

Cooperative exploration of rough Martian terrains with the "Scorpion" legged robot as an adjunct to a rover.

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Abstract:

NASA needs autonomous robotic exploration of difficult (rough and/or steep) scientifically interesting Martian terrains. Concepts involving distributed autonomy for cooperative robotic exploration are key to enabling new scientific objectives in robotic missions.

We propose to utilize a legged robot as an adjunct scout to a rover for access to difficult - scientifically interesting - terrains (rocky areas, slopes, cliffs). Our final mission scenario involves the Ames rover platform „K9" and Scorpion acting together to explore a steep cliff, with the Scorpion robot rappelling down using the K9 as an anchor as well as mission planner and executive. Cooperation concepts, including wheeled rappelling robots have been proposed before. Now we propose to test the combined advantages of a wheeled vehicle with a legged scout as well as the advantages of merging of high level planning and execution with biologically inspired, behavior based robotics.

We propose to use the 8-legged, multifunctional autonomous robot platform Scorpion that is currently capable of:

- **Walking** on different terrains (rocks, sand, grass,...)
- **Perceiving** its environment and modifying its behavioral pattern accordingly.

These capabilities would be extended to enable the Scorpion to

- **Communicate and cooperate** with a partner robot
- **Climb** over rocks, rubble piles, and objects with structural features.

This will be done in the context of exploration of rough terrains in the neighborhood of the rover, but inaccessible to it, culminating in the added capability of rappelling down a steep cliff for both vertical and horizontal terrain observation.