The Atacama Field Trial : A Stepping Stone to the Planets

The near generation of planetary agents will be robots. Well suited for exploration, high performance mobile robots with capabilities for reliable, sustained operation, autonomous navigation, and responsiveness to remote human control offer vast potential in high return planetary missions and commercial planetary enterprise.

In the Atacama Field Trial, NASA and Carnegie Mellon University will deploy Nomad, a self-contained, self-reliant mobile robot, to demonstrate robotic capabilities relevant to long-duration, long-distance planetary excursion. In summer 1997, Nomad will embark on an unprecedented 200-kilometer trek across the Atacama desert in northern Chile. During the two-month demonstration, Nomad will use autonomous driving and safeguarded teleoperation to navigate across uncharted terrain. Nomad will draw on a full complement of onboard resources to determine its position, generate patterned navigation useful for terrestrial and planetary surveys, and deliver visualization and communications never before achieved from a mobile robot.

The Atacama Field Trial will be accessible to interested audiences by way of live broadcast from the desert. In addition, the Atacama Field Trial will combine Nomad's imagery, communications, and safeguarded teleoperation with a virtual environment interface to allow novice drivers such as researchers, scientists, and partner organizations (science centers, schools, and commercial sponsors) the opportunity to operate Nomad from U. S. based control center(s) and over the internet.

Mobile Robotic Technologies

In the Atacama desert, Nomad will traverse harsh terrain analogous to that found on the Moon and Mars. The robot's four wheel drive/four wheel steering locomotion and innovative transforming chassis will provide effective traction, mobility, and propulsion across craters, rocks, and loose sands and soils typical of the Atacama landscape. Unique to Nomad, the chassis expands, increasing the wheel base and track for improved stability over rugged terrain. This ability to expand - and compact - also allows Nomad to adapt its footprint to variations in terrain. With a mass of only 375 kg, Nomad's maximum volume is 2.4 x 2.4 x 2.4 m and minimum volume, 1.8 x 1 8 x 1.8 m.

In the Atacama Field Trial, Nomad's primary mode of navigation will be safeguarded teleoperation. Proven in field trials of increasing distance and difficulty, this navigation system incorporates sensing, planning, and control that will enable Nomad to safeguard itself against unpredictable terrain hazards as it responds to directives from a remote operator. Nomad will also drive autonomously to demonstrate robotic navigation during significant time delays and total loss of communications, potential scenarios in planetary excursion.

The Atacama Field Trial will break new ground in the areas of robotic communications and visualization. Going beyond current technology, which precludes high data rate transfer over distance from a moving vehicle, Nomad will use an onboard tablet-sized directional antenna and innovative precision pointing technology to attain a high data rate of 2 Mbps while traversing natural terrain. This technology, combined with high resolution, panospheric imagery and a Virtual Environment Vehicle Interface (VEVI), will produce a three-dimensional synthetic terrain image with animation. Providing a rich interactive experience, this interface will improve teleoperation of Nomad and enable broad public participation from remote sites across the United States and on the internet.

The Atacama Field Trial will test and validate robotic technologies and capabilities critical to planetary excursion. Representing state-of-the-art in mobile robotics research and development, Nomad will demonstrate locomotion, navigation, visualization, and communications consistent with the needs of bold exploration and planetary enterprise. With capabilities forged in the desert, Nomad will serve as the precursor to robotic explorers destined for distant planets.

Nomad is the culmination of the Lunar Rover Initiative program, a NASA-sponsored research and development initiative of the Robotics Institute of Carnegie Mellon University.

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