

Mars And Beyond: A Panel and Games at the Museum of Science Boston

Joseph Paul Cohen and Wei Ding at the University of Massachusetts Boston, Julia Sable at the Museum of Science Boston, and Ron Li at the Ohio State University, Tom Stepinski at the University of Cincinnati

Introduction

In the second year of this ongoing outreach project [1] we continue to uniquely combine the data, systems, and resources from four existing NASA-funded research projects on Mars robotic navigation. This year's event included highlights from the new Curiosity mission, astronaut Steve Bowen, and many local researchers presenting work on planets throughout the solar system. The ongoing objectives are:

- Effectively take advantage of the public science and technology component of the Museum of Science, Boston, which hosts more than 1.5 million visitors yearly.
- Grow the previous event via community participation. Create a platform for local area researchers to engage the public regarding space exploration.

Approach

This year's event was held August 18-19, 2012 to coincide with the Curiosity rover landing as well as the NASA Destination Station exhibit visiting the Museum of Science. Each day included panel discussions, talks, and table presentations. Panelists, listed in the table below and shown in figure 1b, were asked about their involvement and research regarding space exploration and then received questions from visitors. The next section details other activities and talks during the event.

Both days of the event astronaut Stephen Bowen (figure 1a), a three-time resident of the International Space Station, gave a presentation and then met to talk with visitors, take photos, and sign autographs.

Panelist	Project
Sam Kounaves	Phoenix Lander
Ron Li	Mars Rover GPS
Zachary Girazian	Atmospheres of Mars and Venus
Carol Carveth	Atmospheres of Mars and Venus
Courtney Dressing	Exoplanets using Kepler data

Activities/Talks

The following is a list of talks and presentations that occurred over the two days. With the exclusion of the Mars Crater Seeker game, the following activities are additional and were organized at the Museum event.



(a) Astronaut Stephen Bowen presents "Experiences in Orbit"



(b) Top: Sam Kounaves, Ron Li, and Zachary Girazian. Bottom: Sam Kounaves, Courtney Dressing, and Carol Carveth



Mars Crater Seeker Game (Joseph Paul Cohen of UMass Boston) A rover can't rove without a navigation plan based on high-quality data. This video game, improved and enhanced since last year, lets players drive a Mars rover over simulated surfaces based on real data from Mars missions.

Living on Mars (Bruce Mackenzie of the Mars Foundation) Visitors learn what engineering challenges must be overcome to live on Mars. The Mars Foundation sponsors experimental work toward building the first habitat on Mars using materials found in the Martian soil.

Worlds Outside Our Solar System (Sarah Ballard and Courtney Dressing of the Harvard-Smithsonian Center for Astrophysics) Every week, Kepler and other missions discover possible planets in distant solar systems. Visitors learn how researchers find and study these exoplanets.

Flying SPHERES on the Space Station (Alvar Saenz-Otero of MIT; Kimberly Slater of NASA) Synchronized Position Hold, Engage, Reorient, Experimental Satellites (SPHERES) are small free-flying satellites on the International Space Station. Visitors find out how high school students can compete to operate the SPHERES for experiments.



Life after Liftoff / Space Suit Technology (Don Rethke, aerospace engineer; Erika Guillory and Heather Paul, NASA; and Nikhil Vadhavkar of MIT) Visitors learn how astronauts stay comfortable and healthy in space. The simplest tasks, like using the bathroom, become complicated in near-zero gravity.

Explore the Moon (Mike Sori and Ryan Kobrick of MIT) Visitors study high-resolution images of the Moon's surface and discuss what's next for lunar exploration.

Gas Giants (Glenn Flierl of MIT) Visitors watch demonstrations of turbulent fluid motions like those in

the atmosphere of Jupiter and Saturn simulated with liquids and coloring.

3D Panorama of Martian Landscape Visitors use 3D glasses to get a rover's-eye view of the Gusev Crater area on Mars, imaged by the Mars Spirit rover in 2006.



Asteroids, Comets, and Dwarf Planets (Sonia Keys and Mike Rudenko of Harvard-Smithsonian Center for Astrophysics) Visitors learn to distinguish asteroids, comets, and dwarf planets, and learn how and why scientists track these bodies.

Design Challenge: Soaring Satellites Visitors build and test hovering satellites using some of the same principles that NASA engineers use to design parachutes for Mars lander and rover missions.

Space Weather (Nicholas Gross and Susan McGregor from the Center for Integrated Space Weather Modeling at Boston University) Explosions on the surface of the Sun occasionally send high-energy particles and X-rays toward Earth, resulting in auroras and other space weather phenomena. Visitors learn how the Sun works and how its activity can impact us here on Earth.



Pressures on Mars and Venus (Carol Carveth and Zachary Girazian of Boston University) The solid parts of Venus, Earth, and Mars are similar, but these planets have dramatically different atmospheres. Visitors see how scientists study planetary atmospheres and learn what this means for space exploration.

References

- [1] J. P. Cohen, W. Ding, J. Sable, R. Li, and T. F. Stepinski, "Mars weekend: A panel and games at the museum of science boston," in *Lunar and Planetary Institute Science Conference Abstracts*, Mar. 2012.