

MARS ROVER MISSIONS AND SCIENCE EDUCATION: LESSONS LEARNED FROM A DECADE OF EDUCATION AND PUBLIC OUTREACH 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 (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 is to reach them during the other 95% of their lives.

Program Component 1 Exhibit: The NMMNHS designed and produced a MER exhibit entitled *Making Tracks on Mars* that has been on display since December

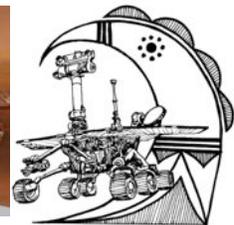


2003, and funded by local and regional donors and businesses. The centerpiece of the exhibit is a detailed full-scale model of the rover built by museum volunteers (with permission from JPL) with a pancam that can be directed by visitors. The volunteer rover builders were machinists, auto mechanics, artists, and engineers. They worked for nine months, formed teams for each component, and self-organized through a project manager. They included their colleagues and small local businesses and donated time and materials. The exhibit also includes: a full Marscape with appropriate soil and rock population (collected by local

high school students) 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 to provide updated images/videos/ reports on Curiosity. In the past ten years, a minimum of 200,000 visitors each year, or 2 million visitors total, have visited the exhibit. **Lessons Learned: Museums create exhibits that are accessible and understandable to the public and have the ability to forge a link between the science/mission and the public.**

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 preK-12 students (classroom outreach programs, after-school programs, Mars-themed week-long summer camps), families (Mars Family Days, Libraries), general public (lectures, classes, field trips, special events), and bilingual (Spanish/English) participants. In the past 10 years, participation in all of our Mars-related EPO programming has reached 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. 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), H.S. senior student (from the traditional Spanish land grant settlement of Seboyeta), and junior student (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. One

is working on a graduate degree and the other is working professionally with at-risk students. **Lessons Learned: It is advantageous to reach large student numbers with some programs while targeting a small number of underrepresented students with a special program. Including K-12 teachers in the development of all of these programs enhanced implementation and learning.**

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. The Museum produced 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. It 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. Mars-related workshops for teachers are offered each year at the Museum, and we have also partnered on workshops provided by ASU Mars Education Office, LPI educators, and SSI Maven Mission Educators. Our curriculum and workshops have reached approximately 3000 classroom/science teachers. **Lessons Learned: Partnering with other missions and programs allowed us to increase the number of teachers reached.**



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, 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 2004 Marsapalooza events, courtesy of Passport to Knowledge with funding and support from NSF and JPL. **Lessons Learned: This type of programming is very successful because it promotes a personal connection between the public and a local scientist and builds hometown pride.**



Component 5 Mars-New Mexico Connection: 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 the landscape. We have built a strong local connection by using a newsworthy planetary mission to excite and interest the public and by making the link to our own backyard with strong



analog. Mars and the rover mission can be used to teach many different subjects. By comparing Mars and New Mexico, we have been able to teach the public about basic geology, Mars geology, and New Mexico geology, plus engineering, math, and the history of exploration. **Lessons Learned: No matter where you are located, there is always some local connection, scientist, or analog.**

Component 6 MER 10th Anniversary:

We celebrated MER's 10th Anniversary with lectures, special events, and the expansion of the Mars Exhibit into a second gallery. This special short-term exhibit, entitled *Mars Landscape Art by Spirit and Opportunity*,



was designed to immerse the visitor in Mars with an art gallery of wall-size pans, MI images, and 3D anaglyphs. In display cases were a rover wheel (on loan from JPL) and



JSC-1 Mars simulated soil with minerals identified by the rover. A monitor showed current images/data from Opportunity. The exhibit received front page newspaper [3] and local media coverage.

Lessons Learned: Linking to the national celebration, renewed local interest in the mission and in Mars.



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.