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S. Utah doubles as the planet for scientists planning missions

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HANKSVILLE - It might as well have been the Grand Canyon as far as Boudreaux was concerned.

A shallow, bone-dry creek bed, looming just inches below the NASA robot's four motionless wheels, seemed to present an insurmountable barrier. Boudreaux's "head," actually an obstacle-detection device, continuously nodded up and down as if still answering a long-forgotten question.

Bill Vreugde, a mechanical engineer working with NASA, stood nearby this week wondering what could be going through Boudreaux's software as it tried to autonomously plot a course around a distant hill. Such minor setbacks are why NASA picked southern Utah's Mars-like terrain to test robots - distant cousins of the rovers now roaming the Red Planet - before they head to the Moon and beyond.

With no obstacle in sight, Vreugde radioed back to engineers at headquarters for advice.

Bill Clancey, the NASA scientist in charge of the expedition, turned to watch an engineer ride up on an all-terrain vehicle. While many science fiction movies depict robots saving humans, the reality today is a bit different.

"This is a story that will be told hundreds of times on Mars - a person coming to help a robot," Clancey said as the engineer opened a compartment on Boudreaux. "The first Mars astronauts will have to be mechanics as well as physicians and geologists."

As part of the project, 16 NASA researchers from Ames Research Center, Moffett Field, Calif., and Johnson Space Center, Houston, commandeered the Mars Society's Mars Desert Research Station for the past two weeks. The two-story, tin can-shaped habitat, hidden in the badlands near Hanksville, typically houses volunteer crews for two weeks at a time to work out the logistics of living and working on Mars.

Blueprint for living on the Red Planet: The NASA team, armed with enough laptops to double the county's computing power, adds another dimension to preparing for the Red Planet. Clancey said the project looks at how humans work with one another as well as with robots on extravehicular activities, or EVAs, to collect rock samples.

Since a small team of astronauts would likely visit Mars for several months at a time, questions arise about how much storage space is needed and how to keep crew members entertained.

"How much time does he have to plan an EVA if he's going to be responsible for making dinner?" Clancey asked, while looking at a crew member working on a computer.

Clancey, an anthropologist who is chief scientist for human-centered computing at Ames, said the Apollo 17 moon mission inspired part of this work.

Astronauts on the moon had to ask a person sitting in Houston for basic information such as where the sample collection bags were kept. Other controllers in Texas constantly watched the astronaut's every move during an EVA.

Up to a 20-minute time delay in radio communications between Mars and Earth will make it impractical for routine questions. With a crew of maybe six people, team members on the Mars station will not have time to sit around for hours watching astronauts in the field.

Researchers are creating software to automate as many functions as possible. Robots like Boudreaux, designed to help, not replace humans, are what engineers should be thinking about for the moon and Mars, Clancey said.

Astronauts simulating EVAs on Mars, for example, can ask Boudreaux where they are and how to reach a destination. Cameras on the robot follow the astronauts and alert crew members at the habitat module if there is a problem.

At this point, researchers cannot create robots that think like humans. Neither Mars Exploration Rover still scampering around on Mars, Clancey said, should be considered a robotic geologist.

"It's totally incapable of interpreting any data. It can make no choices of where to go. It never forms a single hypothesis," he said.

The rovers are more like mobile laboratories that can respond to commands and send back raw data for human scientists to interpret. Future Mars rovers, for example, could help scout places for human geologists to work.

Part of the Hanksville research involves volunteer geologists, graduate students from the State University of New York's University at Buffalo, working with Boudreaux and Thibodeaux, another robot, and associated software.

Brent Garry, one of the Buffalo geologists, practiced how to work in the field while wearing a space suit and interacting with robots. Boudreaux can lug a trailer carrying field tools.

"We can take home quite a bit more samples," he said of the trailer.

Garry explained that working in a suit forced him to rethink how to do science. What types of voice notes and photos will provide data that researchers on Earth would find valuable?

Boudreaux returns: Though Boudreaux has spent three field seasons in Utah, there are always new obstacles to overcome. Jeff Graham, a robotics engineer working with NASA, rewrote Boudreaux's code just before shipping the robot to Hanksville.

When Boudreaux rolled off a truck Tuesday morning, it could only spin itself around. Engineers brought out a small jack to raise the robot's wheels off the ground.

"We're doing a little robot surgery," Graham said, as several engineers huddled around Boudreaux.

Eventually, Graham and company fixed the wheel problem and brought Boudreaux online to begin the day's mission. The robot's "head," which contains a laser to scan for obstacles, began nodding. A half-hour later, the robot's male computer voice blurted out, "Why, oh why are we all just standing around?"

After a few false starts - and the emergency field repair at the creek bed - Boudreaux crossed a dirt road at a slow walking pace and headed toward a gap between two hills.

"Don't climb the mountain, Boudreaux," Vreugde said to himself as the robot trekked up a steep incline. "He's going to get himself into a corner. I'm going to kill it."

Turning a dial on a yellow remote control, Vreugde shut down the robot as well as the brakes. Boudreaux rolled quickly down before Vreugde managed to catch it with his foot.

On Mars, this would be a disaster. In southern Utah, it's just another obstacle.

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Solid partnership: Mars and Utah

Boudreaux and Thibodeaux, the robots brought to Hanksville that may someday travel to Mars, are part of a growing list of connections between Utah's redrock country and the Red Planet.

Booster rockets from Utah's ATK Thiokol Propulsion and ATK Composites helped launch the Mars Exploration Rovers in 2003 while ATK-created gas generators inflated special balloons on the outer walls of the landing structures to help the rovers bounce to a safe landing in 2004.

The rovers sent back pictures of tiny pebbles nicknamed blueberries. These same tiny rocks, which are found in southern Utah, are locally known as "moqui" marbles, named for the ancestral spirits of the Hopi people. The rocks are likely signs of ancient groundwater flow on Mars.

Utah State University researchers are developing wheat that will grow on spaceships, which could help feed voyagers on their way to Mars.

The Mars Society in 2002 created the Mars Desert Research Station, which allows volunteers to practice how to run a small colony on the Red Planet.