CT POST Sunday July 11, 2010

SKY'S THE LIMIT

UB students reach for the moon

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University of Bridgeport graduate student and team leader Nicolae Gari, right, demonstrates the lunar excavator that a group of students designed and constructed for the inaugural NASA Lunabotics Mining Competition. Undergraduate team member Matthew Breland looks on.

NASA challenge: Design and build an unmanned robotic lunar exacavator.

BRIDGEPORT — Digging a ditch is hard work, especially when the ditch is 250,000 miles away.

That was the problem that engineering students at the University of Bridgeport faced when they entered a design competition sponsored by NASA. The purpose of the contest was to come up with ideas for a lunar excavator that NASA engineers could use for an unmanned robotic device that the space agency hopes to send to the lunar surface in the future.

Twenty-one other colleges and universities participated in the NASA Lunabotics Mining Competition, which took place in May. The challenge, NASA said, was to design and build "a remote-controlled or autonomous excavator (lunabot) that can collect and deposit a minimum of 10 kilograms" of simulated lunar surface within 15 minutes.

Even for a machine, conditions on the lunar surface are not conducive to digging ditches, nor to anything else for that matter. Temperatures range from 250 degrees Fahrenheit at "noon" to minus 240 at night. The surface is shrouded in a thick layer of regolith — superfine dust that seems to stick to just about every man-made surface. Then there's the airless environment that makes lubrication of parts difficult and the low gravity, which confounds earthbound testing efforts.

Plus, there's no place to fuel up, and even if there was, a gasoline engine wouldn't work there anyway because there's no air.

"We were limited to 80 kilograms and we had to keep power consumption to 30 watts," said Nicolae Gari, a student from Romania who is the team leader. It took only a few months to put together the prototype, Gari said, adding, "My laptop uses more electricity than this thing."

He said that photovoltaic solar cells could not be used because they'd have to be too large to be practical, so lithium-ion batteries were used instead.

"The density of the lunar regolith is a lot less than, say, sand on Earth — 1.9 (grams per cubic centimeter) as opposed to 2.6 on Earth," Gari said. This is why the "buckets" are shaped the way that they are, much wider than they are deep.

Plywood was used as the framework because it's cheap, strong and easy to modify when last-minute changes are needed.

"A lot of teams from other universities got in trouble because they used steel, and they found it difficult to make last-minute changes," said Matthew Breland of Bridgeport, another graduate engineering student who worked on the project.

The NASA grant was small — only $4,500 — which had to cover travel expenses, too. The competition took place last spring at NASA's Kennedy Space Center in Florida.

"We had to pitch in," said professor Tarek Sobh, chairman of UB's Department of Engineering.

"There's is an ongoing debate on whether this should be completely autonomous, semi-autonomous or completely manual," said Sobh.

All three have their advantages and drawbacks.

To control a lunar device from Earth, you'd have to deal with a 2.6-second delay time — the time it takes for the radio signal to get to the device and for the device to signal back to Earth again. NASA scientists ruefully note that light might seem instantaneous on Earth, but it's agonizingly slow when dealing with astronomical distances.

"Then, you're dealing with human reaction times," Sobh said. "If you're controlling the thing from Earth, and you don't react in time, it goes off a cliff and that's the end of that."

He said that the fully autonomous approach, in which the rover is programmed to react to every conceivable situation, has a drawback, too, in that a situation might arise that the unit is not programmed to handle.

"That's why we like the semi-autonomous approach, in which you have all these sensors — stereo cameras, infrared sensors, laser range finders and so forth — to allow the unit to reaction to foreseeable situations, and then when there is a danger to the rover excavator, you'll be able to take over," he said. "And, with this approach, we might be able to find something interesting, pick it up and look at it."

The competition was won by the "MULE" entry from Montana State University, NASA said.