



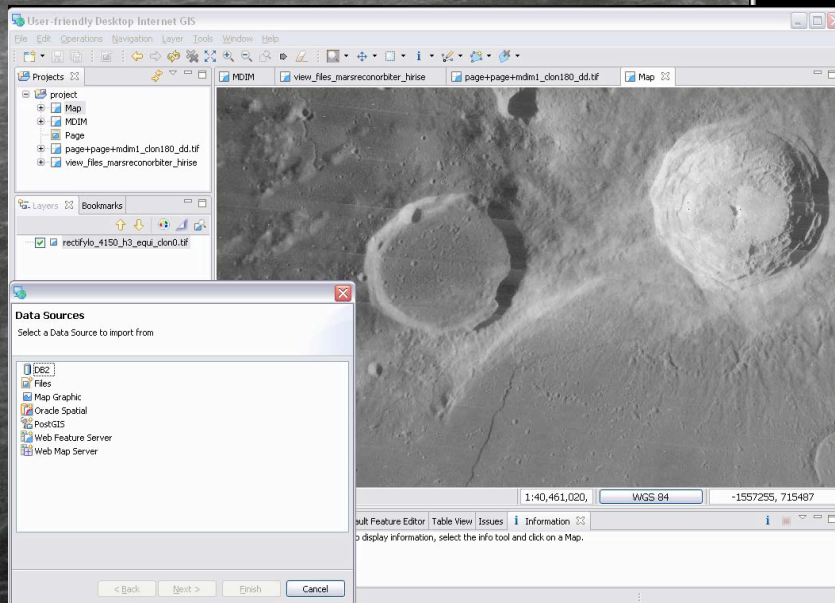
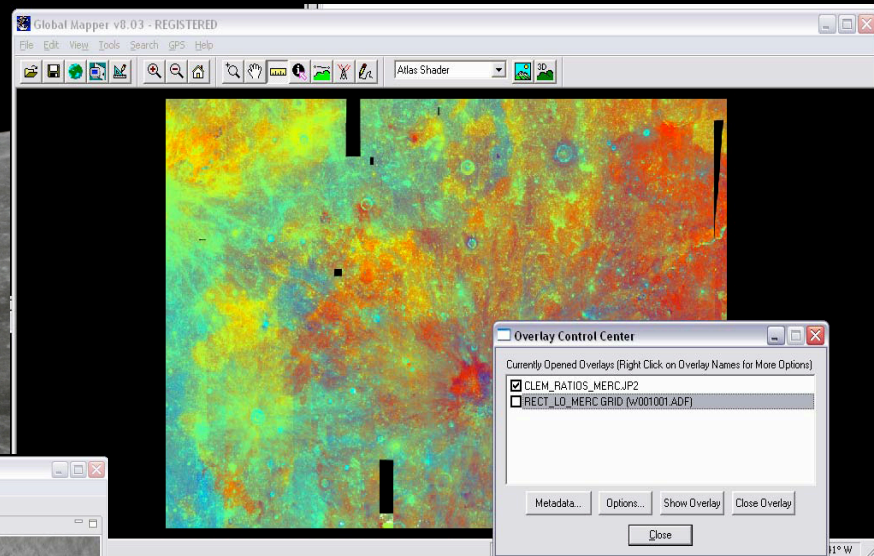
Lunar Mapping and Modeling Project Summary and Status

Go for Lunar Landing Conference
Tempe, AZ
March 3 & 4, 2008



Lunar Mapping and Modeling Project: Summary

- Tasked by ESMD Advanced Capabilities Division to develop mapping and modeling tools to benefit ESMD lunar planning
- Develop validated display tools and model outputs (terrain, thermal, lighting, resources, etc.) to users with attention to ease of user interface

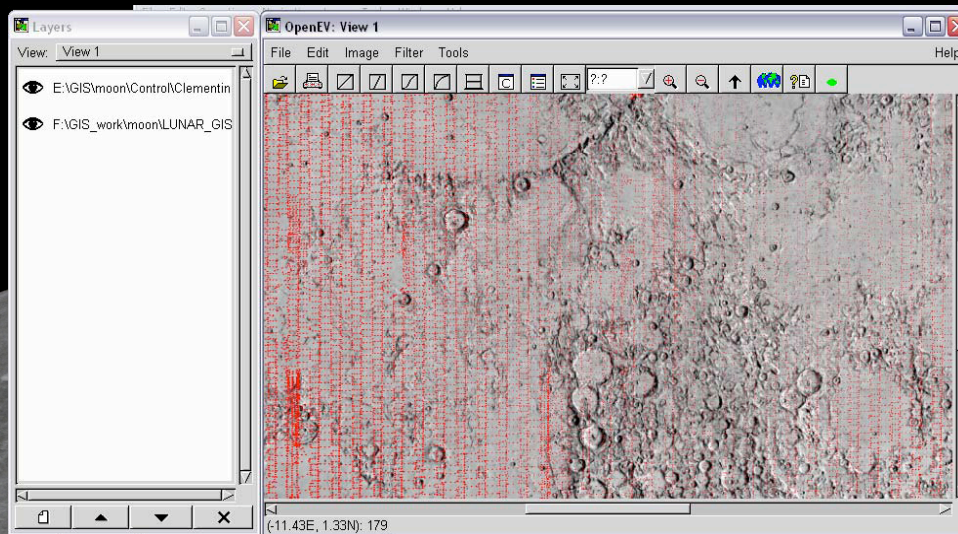


- Lunar Mapping and Modeling has focusing on customer needs by involving the customer community (Constellation, SMD, etc.) in all phases of mapping and modeling tool development

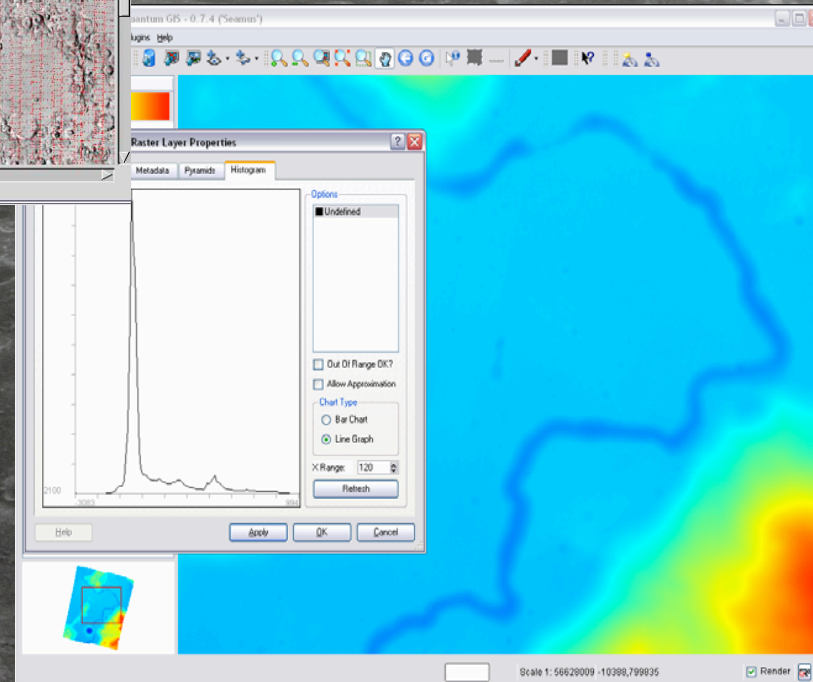


Lunar Mapping and Modeling Project: Summary

➤ Lunar Mapping and Modeling will utilize LRO, non-NASA and historical data to aid ESMD system designers, mission planners and operations



➤ Lunar Mapping and Modeling intends to make all of its tools and products available through a common web portal





Lunar Mapping and Modeling Project: Summary

- ▼ The purpose of the LMMP is to provide a suite of lunar mapping and modeling products that support the Constellation Program and other lunar exploration activities, including the planning, design, development, test and operations associated with the establishment of a lunar outpost, sortie missions and crewed operations on the surface
- ▼ Several meetings and intervening iterations between LMMP and Constellation have resulted in both level 1 and 2 draft requirements
 - Characterize lunar surface morphology (albedo base maps, surface roughness & rock size, terrain features, communication coverage, human emplaced artifacts & digital elevation models)
 - Characterize the lunar lighting and thermal environments (any location and given lunar year time reference)
 - Characterize the lunar gravity (global lunar gravity model)
 - Characterize lunar surface geochemistry and mineralogy (global resource maps)
 - Characterize lunar surface physical properties [Implementation Deferred]
 - Make relevant products available for engineering, operations, mission planning, science, commercial, education and public outreach uses (standardized data & interface formats and usable and accessible interfaces, display tools, & models)



Lunar Mapping and Modeling Project: Status

- ✔ **Based on direction from ESMD management, Constellation Level 2 is to become the focal point for the coordination of all lunar mapping, modeling and simulation requirements**
 - Some overlap exists between the Lunar Surface Operations Simulator development activity and LMMP with regard to a couple of lunar environment model developments
 - John Gruener, Constellation Program Office, has been identified as the focal point for collecting, integrating and formally documenting these requirements
- ✔ **Lunar Geodesy and Cartography Working Group**
 - Working with Constellation and International Missions to define lunar ephemerides, coordinate systems & other standards to enhance data exchange and consistency
- ✔ **Kaguya Gravity Data**
 - MoU between NASA and JAXA for NASA to obtain Kaguya pre-release gravity data and produce a set of equations describing the parameterized gravity field - **Limited to NASA Internal Use Only**



Lunar Mapping and Modeling Project: Status

▼ LRO Instrument Data Products

– DLRE (Diviner Lunar Radiometer Experiment)

- Calibrated radiances (Level 1)
- Surface temperatures gridded in space and time (Level 2*)
- Higher-order products such as thermal inertia, rock abundance, mineralogy, illumination, etc., can include man-made objects (Level 3*)
- Lunar thermal model, including multiple scattered solar and infrared radiation, and 1-dimensional heat conduction

– LOLA (Lunar Orbiter Laser Altimeter)

- Topographic files and digital elevation models
- Surface slope & roughness files and digital models
- Surface reflectance files and digital models
- Digital Elevation Model of topography in permanently shadowed polar regions
- Parameter set defining the lunar geodetic coordinate system
- Global topography model; spherical harmonic coefficients
- Resolution:
 - Surface roughness: ~30 cm, Surface reflectance: ~10%, Surface slopes: ~0.4 deg over 5-m baseline
 - Local topography: ~10 cm, Range to surface: <10 cm precision, Orbital radius: <1 m
 - Positional accuracy: <50 m, Point-to-point distance: ~70 m



Lunar Mapping and Modeling Project: Status

▼ LRO Instrument Data Products (cont.)

- LAMP (Lyman-Alpha Mapping Project)
 - Mosaics/maps of UV brightness, albedo, and water ice absorption feature depth
 - Spectra and limb profiles of lunar atmosphere emissions
 - Global Coverage: Precision will vary with latitude
 - Resolution: 500 m/px standard, ~100 m/px highest-res
- LROC (Lunar Reconnaissance Orbiter Camera)
 - Narrow Angle Camera and Wide Angle Camera files, images, mosaics, movies
 - Resolution: 0.5 m/px (NAC), 100 m/px (WAC)
- CRaTER (Cosmic Ray Telescope for the Effects of Radiation)
 - Data organized by particle environment (GCR, foreshock, magneto-tail) (Level 3)
 - SEP-associated events identified and extracted (Level 3)
 - Calculation of incident energies (Level 4)
- LEND (Lunar Exploration Neutron Detector)
 - TBR with instrument team
- Mini-RF Experiment
 - Radar maps, individual images and mosaics
 - Resolution: 20-30 m per pixel and 150 m per pixel depending on mode