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Strutting its stuff.
A new generation of robot walkers could help humans explore other planets.

Credit: Josh Sams at Langley Research Center/NASA in collaboration with Goddard Space Flight Center.

Rovers That Walk on the Wild Side

By Christina Reed
*Science*NOW Daily News
13 December 2005

SAN FRANCISCO, CALIFORNIA--Remember the horrific, three-legged fighting machines in Steven Spielberg's *War of the Worlds*? Well, those Martians may have been onto something. At a meeting here of the American Geophysical Union last week, NASA engineers presented a new solution to the problems posed by exploring other planets--and it's got legs.

Traditionally, planetary rovers use wheels for locomotion. But for climbing over rocks, down steep valleys, and up sand dunes, nothing beats a great set of legs. That's why chief investigator Steven Curtis at Goddard Space Flight Center in Greenbelt, Maryland, began modeling what would happen if a shape-changing robot--one that can vary its geometry with motion--explored extreme environments on Earth, Mars, and the moon.

So far the technology is still in the prototype phase and looks like a tripod standing in a triangular frame. Called Tetrahedral Explorer Technologies, or 'Tet walkers', the rovers tumble along by extending a strut and shifting their center of gravity out. Theoretically, a Tet walker can climb a canyon wall as well as a professional rock climber, by keeping its center of gravity close to the vertical surface and placing its nodes in small nooks to create a series of platforms to gain elevation. To cross over a deep crevice, the struts would extend out to create a bridge. Faced with a narrow opening in a rock, a Tet walker could collapse and slink through.

Such agile shape-changers could navigate almost any type of terrain, says Goddard planetary scientist Pam Clark, who presented a model and prototype in a poster session at the meeting. Currently the team is building models with aluminum struts, extended by motors that use a pulley system of Kevlar-braided fishing line, which can hold up to 150

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pounds of force. Allen Lunsford, a computer scientist on the team, hopes that future work will rely on air pressure or other pneumatic technology to drive the extensions, which would ideally be made of carbon-fiber nanotubes. If funding becomes available, Clark says the Tet rovers could be fully functional in five to six years.

Mastering the theoretical and practical problems of building such robots is complicated, but "the potential is enormous," says Charles Reinholtz, a mechanical engineer at Virginia Polytechnic Institute and State University in Blacksburg, who has worked with similar technology to design robotic caterpillars. "If we want to cover [inaccessible terrain], we have to start thinking of things with legs or snakelike devices."

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