

MARS ON THE MALL: WALKING ON MARS IN THE NATION'S CAPITAL. J. R. Hill¹ and P. R. Christensen¹, ¹School of Earth and Space Exploration, Arizona State University, Tempe, AZ (jonathon.hill@asu.edu).

Introduction: The Thermal Emission Imaging System (THEMIS) [1] onboard the 2001 Mars Odyssey spacecraft has acquired over 265,000 infrared images of the Martian surface at a resolution of 100 m/pixel since the start of science operations in February 2002. A global infrared map was previously developed by mosaicking together over 24,000 high-quality full-resolution THEMIS daytime infrared images [2] and colorizing it using MOLA [3] elevation data. Although the resulting map was extremely valuable for scientific and mission operations applications, it was difficult to communicate this value to students, citizen scientists and the general public since their interactions with the map were limited to viewing it on computer screens.

In order to better communicate the value and importance of mapping the entire Martian surface at 100 m/pixel resolution, the THEMIS Day IR with Colorized MOLA Elevation Global Map was printed on a 47.5ft x 95ft vinyl mat, which allows observers to walk across the map and view it at approximately photo resolution (~200 pixels per inch).

The Walk on Mars map was completed in February 2018 and has since been displayed at more than 15 events with over 4,000 people having walked across it.

Map Details: The size of the map (47.5ft x 95ft) was chosen to fit on a standard-size basketball court, so that a large number of schools will have a sufficiently large indoor surface on which to display the map for education and public outreach events.

A simple cylindrical projection centered on the prime meridian was chosen for the map because it maximizes use of the printed surface, which is inherently rectangular, while avoiding the division of any major surface regions between the two ends of the map. In addition, there are two smaller (15ft x 15ft) polar stereographic maps centered at each pole. These smaller maps are designed to give participants a better understanding of the Martian poles, which are significantly distorted in the simple cylindrical map. Both polar maps use their own individual MOLA elevation color scales in order to better emphasize the topography of the ice deposits at each pole.

The vinyl base material and large-format printing process selected for the map were proven to be wear-resistant in similar applications by the National Geographic Society's Giant Maps Program [4] and the Arizona Geographic Alliance's Giant Arizona Floor Map Program [5]. Participants are required to wear socks or cleanroom-style shoe covers while on the map in order to prevent wear on the printed surface.

Lessons Learned in 2018: As expected, the THEMIS team has learned many valuable lessons regarding the best outreach strategies for the map through trial and error over the first year of operations.

Partnerships: We initially found it challenging to identify schools and events interested in displaying the map. By partnering with the JPL Solar System Ambassadors program, we were able to coordinate with educators in Arizona who were already interested in organizing NASA and STEM-related outreach events. The majority of our events in Fall 2018 were co-organized with Solar System Ambassadors.

Pre-Event Preparation: Since our very first school event, teachers have expressed interest in additional resources they could use to better prepare their students for the experience of walking on the map. Therefore, we developed an "Introduction to Mars" PowerPoint presentation with extensive notes that teachers can review with their students prior to the map event. Multiple teachers have confirmed that they were able to give the presentation from the notes without any previous knowledge about Mars and students clearly engage with their tour guides more when they have already seen the introduction presentation.

Student Accountability: Another request from teachers was for worksheets that students could fill out during the "Introduction to Mars" presentation and while walking on the map, either with a tour guide or as part of the scavenger hunt activities. In response, we created "Introduction to Mars" and "Walking on Mars" worksheets, which are simple enough that they can be used by a wide range of ages. We also produced answer keys so teachers can quickly and easily grade them. The teachers who have used the worksheets so far have verified that they help keep students engaged, since the students know they are being held accountable through a graded assignment.

Public Event Format: Our initial public events used a format where volunteer Mars experts from ASU's School of Earth and Space Exploration (SESE) were stationed at important landmarks on the map and would answer questions from participants. However, we quickly found that most people were hesitant to approach our Mars experts with questions, often because they did not know enough about Mars to formulate their own questions. We quickly modified our public events to operate around our Mars Geography and Mars Landing Site scavenger hunt activities. Participants are now given a very brief introduction to the map by a volunteer and then receive a binder with the Mars Geography

scavenger hunt (15 major geologic landmarks, each with an accompanying “Quick Facts” page) and challenged to locate all 15 landmarks on the map. They can work on the scavenger hunt as individuals, small groups or families. Our Mars experts then circulate around the map helping people find the harder landmarks and answering questions they have about the landmarks. Once they complete the Mars Geography scavenger hunt, participants are given the opportunity to try the Mars Landing Site scavenger hunt, which is considerably harder. We have found this format gives participants enough initial information and time to formulate their own questions about Mars, which makes them much more confident when talking with our Mars experts.

Outdoor Display: In order to prevent damage to the vinyl material and printed surface of the map, it must be displayed on a smooth and relatively firm surface. Initially, we planned to only display the map on indoor surfaces, such as basketball courts and large conference rooms. However, it quickly became obvious that having the ability to display the map outdoors would greatly increase the number of locations and events where it could be used. With the remaining funds from the initial grant, we purchased a large foam mat made of interlocking 2ft x 2ft pieces. Although it is slightly difficult to transport, the foam mat can be assembled in ~1 hour with ~6 volunteers and can be disassembled in about half that time. Our largest map event so far was held outdoors with the foam mat and we had over 400 participants walk across it and talk with our Mars experts.

Accessibility: From the beginning, we have wanted to ensure that everyone is able to explore the map, regardless of whether or not they require assistance while walking across it. We have verified that walking casts do not damage the map, as long as a large cleanroom-style shoe cover is worn on the cast. Similarly, we have had participants use crutches or walkers to help them walk on the map, which does not cause any damage as long as the crutch tips, walker tips and/or wheels are free of any dirt or debris. We have not yet had a participant who uses a wheelchair, either manual or electric, however we do not believe this would cause any damage as long as the wheels are clean and the map is displayed on a hard surface. We have not yet tested a wheelchair on the map when it is displayed outdoors on the foam mat, but we plan to do this test at our next outdoor event.

Web Presence: In order to more effectively publicize the map to educators and event coordinators, we established a website at: <http://www.walkonmars.space>. The website includes a description of the map, pictures from all of our previous events, download links for our educator resources (“Introduction to Mars” presentation and worksheets), and online versions of our Mars Geography and Mars Landing Site scavenger hunts.

Future Plans: First on our priority list is developing a “Mars in Sci-Fi” scavenger hunt. Some of the most common questions we get from participants are about Mars locations mentioned in popular science fiction books, shows and movies. Second, we would like to print a smaller version of the map (approx. 20ft x 40ft) for use in smaller areas, since some elementary schools do not have full-size gyms where they can display the basketball court-size map. And third, we are exploring additional funding opportunities so that we can print additional copies of the map and reach a larger number of potential participants.

Mars on the Mall: The THEMIS team has partnered with the American Geophysical Union, through the AGU Celebrate 100 Grants Program [7], as well as the Smithsonian Air & Space Museum [8] and Explore Mars [9] to bring the Walk on Mars map to Washington, D.C. in Spring 2019.

The Walk on Mars map will be displayed on the National Mall near the entrance to the Smithsonian Air & Space Museum for an entire weekend, so that visitors to the museum will have the opportunity to explore Mars themselves and learn about the history and future of Mars exploration. This will address the AGU Celebrate 100 goal of increasing awareness of space science beyond the membership of AGU.

Explore Mars and Arizona State University will also invite members of Congress and their staffs to join us on the map to talk about the United States’ Mars exploration program. This will address the AGU Celebrate 100 goal of increasing awareness of space science amongst decisionmakers.

Once the final date for the event has been confirmed, it will be publicized on our website (www.walkonmars.space), through the JPL Solar System Ambassadors Program, and at LPSC 2019.

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References: [1] Christensen et al. (2004) *Space Sci Rev* 110: 85-130. [2] Hill and Christensen (2017) *J. Geophys. Res. Planets*, 122, 1276–1299. [3] Smith et al. (2001) *J. Geophys. Res. Planets*, 106, 23689–23722. [4] <https://www.nationalgeographic.org/education/giant-maps/> [5] <https://geoalliance.asu.edu/GiantTraveling-Map> [6] <https://solarsystem1.jpl.nasa.gov/ssa> [7] <https://centennial.agu.org/centennial-project-support> [8] <https://airandspace.si.edu> [9] <https://www.exploremars.org>