

The Mars Outreach for North Carolina Students (MONS); High School Students with “Hands On” Mars Research. H Lineberger¹, S Fuerst², S Whisner³, and J Moersch³, ¹ Durham Academy Upper School, Durham, NC, ² Northern Durham High School, Durham, Public Schools, Durham, NC, ³ Department of Earth and Planetary Sciences, University of Tennessee, Knoxville, TN.

Introduction: The Mars Outreach for North Carolina Students (MONS) project is a collaborative educational effort designed for academically gifted high school students. The project includes staff and students from Durham Academy (DA) Upper School, an independent K-12 day school in Durham, NC, Durham Public Schools (DPS) in Durham, NC, and the Department of Earth and Planetary Sciences at the University of Tennessee at Knoxville (UTK). MONS is mentored by Dr. Jeff Moersch, an associate professor at UTK and a veteran planetary scientist whose NASA mission resume includes Voyager 2, Galileo, Mars Observer, Deep Space 2/Mars Microprobe, Mars Odyssey, and the Mars Exploration Rovers. Dr. Moersch’s vision for MONS grew out of his own high school experience, where finding answers in the “back of the textbook” failed to inspire his own learning experience. MONS seeks to enrich the education of gifted high school students in the Durham, NC area, which contains one of the densest populations of PhD/MD professionals in the U.S. Under the guidance of Dr. Moersch, his post doctorate assistance, Dr. Chris Whisner, and high school teachers Howard Lineberger and Sam Fuerst, who are master earth science teachers with professional geological experience, MONS students design and conduct research-based projects related to the study of Mars and the rest of the solar system.

MONS is generously funded by a grant from the Burroughs-Wellcome Fund’s Student Science Enrichment Program (SSEP) which provides over \$3 million a year to support creative science educational activities for primary and secondary school students in North Carolina. The project operates with the three main goals of SSEP. These goals are: 1.) improving students’ competence in science and mathematics 2.) nurturing student enthusiasm for science and mathematics and 3.) interesting students in pursuing careers in research or other science-related areas. Thus, MONS is a year-long, STEM-based experience that allows high school students a chance to do authentic research projects that might contribute to our knowledge of Mars and the inner solar system.

Project Design: During January of each project year, MONS students are recruited from the student bodies of Durham Academy and from the seven high schools representing DPS. MONS seeks to recruit 20 gifted freshman and sophomore students with strong

math and computer skills. Special consideration is given to ethnic groups who are traditionally underrepresented in STEM-related college majors and professional careers. Once MONS students are selected, they participate in a series of eight training sessions designed to teach techniques of remote sensing necessary to interpret data released by ongoing NASA missions, especially those investigating the Martian planetary system. Such a curriculum allows students to learn principles that are addressed by the most abstract and difficult objectives of NC and national science objectives. Then, during a summer session involving five weeks of experimental design and data collection/analysis, the students do research projects that have application to earth and extra-planetary remote-sensing-based exploration. During the past year, the MONS team chose to study the thermal characteristics of fluvial sediments, with the goal of discerning Earth-like fluvial systems on Mars. Experimental design was entirely driven by the student participants. After fine tuning the design, which consumed most of the summer session, the students chose to extend the project by collecting data during most of their fall semester. In

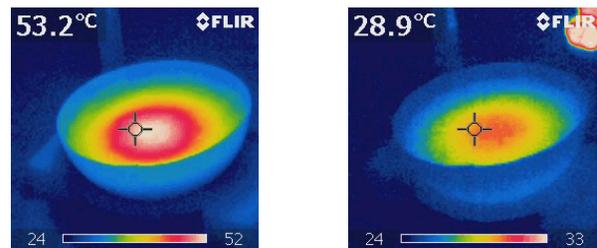


Fig 1: Thermal Image of experimental setup recording the rate of heating and cooling of a silt and clay mixture.

December of 2007, the students submitted individual abstract presentations of their work which were consolidated into a single abstract and submitted to LPSC 2008. (See LPSC abstract #1220 titled “Thermal Modeling of Fluvial Sediments.”)

Design of the MONS project incorporates attrition of students; only the most motivated complete the year. This year, out of 20 original recruits, eleven completed the project and wrote individual versions of the abstract. These eleven students will be rewarded in the coming year with positions as mentors to newly

recruited students. Mentorship is rewarded with a \$100 per month stipend during the coming year.

Interaction with Space scientists: Student experience with MONS began with an exciting talk given by Dr Moersch during an open house activity in January of 2007. The summer program culminated with an incredible trip to Cape Canaveral, where participants interacted with members of the Phoenix Lander Mission Science Team and then watched the launch of the Phoenix mission. In March, 2008, MONS students who completed the 2007 program will participate in LPSC 2008, where they will present a poster summarizing their research during the 2007 year.



Fig. 2: Phoenix Lander Payload just prior to early morning launch.

Project evaluation: The value of true inquiry-based education for secondary school students is fully supported by the evaluation of the project conducted by a contracted outside agency. Analyses of collected data from MONS participants show that the project was effective in addressing the three SSEP goals stated above. Following is a set of comments pertinent to the success of MONS to interest student in the field of space science:

“I enjoyed being in a science environment where everyone was really excited to participate and learn (unlike school). It was like taking a great science class during summer! I learned so much stuff, and it was fun to use my Science Olympiad skills from this past year.”

“I liked how it was mainly run by us, the students, rather than being a school-like environment and controlled. It was lots more experimentation and learning more as we go than slow-paced basic learning.”

“ I loved learning more about Mars and having the exciting experience to be exposed to such amazing

people and equipment that I would normally not be around.”

“The fact that I've learned quite a bit about an area I've been interested in is probably my favorite thing. Many science classes I've been in have been interesting, but this program has caused me to think more than a regular class, which is really nice.”

Future Plans: The thermal modeling project of 2007 is not yet complete and will continue during the upcoming year. In addition to the fluvial experiment model, MONS plans to add research into the thermal characteristics of evaporite deposits and to do IR-based compositional spectral studies pertinent to both TES/Mini-TES (emission characteristics) and CRISM (reflectance characteristics) of mafic and ultramafic materials found on Earth. In addition, a secondary objective of the program is to instruct science teachers in the Durham, NC area in the use of state-of-the-art remote-sensing principles used in planetary study.



Fig. 3: MONS Team 2007