



### Robot Would Climb Steep Terrain

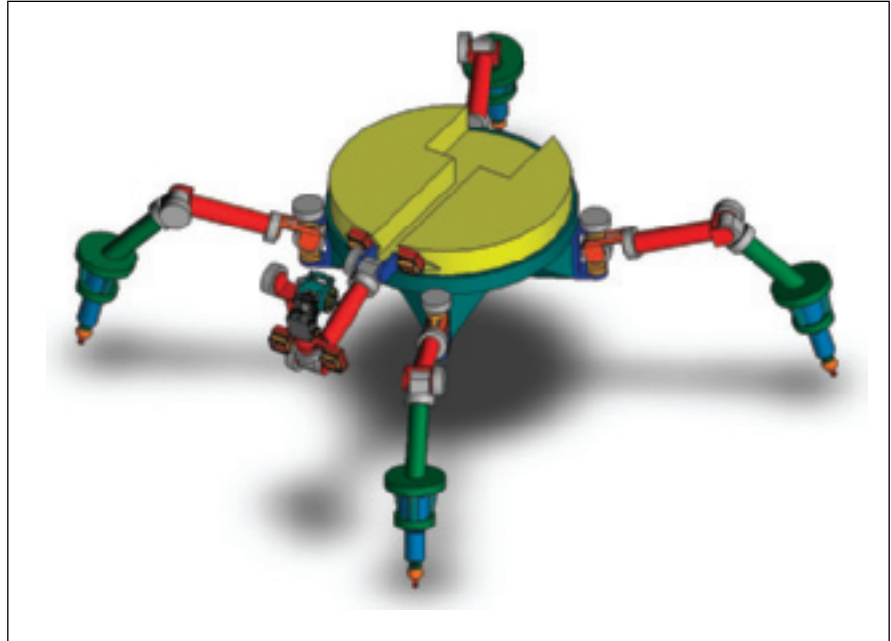
**This walking robot could even climb under overhangs.**

*NASA's Jet Propulsion Laboratory, Pasadena, California*

The figure depicts the steep terrain access robot (STAR) — a walking robot that has been proposed for exploring steep terrain on remote planets. Robots based on the STAR concept could also be used on steep terrain on Earth for diverse purposes that could include not only scientific exploration but also military reconnaissance and search-and-rescue operations.

The STAR would be able to climb up or down on slopes as steep as vertical, and even beyond vertical to overhangs. Its system of walking mechanisms and controls would be to react forces and maintain stability. The STAR would be capable of performing such tasks as acquisition of samples and placement of instruments. To enable the STAR to anchor itself in the terrain on steep slopes to maintain stability and react forces, it would be necessary to equip the tips of the walking legs with new ultrasonic/sonic drill corers (USDCs) and to develop sensors and control algorithms to enable robust utilization of the USDCs.

The plan for the initial stage of development calls for construction of a prototype STAR as a combination of a walking robot, denoted the LEMUR IIb, that was described in "Modification of a Legged Robot to Favor Climbing" (NPO-40354), *NASA Tech Briefs*, Vol. 30, No. 4 (April 2006), page 80. The prototype would enable testing of



The **Steep Terrain Access Robot** would walk by use of legs tipped with ultrasonic/sonic devices that would anchor themselves in the terrain.

the STAR concept on planar slopes. Eventually, a robot more like the one shown in the figure would be constructed. This robot would be capable of moving over slopes having three-dimensional features.

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*rett of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).*

*The software used in this innovation is available for commercial licensing. Please contact Karina Edmonds of the California Institute of Technology at (626) 395-2322. Refer to NPO-41158.*

### Measuring Dynamic Transfer Functions of Cavitating Pumps

**Flow and pressure perturbations are imposed; transfer functions are computed from responses.**

*Marshall Space Flight Center, Alabama*

A water-flow test facility has been built to enable measurement of dynamic transfer functions (DTFs) of cavitating pumps and of inducers in such pumps. Originally, the facility was intended for use in an investigation of the effects of cavitation in a rocket-engine low-pressure oxygen turbopump. The facility can also be used to measure DTFs of cavitating pumps in general.

It is necessary to measure DTFs in order to understand the dynamic couplings between a cavitating pump and the rest of the flow system of which the pump is a part. In the case of a turbopump, inducer cavitation dynamics can cause flow and pressure pulsations arriving at the turbopump inlet to become amplified by the turbopump, thereby giving rise to very large flow

and pressure fluctuations in the feed system served by the turbopump. If the feed system in question is a rocket-engine fuel or oxidizer feed system, these flow and pressure fluctuations can, in turn, cause large variations in engine thrust, even to the point of pogo instability. Within the turbopump, the cavitation-induced dynamic couplings generate intense dynamic loads on the