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NASA uses facility to analyze life in tight space

In southern Utah: The agency wants to see how people use the quarters so they can design efficient living space for missions to the moon and Mars

By Greg Lavine

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Frank Schubert, program manager for the Mars Desert Research Station, takes a walk at the southern Utah facility in 2002. NASA used the station on Mars-like terrain this spring to study human interactions with robots, and with one another, in tight quarters. (Francisco Kjolseth/The Salt Lake Tribune)

Southern Utah's Mars Desert Research Station offers more than a place to practice living on the Red Planet.

The two-story, tin can-shaped structure, located near Hanksville, also served as a proving ground for a new system that could help in examining how best to use limited spaces. Such research holds value in planning for proposed NASA missions to the moon, Mars and beyond.

NASA scientists, along with several graduate students, took over the Mars Society's research station for part of the spring to develop ways to improve interactions between people and robots. While that work went on, researchers also tested methods to see how humans interact with one another, said Judy Gertler, of Foster-Miller, a Massachusetts consulting firm.

A working prototype of the system - called the Crew Activity Analyzer - is nearly ready to be delivered to NASA's Ames Research Center in California.

"We now have a system that allows us to track people in an indoor environment," Gertler said.

Study subjects wore what are known as "crickets," which are tracking devices developed at the Massachusetts Institute of Technology. Each unit emits a radio as well as an ultrasound pulse, said Jim Murray, another Foster-Miller consultant involved in the project.

If three of the six sensors mounted on the ceiling receive the same signals, they can pinpoint where the tracking device is in a room. These electronic positions are combined with video recordings of the activities in the room, Murray said.

A computer screen can display a map of the room with people represented as dots. Observers then can tell the computer to show all instances of a certain situation - for example when three people are sitting at the same table.

"What are they using it for?" asked Gertler. "Are they working independently at the table or are they having a meeting?"

The new system could save hours of analysis for people studying the video and audio recordings. It can take up to four hours to properly analyze each hour of videotape, Gertler said.

When the computer detects the desired situation, the program shows the exact time of the event on the video. The researcher then can hone in on the situations of interest.

Future missions to the moon and Mars will have to make due with limited amounts of space for long periods of time. There are obvious advantages to determining how to make the most of tight spaces, which is where the Crew Activity Analyzer comes in, said Bill Clancey, a NASA computer scientist who studies interactions between people and computers.

"Foster-Miller's system could prove useful for studies of [Crew Exploration Vehicle] activities, to inform design and evaluation of facilities, tools and operating procedures," said Clancey, who led the NASA team in Hanksville this spring.

Typically, the Desert Research Station houses volunteer crews from the Mars Society, an organization dedicated to lobbying for exploration of the Red Planet. Each crew spends about two weeks.

The Mars Society selected Hanksville because of its isolated location and its Mars-like landscape. NASA has taken over the habitat several times for projects, including the robot interaction work this spring.

Most human issues have focused on ergonomic matters such as whether an astronaut can reach a keyboard from a certain position. Clancey said more attention is now being paid to efficiency of space and psychology of extended stays in confined spaces, such as spaceships or a moon base.

A NASA Small Business Innovation Research grant funded the development of the Crew Activity Analyzer.

glavine@sltrib.com