

Who Needs a Social Life When You Can Mine the Moon?

Dust, soil broken rock and other related materials that blanket planetary surfaces—known as regolith—have great potential to contribute to space observation research, but the physical properties of lunar regolith are unique and very difficult to excavate from a technical perspective. A group of students at the Missouri University of Science and Technology, dubbed the Lunar Miners, decided to step up to the plate—that is, by entering the 2008 NASA Regolith Excavation Challenge.

“We entered this design competition to put the knowledge and skills we learned in the classroom to use in a real world simulation,” said Joel Logue, a member of the Lunar Miners team from Missouri S&T. “By participating in such events, we want to prove to ourselves and to others that the young engineers of today can compete and challenge the engineers and the scientists in industry who have many years’ more experience than we do.”

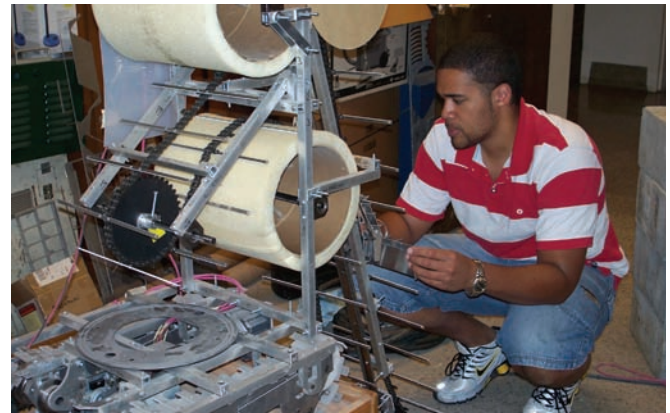
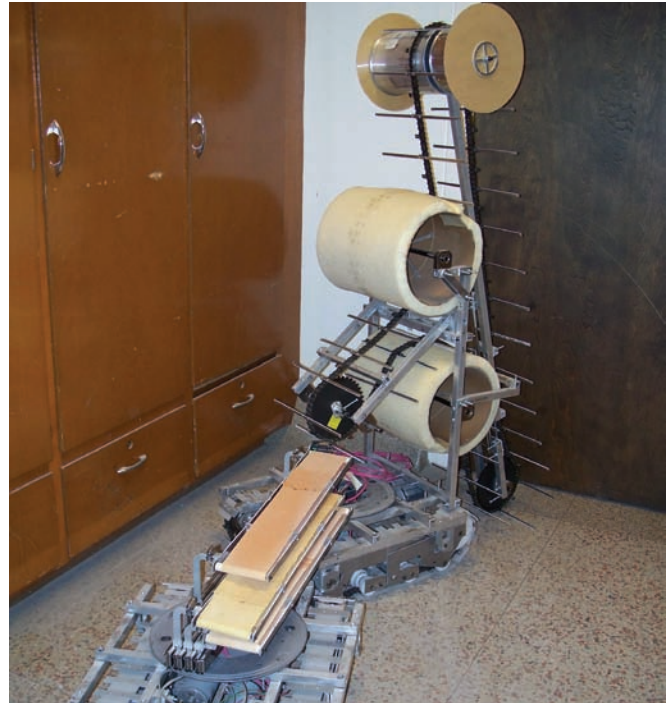
In alliance with the NASA Centennial Challenges Program, the Regolith Excavation Challenge, co-hosted by the California Space Education Workforce Institute (CSEWI), California Space Authority (CSA) and California Polytechnic University in San Luis Obispo promotes new technologies to excavate lunar regolith. The 2008 prize purse stood at \$750,000.

Logue’s teammate, Masafumi Iai, described the group’s machine, referred to as a Binary Autonomous Continuous Excavation System (BACES). “This mobile unit is powered with a pair of small motors driving two, custom-fabricated tank-like tracks. One mobile base carries the excavation conveyor that can be driven into the regolith with another motor for higher pressure and greater performance capability. The excavated regolith is carried to the back of the machine, where it’s transferred onto an expandable transportation conveyor suspended between the two mobile bases. The remaining mobile base seeks the collector bin and serves as an anchor and offloading point for the regolith. The unique part of our robot is that the excavation process is completely continuous. This continuous process has been found to be the most efficient method in the mining industry.”

Team leader Cory Smith stressed the extensive time devoted and money that came out of their pockets. “We spent countless hours in this machine shop,” Smith said. “We would usually start on Saturdays at noon and probably wouldn’t go home until two or three in the morning, and then the same thing on Sundays. We rarely took breaks.”

The project required a variety of structural and motion control components, including axle shaft, drive chain, gears and bearings. The Lunar Miners received some financial help from an alumni association, and Misumi supplied them with shaft bearings, chain and gears. “The fact that on their website they have CAD models of every part they stock helped immensely because we could import them directly into our model and find out what worked.”

The realization that the machine wouldn’t be completed in time to compete in California came about two months before the big day in August. Twenty-five teams registered for the challenge, only 16 teams traveled to San Luis Obispo to compete, and all but eight withdrew due to last-minute mechanical and logistical problems. “We still completed parts of it even though we knew it wasn’t going to work,” Smith says.



Joel Logue (bottom) attaches the excavation scoops to the BACES machine’s supports on the excavation chain. The machine in its entirety is pictured (top). (Courtesy of Misumi.)

Smith has heard buzz of participating in the 2009 competition, but nothing official on this note. Details of what next year’s challenge will consist of have not yet been released by the California Space Authority.

The group received no technical assistance and no school credit for the project. Smith said his social life and grades suffered due to the project, but when asked if he would do it all over again, he didn’t have to think twice before responding, “definitely.”

“It consumed so much of my time, but it was so worth it,” Smith says.

“It took a long time, and I’ll never forget it. It’s so memorable to tell someone ‘Hey, I entered a robot in a NASA challenge’...It’s just way fun.”