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Mountains & Minds



MSU engineering students built a 120-pound robot to dig simulated moon dirt in a national competition sponsored by NASA. If "Montana MULE" digs more dirt in 15 minutes than any other robot in a giant sandbox, it will win the contest at the Kennedy Space Center in Florida. [READ MORE AND SEE THE VIDEO](#)



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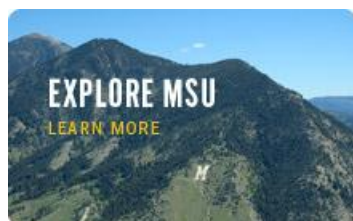
MSU standouts part of Absarokee family band that performed on MontanaPBS



Photo Feature: 2010 Montana State University Commencement



Record number of Native Americans to graduate from MSU this spring



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MSU News Service

MSU robot to dig "moon dirt" in national contest at Kennedy Space Center

May 21, 2010 -- By Evelyn Boswell, MSU News Service

BOZEMAN -- A Montana State University robot that sometimes had a spooky mind of its own is at the Kennedy Space Center to see if it can dig more moon dirt than any other student-built robot. ([See the video.](#))

In a May 27-28 competition sponsored by NASA, an MSU engineering student will remotely steer the 120-pound robot through a giant sandbox so it avoids craters and rocks, then removes as much simulated moon dirt as possible in 15 minutes.

The simulated dirt -- officially called "regolith" -- is different from the sand on a Florida beach or the outdoor volleyball court where the MSU students tested their robot in a May snowstorm. Since erosion doesn't occur on the moon like it does on Earth, the top layer will be like powdery glass that's extremely loose and super fine. The soil beneath will be small, sharp, jagged particles that can clump together. They're almost as hard as concrete.

If MSU wins [NASA's first Lunar Regolith Excavator Student Competition](#), it will receive \$5,000 and the opportunity to return to the Kennedy Space Center to watch a launch. If MSU's robot, "[Montana Mule](#)," doesn't dig the most dirt and the MSU team doesn't dazzle with its spirit, robot design, video and project presentations -- other contest categories -- the students said they will still have gained valuable experience from the project that spanned two semesters.

The eight team members are Christopher Ching of Belgrade, Ben Hogenson and Phillip Karls from Billings, Steve Pemble of Colstrip, Craig Harne of Cutbank, Paul Dallapiazza from Florence, Jennifer Hane of Fort Shaw and John Ritter of Idaho Falls, Idaho. Their faculty advisers are Brock LaMeres in the [Department of Electrical and Computer Engineering](#), Hunter Lloyd in the [Department of Computer Science](#) and Robb Larson in the [Department of Mechanical and Industrial Engineering](#).

Representing three departments and five majors in the [College of Engineering](#), the students said the project taught them how to communicate their ideas across specialties -- a skill they'll need when they become practicing engineers. They also worked together to design and build a robot that MSU faculty said is much more complex than senior capstone projects in past generations.

The robot that stands about five feet tall is mostly recycled aluminum, rolls on four wheels and incorporates several systems instead of just one. The students run it by using wireless technology and the controls for an X Box 360 computer game. The wireless technology talks to the robot's electronics system. The electronics system turns a motor on and off. The motor turns a chain that moves small buckets below the level of the wheels. The buckets -- moving as though they were the seats on a Ferris wheel -- dig the soil, take it along for the ride and dump it into the robot's hopper.

NASA said the purpose of the regolith competition is to retain students in science, technology, engineering and math. The contest may also result in innovative ideas and solutions that could be applied to actual NASA excavations.

NASA gave students some general guidelines for their robot. Besides weight, height, power and communication constraints,



John Ritter observes "Montana MULE" to see what needs to be done before the robot competes in a national contest at the Kennedy Space Center. Six MSU students and a faculty adviser will be in Florida for the NASA competition. (MSU photo by Jackson Harris). [Click here to see a video of Montana Mule in action and its history.](#)

Montana MULE couldn't do anything that astronauts couldn't do on the moon. Since suction doesn't exist on the moon, MSU couldn't invent a robot that contains a powerful vacuum cleaner.

To meet those stipulations, the MSU students met last fall to design the robot.

"We had complete free-rein," Harne said. "We had free-rein to do whatever the heck we wanted. It's pretty rare that you get to do that."

"That's why it looks the way it does," Pemble added, laughing.

Once the students designed the robot, they broke into smaller groups to build the components. As the year passed and the robot progressed, the students came together to mesh the systems they had developed.

In early tests, the robot started moving on its own during outreach presentations. LaMeres said it was an intimidating occurrence that sometimes required four team members to wrestle down the robot and regain control. Later in the year, the students displayed their robot without incident at the spring engineering design fair. In early May, they demonstrated the robot to engineering alumni who returned to campus for graduation. Just before shipping the robot to Florida, they tested it in the volleyball courts near the Roskie and Hedges residence halls.

"I was very impressed with how it turned out," LaMeres said. "The sophistication of the mechanical design was very impressive. I couldn't have envisioned something that complex and sophisticated and operational."

He added that the robot is one of the largest interdisciplinary projects in the College of Engineering and maybe in the entire university.

Robert Marley, dean of the College of Engineering, said, "This would be a complex project in industry."

He noted that broad-scoped projects involving colleagues from several disciplines is a national trend and a priority for engineering schools who train future engineers. In that regard, Marley said MSU is ahead of the curve. MSU's College of Engineering has been emphasizing interdisciplinary projects and teamwork since 1998.

Six students and LaMeres will be in Florida for the regolith contest. LaMeres learned about the competition last year while attending a NASA workshop. He brought back the idea to MSU and obtained NASA funds for materials. [The Montana Space Grant Consortium](#) then awarded LaMeres, Lloyd and Larson additional funding for competition travel and for the development of formal senior design curriculum material based on this project so that future students can have a rewarding experience, too. The Montana Space Grant Consortium also provided T-shirts for the students to wear during the competition. Hogenson received funds from MSU's Undergraduate Scholars Program to continue his participation after he finished his senior design class.

The students said they don't know exactly when they'll compete, but it will be sometime May 27 or 28. They'll have 30 minutes notice, then they'll have 10 minutes to move their robot to the sand, 15 minutes to compete and five minutes to remove their robot from the sand. They only have one chance to perform. Approximately 22 robots will participate, with two competing every hour.

No one knows how they'll do. It's possible Montana MULE will display its old independent spirit. Some robots in the competition may not even start.

But the students said the experience has been a great opportunity, and they'll see what happens.

"I'm not as nervous as I was," Hogenson said. "I think we will have a pretty good chance."

NASA will webcast the competition through NASA EDGE on USTREAM channel at <http://www.ustream.tv/channel/nasa-edge3> at 9 a.m. Mountain Time on Friday, May 28.

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