

## **Viz: An Automated 3D Mapping System for Planetary Exploration.**

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### **Abstract**

The fast pace of NASA's Mars Surface Exploration missions, combined with the high quantity of data returned and the complexity of controlling a robot millions of miles away, require the development of new tools allowing mission personnel to rapidly and accurately visualize and analyze all the information necessary for daily operation planning activities and science analysis.

In this paper we describe the concept behind Viz and the Ames-Stereo-Pipeline, a near real time and fully automated mapping system developed to alleviate this shortcoming. The Ames-Stereo-Pipeline automatically produces accurate photorealistic virtual model patches of the terrain as images are received from the spacecraft. Terrain patches created from individual image pairs are mosaiced together to form a model of the lander or rover's surroundings. Local models can be integrated with regional digital elevation maps (DEM) created from orbital, descent or aerial images.

This integrated model can then be displayed in Viz, a custom virtual reality interface responding to mission operation and science needs. Viz allows mission engineers and scientists to view the remote work site from any perspective (virtual camera), to measure feature positions and distributions, to simulate robotic activities, to replay telemetry files and to generate command sequences for the spacecraft. The integration of data covering multiple orders of magnitude in size into a single model allows the operator to naturally and effortlessly place local features into their global or regional context.

We review the use of Viz and its predecessors in support of planetary or terrestrial missions including: the Mars Pathfinder mission, the Mars Surveyor Polar Lander mission, The 3D mapping of the Chornobyl nuclear accident site, and the hot springs mapping expedition in Yellowstone national park.