

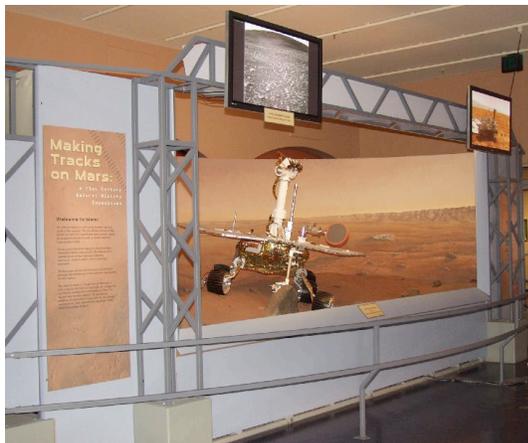
MARS ROVER MISSIONS AND SCIENCE EDUCATION: A DECADE OF EDUCATION AND PUBLIC OUTREACH USING THE MARS EXPLORATION ROVER MISSION AT THE NEW MEXICO MUSEUM OF NATURAL HISTORY & SCIENCE J.C. Aubele¹ and L.S. Crumpler¹ ¹New Mexico Museum of Natural History and Science (1801 Mountain Rd. NW, Albuquerque, NM, 87104, jayne.aubele@state.nm.us).

Introduction: In late 2003, the New Mexico Museum of Natural History and Science (NMMNHS) began an integrated program of museum exhibits and education using Mars and the Mars Exploration Rover (MER) mission. The goals of the program were to: (1) teach about Mars and the rover mission; (2) increase planetary science awareness and literacy for students, teachers, and the general public; (3) increase support for and understanding of planetary missions; (4) use the exploration of Mars to teach science. The NMMNHS is a statewide institution and serves a statewide population that includes a total of 52% Hispanic and Native American populations, as well as a high percentage of rural communities, and therefore reaches an audience traditionally underrepresented in science.

Informal science education (sometimes called free-choice learning) continues throughout a person's lifetime [1]. It is the science information acquired from museums, zoos, parks, visitors' centers, books, internet, and TV. Museums with physical, earth, or space science expertise are good partners for NASA mission EPO efforts. In a time of decreased national funding, they are local partners adept in interacting with the public. The average person spends only 5% of their life [1] in a classroom (including four years of college). The best way to increase the public's science literacy may be to reach them during the other 95% of their lives.

Program Component 1: Making Tracks on Mars Exhibit

The NMMNHS designed and produced a MER exhibit entitled "Making Tracks on Mars" that has been on display since December 2003. The exhibit was funded by local and



regional donors and businesses. The centerpiece of the exhibit is a detailed full-scale model of the rover built by museum volunteers (with permission from JPL) with a working pancam that can be directed by visitors. The volunteer rover builders were machinists, auto mechanics, artists, engineers, and model builders. They worked for nine months, formed teams working on each component, and self-organized through a project manager. They

included their colleagues and small local businesses and donated hundreds of hours and materials. The exhibit also includes: a full Marscape with appropriate soil and rock population (collected by high school students in New Mexico), and background mural depicting the Gusev Crater landing site painted by a local artist; three interactive computer stations designed and built by the Museum to allow the visitor to explore the planet, the mission, and the rover; a hands-on Mars Cart; monitors showing updated and annotated images/videos from the MER rovers; and, in 2012, a new station was added to provide updated images/videos/ reports on Curiosity. **In the past ten years, a minimum of 200,000 visitors a year, or 2 million visitors total, have visited the exhibit.**

Component 2: Educational Programs

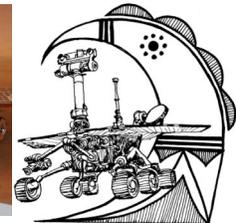
During the past decade, the NMMNHS has developed and provided targeted educational programs using Mars and the



MER mission for all age groups from preK through senior citizens. Programs were created specifically for students (classroom outreach programs, after-school programs, and Mars-themed week-long summer programs), families (Mars

Family Days, libraries), general public (public evening lectures on site and offsite, classes, field trips, special events), and bilingual participants (Spanish/English events and activities). **In the past 10 years, total participation in all EPO programming has approached a total of 10,000 adults and children.**

We also formed a strong partnership with a regional Native American high school. One of NASA's Athena Science Intern Program (ASIP) high school teams was selected from New Mexico. Only 13 high school teams were selected nationwide to work with MER and the teacher/student team from Laguna-Acoma Jr. Sr High School in New Mexico worked with science team member (and Museum Curator) L.S. Crumpler. The teacher (from Acoma Pueblo), senior student (from the traditional Spanish land grant settlement of



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(from Laguna Pueblo) continued to work with us for several years on their own Mars research projects. They participated in Museum Mars-related special events and gave presentations on their research and experiences to

other Native American schools in NM. They created their own logo for this project using traditional design elements. The teacher has continued to work with the museum and use Mars-related science. Both students have now completed undergraduate degrees in science or engineering. One is working on a graduate degree and the other is working professionally with at-risk students.

Component 3: PreK-12 Teachers

In the past ten years, the Museum has become a resource for reliable information about Mars and Mars missions for preK-12 teachers. One of the results of the Museum's educational programming is a complete teachers' guide and curriculum. *Making Tracks on Mars: Teacher Resource and Activity Guide* [2] has been reviewed and accepted by NASA Educational Materials Adoption Review and is



currently in a 2nd edition DVD, updated to include Curiosity data and information. It is designed for classroom/science and homeschool teachers in both formal and informal education settings. The Guide also includes basic information about Mars and Mars missions and an annotated power point that can be used in the classroom. With LPI's help, the DVD has been sent to teachers in Texas, Louisiana, Florida, and Bermuda. Professional development workshops for teachers have been offered each year at the Museum for a decade and we have been a site for Teacher Training provided by ASU Mars Education Office Coordinator Sheri Klug. **The workshops and curriculum have reached approximately 3000 classroom and science teachers.**



Component 4: Public Engagement

Over the past decade the Museum has offered a variety of public programs specifically targeted toward adults and teens. MER science team member L.S. Crumpler has been the mission's ambassador to the New Mexico public, with annual Rover Mission Update articles and lectures, small discussion groups, special events, field trips, and outreach presentations. In addition to our own EPO programming, we also hosted one of the national Marsapalooza events in 2004, courtesy of Passport to Knowledge with funding and support from NSF and JPL.

This type of programming is very successful because it promotes a personal connection between the public and a local scientist and draws on their pride that a scientist from their hometown is involved in a national project. Mars exploration captivates the public. Rover missions, in



particular, are interesting to people because they are more human-scale and offer a human-perspective of landscape. We have built a strong Mars-New Mexico Connection by



using a newsworthy planetary mission to excite and interest the public and by making the link to our own backyard with strong analogs, examples, and connections. Mars and the rover mission can be used to teach about many different topics. By comparing Mars and New Mexico, we have been able to teach the public about basic geology, Mars geology, and New Mexico geology in one program.

Component 5: MER 10th Anniversary Celebration

To celebrate the 10th Anniversary of MER, the Museum offered a variety of lectures and special events during January 2014. A more permanent addition was the expansion of the Mars Exhibit into a second gallery. This exhibit is entitled Mars Landscape Art by Spirit and Opportunity. It is designed to immerse the visitor in Mars with an art gallery of wall-size pans, MI images, and 3D



anaglyphs. One section shows features on Mars that have been named after places in New Mexico. In display cases are a rover wheel (on loan from JPL) and JSC-1 Mars simulated soil with a display of minerals that have been identified by the rover instruments on Mars. A monitor shows current images and data from Opportunity. The exhibit received front page newspaper [3] and local media coverage and will be on display until August 3, 2014.



References: [1] Taylor, S., 2008, Public Understanding of Science 17:55-72; Falk, J.H, and Dierking, L.D., 2010, The 95% Solution, American Scientist, vol 98 [2]Aubele, et al, 2006, LPSC37; Aubele, et al, 2012, LPSC 43; Aubele, J.C., et al, 2006, "Making Tracks on Mars Teacher Resource and Activity Guide" [3] Gomez, A., 2014, Mars: A Lot Like Home; The Sunday Journal (front page) Feb 2, 2014.