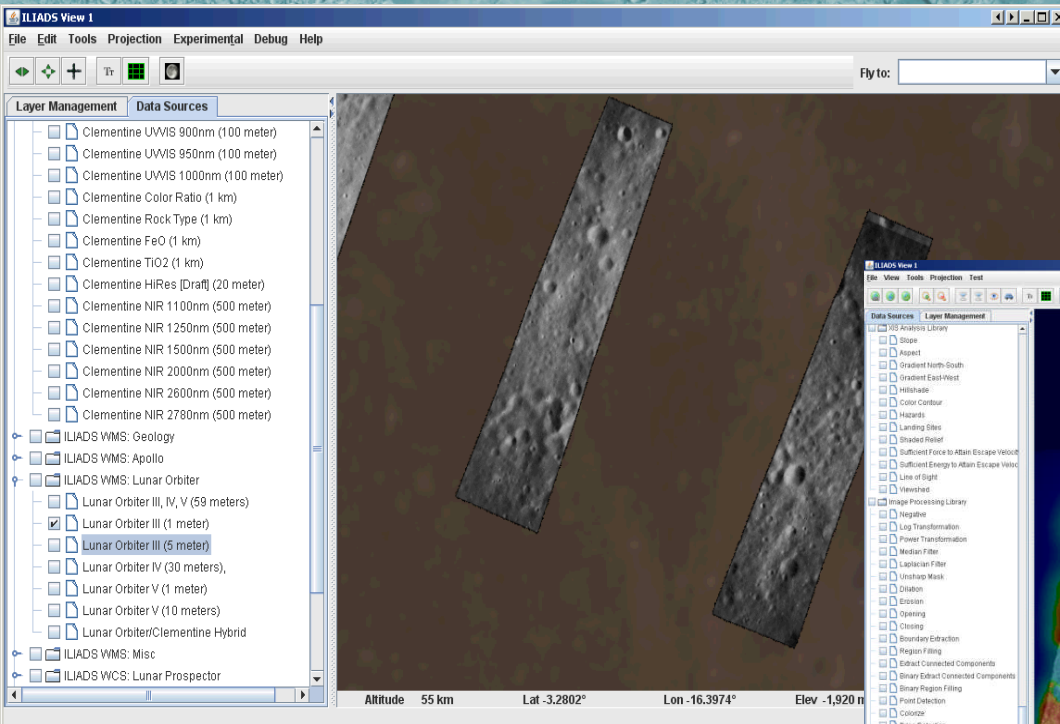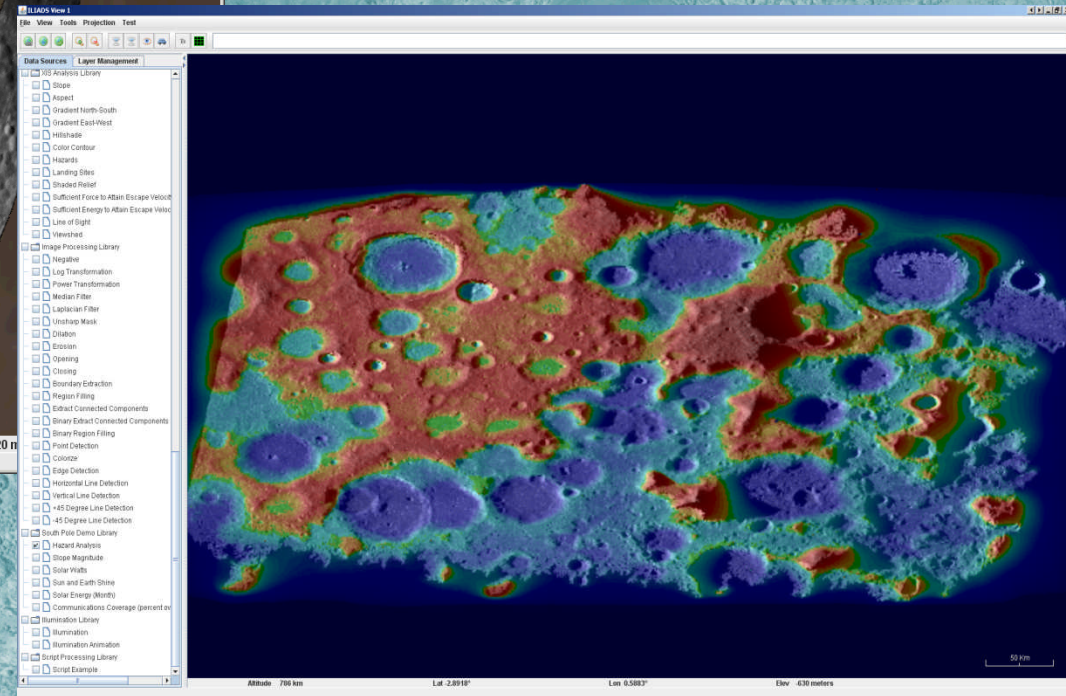

Clementine Albedo (oblique view)
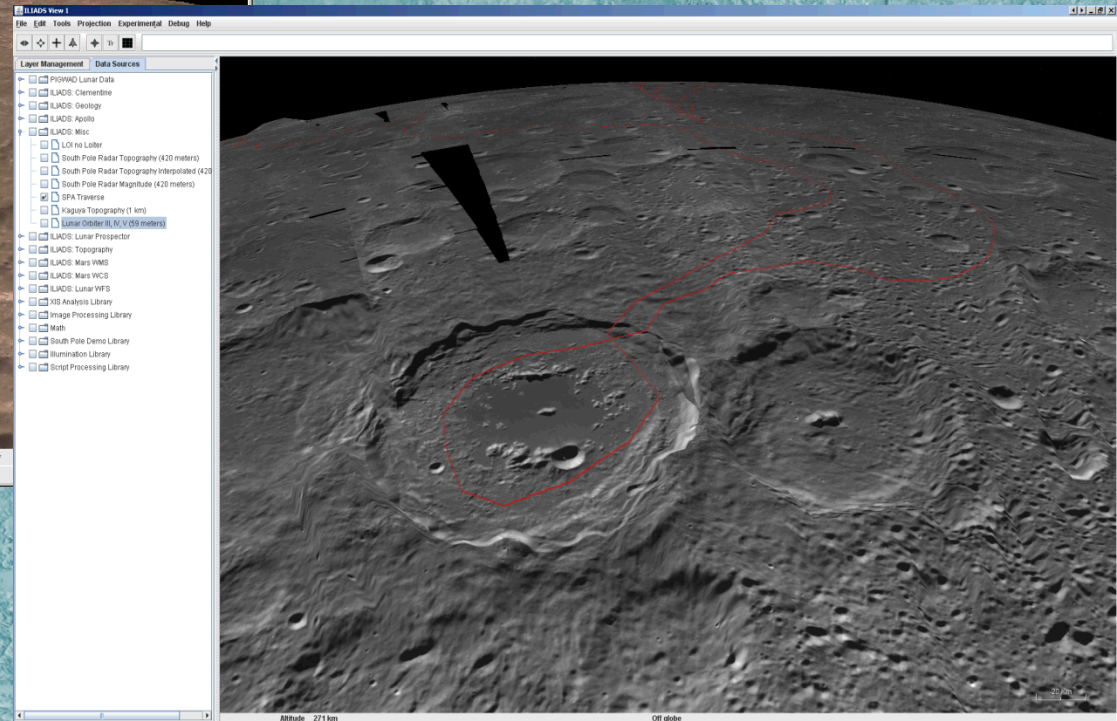
Lunar Surface Traverse Tool (oblique view)

Integrated Lunar Information Architecture for Decision Support (ILIADS) (pre-beta)

Clementine with high-res Lunar Orbiter

South Pole hazard analysis (surface roughness)

LMMP Milestones

- Apr 2009 – Formulation review
- Jun 2009 – LRO launched!
- Jun 2009 – Requirements review
- Aug-Sep 2009 – Individual product process validation audits
- Sep 2009 – Preliminary System design audit
- Nov 2009 – Beta release of Mapper, ILIADS, Portal, infrastructure and content
- Late 2010/Early 2011 – Version 1 release