

## THE MARS STUDENT IMAGING PROJECT: USING DISTANCE LEARNING STRATEGIES TO ENHANCE STEM EDUCATION BY CONNECTING SCIENTISTS AND STEM-FOCUSED CONTENT TO THE CLASSROOM

P. Valderrama Graff<sup>1</sup>, B. Grigsby<sup>1</sup>, W. Taylor<sup>1</sup>, P. R. Christensen<sup>1</sup>, J. Bandfield<sup>1</sup>, R. Ferguson<sup>1</sup>, K.C. Bender<sup>1</sup>, S. L. Klug<sup>1</sup>, <sup>1</sup>Arizona State University, Mars Space Flight Facility, Moeur Bldg. Rm. 131, Box 876305, Tempe, AZ 85287-6305, paigev@asu.edu.

**Introduction:** The Mars Student Imaging Project (MSIP) focuses on immersing teams of 5<sup>th</sup> grade through early college students in an authentic research STEM-based experience. MSIP is designed to allow the students to be direct participants in the scientific process. Students follow the same process of the Mars mission participating scientists: 1) define an essential scientific question and write a proposal that defends their choice of a research topic that relates to features on the surface of Mars (the team must also receive acceptance of their proposal after a review by the Arizona State University (ASU) MSIP Team); 2) target an image using the Thermal Emission Imaging System (THEMIS) camera on the Mars Odyssey using *JMARS* targeting software and orbital predictions that are burned on a CD and sent 2 weeks in advance of the targeting; 3) analyze their image and other archived THEMIS images in relation to their essential science question; and 4) write up and potentially post their findings and results on the MSIP website. The Mars Student Imaging Project allows the student teams to take ownership during each step of this process by the students making the research choices, choosing the image target, working through the data analysis, and determining their results.

The Mars Student Imaging Project has been in existence since February 2002. Since its inception, MSIP has been, by design, an evolving project. The MSIP Team, led by P. Valderrama Graff, has kept close contact with the “customers” of MSIP (students and teachers) throughout the MSIP process. This high level of communication with the MSIP teams has allowed this feedback on customer needs, customer focus, and educational best practices to quickly be evaluated and incorporated into MSIP. As a result, MSIP has evolved into a much broader and deeper cutting-edge educational experience.

One of the findings of this MSIP feedback resulted in the creation of a MSIP Distance Learning component that has provided an opportunity to MSIP teams to enhance and supplement the connectivity of their classroom to Mars research scientists and the STEM content that the MSIP teams are researching.

**Format:** The ASU MSIP team evaluated several software types that would enable distance learning to be easily facilitated, again by the MSIP customer or

schools. One of the customer feedbacks that had high importance to the usability was that most schools reported firewall issues of downloading new software of any type on school-based computers. One of the software packages explored and subsequently chosen for use was web-based and easily exported to schools. This software – *Breeze*, converts slides into flash and allows presentations to be easily archived so they can be viewed asynchronously at later dates. A *PowerPoint* format was also available and sent ahead of the event to MSIP participants who felt it would be easier to utilize. To have national accessibility, it was decided that two duplicate distance learning events would be held to accommodate spanning different time zones and make sure the events could be held during the normal school day. These format designs also fit the ASU Mars Education Program’s “high-tech and low-tech” approach to inclusively provide access to programs to schools that do not have all the latest “bells and whistles” technology and provide opportunities for all schools to participate.

Using *Breeze* software or the *PowerPoint* format, the MSIP Distance Learning component can accommodate fairly large audiences of students and teachers at each event. During the MSIP Distance Learning beta-testing phase (September 2006 – December 2006), 805 students and 79 teachers have participated in the hour-long distance learning events with the largest audience on-line at a single event being 216 students and 18 teachers. A total of 228 students and 12 teachers have utilized the MSIP Distance Learning archived format (beta-testing phase - Sept. 2006 – Dec. 2006). The breakdown of grade levels that have participated in MSIP Distance Learning events are: 7 elementary teams, 23 middle school teams, and 14 high school teams. Approximately 50% of the MSIP Distance Learning participants have chosen to utilize the *Breeze* software and 50% have chosen to utilize the *PowerPoint* format.

A variety of topics are scheduled to be presented during the MSIP Distance Learning Events over the school year and incorporate the most common surface features and requested topics. These include craters, volcanoes, fluvial features, and how to interpret THEMIS data.

**Procedure:** The MSIP Distance Learning Opportunities are promoted to the MSIP teams through MSIP Team e-mail blasts, announcements at Mars educator workshops, and on the Mars websites. Teachers pre-register and instructions are given on how to connect (toll-free meet-me number) for the actual MSIP Distance Learning Event. During the event, teachers can connect via the Web either with students at individual computers (*i.e.*, in a computer lab) or through a single classroom computer and a speakerphone. The classes that are connecting and using the *PowerPoint* format use the meet-me number and follow along with the *PowerPoint*. An ASU MSIP coordinator brings the audience together and introduces the guest scientist and topic. The scientist explains the MSIP-related content and the participants are given a time for questions.

**Current Outcomes:** The primary benefit that has been observed (anecdotally) using the early data acquired by the ASU MSIP Team during the MSIP Distance Learning events is that the MSIP teams that participate in these opportunities are gaining a deeper understanding of the research content. This observation is based upon the teams that have participated in these MSIP Distance Learning events have had a higher rate of successfully completing their projects. The teams that have participated have also been (for the most part) more robust in carrying through various procedures and steps within MSIP.

**Future Outcomes:** Data on the MSIP Distance Learning events will continue to be collected and evaluated within the ASU MSIP Team. The MSIP participant feedback will continue to be collected and evaluated (there is an on-line evaluation that is completed by each of the teams after each distance learning event). One of the most recent outcomes and changes that have resulted from this feedback is the desire for teams to have MSIP Distance Learning opportunities with single team connections. This smaller format will allow for a higher, more personal exchange between the MSIP team and scientist that will directly pertain to their topic or Mars site. This will be incorporated into the MSIP Distance Learning portfolio early in 2007.

This MSIP Distance Learning component, along with the entire Mars Student Imaging Project is scheduled to be evaluated by Western Michigan University in the near future.