

What's New with the Moon Mineralogy Mapper / Chandrayaan-1 E/PO Program? C.R. Runyon¹, S. Shipp², G. Tuthill³, K. Garver³; ¹Lowcountry Hall of Science & Math, College of Charleston, Charleston, SC 29403, runyonc@cofc.edu, ²Lunar and Planetary Institute, Houston, TX, shipp@lpi.usra.edu, ³Montana State University, Bozeman, MT, Tuthill@montana.edu and kgarver@montana.edu,

Moon Mineralogy Mapper / Chandrayaan-1.

Moon Mineralogy Mapper (M³) is one of eleven instruments onboard India's Chandrayaan-1 (Ch-1) spacecraft launched on October 22, 2008. M³ is a high spatial and spectral resolution spectrometer that will help scientists better understand the compositional variation of the Moon's surface



by mapping it at high spatial resolution.^{1,2,3}

M³ was proposed in 2004 and selected as a NASA Discovery Mission of Opportunity in February of 2005. Instrument Principal Investigator, Dr. Carle Pieters of Brown University and Instrument Scientist, and Dr. Rob Green of NASA's Jet Propulsion Laboratory have been working together to design, build, and test the instrument and now collect and analyze spectral data with an expert team of engineers and scientists from across the United States and India.

M³ Education & Public Outreach.

The M³ Education and Public Outreach (E/PO) plan is designed to promote science, technology, engineering and mathematics (STEM) literacy and awareness of NASA's mission and vision and the success of Chandrayaan-1 and M³.^{4,5} As such, it is being developed around three unifying themes that thread together the M³ science, engineering, technology and E/PO. Each theme may stand alone or support the others. They are: 1) *Geology of the Earth-Moon System*, 2) *Properties of Lunar Materials*, and 3) *Science & Technology of Lunar Resources*. M³ EPO activities and programs designed within the themes are inquiry-rich, meet the national standards in science, math and engineering, and have been educator-vetted.

Sharing M³ with the Community.

Lunar exploration should be presented as an ongoing story of exploration and discovery that encompasses: why we are going to the Moon; what we hope to discover; what we are discovering; what challenges we face; how people can help to solve these challenges through science and engineering; and how we benefit.

All audiences need to be engaged through multiple paths, which include direct experiences and the use of new media platforms.² M³ E/PO activities and resources engage students in learning how the Moon and planetary surfaces form, and help them understand how scientists and engineers explore remote worlds.

Educator Guide - An M³ educator guide has been developed and is currently in the vetting phase with formal and informal educators across the country – from 22 states and two territories - through workshops and an on-line course on the *Geology of the Moon* sponsored by M³. Included in the M³ middle-school level guide are introductory activities on spectroscopy, lunar geology, surface morphology and composition leading to the use of an ALTA hand-held spectrometer to help identify and map the variation in the structure and composition of the moon's surface and history of formation. Teachers participating in the on-line course found the activities to be age-appropriate and challenging enough to retain their student's interest.

M³ Educator Tool Kits – Created for use in workshops and for classroom loan, the tool kits have been in transit between formal and informal education settings by Girl Scout trainers, classroom teachers and home-school educators since the summer of 2008. Included in the kits are activities and resources related to the current Chandrayaan-1 mission, the M³ instrument, spectroscopy, lunar history and more.

Web sites - Background information on the Chandrayaan-1 mission and M³ and instrument are available via the web, as are the latest science updates, 3D image cube releases and E/PO



Fig. 2. M³ site

resources, and activities. Three connected M³ specific web sites share the different aspects of the team's activities. These include a more technical mission / instrument specific site (<http://m3.jpl.nasa.gov> : Fig. 2); a science blog that shares the latest and greatest imagery and comments from the science team



Fig. 3. M³ Science blog

(<http://m3science.geo.brown.edu> Fig. 3); and the E/PO web site designed for use by educators and a more general audience (<http://m3.cofc.edu> Fig. 4).

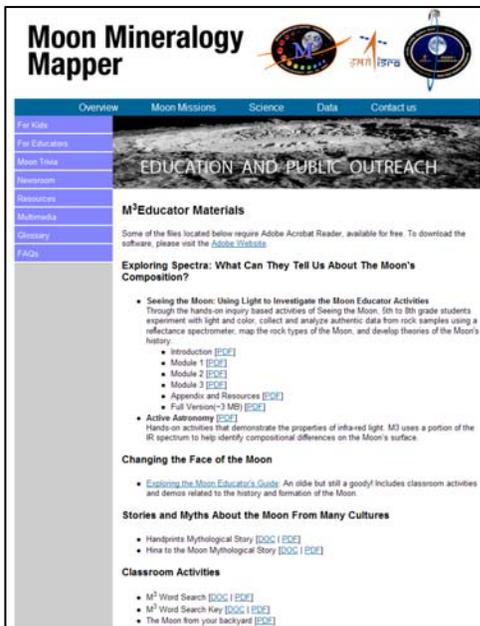


Fig. 4. M³ E/PO page

Lunar Posters – In cooperation with members of the lunar science education community, M³ participated in the creation of three new posters on the Moon developed around the three general themes mentioned above; Geology of the Earth-Moon System, Properties of Lunar Materials, and Science & Technology of Lunar Resources. Each poster may be used as a stand-alone exhibit, or may be displayed together for a more complete view of our current understanding of the Moon, how we explore it, and with what technology. Noted lunar scientists and engineers are also featured as are key lunar resources. These are available via the LPI and the M3 E/PO websites.

By generating the M³ activities and resources such that they support one or more of the three themes, they may be useful for future mission EPO programs such as Lunar Reconnaissance Orbiter (LRO), LADDIE, NLSI and more.

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References: [1] Pieters et al. (2009) these volumes; [2] Pieters et al (2007) LPSXXXVIII #1295; [3] Pieters et al (2006) XXXVII, #1630; [4] NASA Headquarters; [5] Runyon et al (2007) LPSXXXVIII #1812; [6] Shipp et al (2008), NLSI Conference abstract.