The Lunar Mapping and Modeling Project

Sarah Noble, Raymond French, Mark Nall, and Kimberly Muery

NASA Marshall Space Flight Center
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 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 (e.g. GLXP teams)
  – Education/Public Outreach community
Management Structure Post LPRP

FY 2010-11

MSFC Team:
Project Manager: Mark Nall
Project Integration Lead: Ray French
Project Development Lead: Kim Muery
Project Scientist: Dr. Sarah Noble
Chief Engineer: Judy Ballance
S&MA TA: Rosalynne Strickland
Scheduling and Risk: Dominique Cavanaugh
LMMP Team

- Regional Apollo visible base imagery mosaics
- Regional DEMs
- EPO web-based neo-geography interfaces
- Local/site visible base imagery mosaics
- Regional/polar visible base imagery mosaics
- Local/site DEMs
- Visualization system infrastructure, web portal and interoperable GIS infrastructure
- Local/site DEMs (stereo photoclinometry)
- Hazard assessment maps (including slope maps)
- Local/site DEMs
- Web-based visualization system digital overlay tools
- Desktop visualization client – Integrated Lunar Information Architecture for Decision Support
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...
Created Products - DEMs

Regional DEMs using scanned Apollo metric camera data

Covers ~18% of the Moon (low latitudes)

Small section of DEM from orbit 33. DEM resolution ~40m/pixel

Map showing coverage of metric camera data
DEMs

Local DEMs from LOLA NAC covering the 50 CxP regions of interest

Preliminary USGS Aristarchus Plateau (DEM 1) from JSC/ASU Apollo Pan Cam Scans

Malapert (left) and Ap 15 (right) ROIs showing in red the NAC images acquired through the 1st month of mapping orbit
Created Products - Hazard Maps

- Craters
- Boulders
- Slopes
- Surface Roughness
**Data Products Process**

1. **Produce preliminary data products**
   - In some cases using Apollo or other historic data

2. **Hold process validation audits**
   - These have occurred

3. **Acquire final data sets from LRO teams.**
   - Adjust methods, if necessary.

4. **Produce final products**

5. **Ingest into LMMP system**

6. **Hold final product validation audits**
   - To insure that products are of high quality, display correctly, and meet CxP’s needs

7. **Release to Public** (or where appropriate, CxP internal use)
Portal
Lunar Mapper
Integrated Lunar Information Architecture for Decision Support (ILIADS)
Integrated Lunar Information Architecture for Decision Support (ILIADS)

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
- Dec 3rd 2009 – Beta release of Mapper, ILIADS, Portal, infrastructure and content
- Late 2010/Early 2011 – Version 1 release