Stereogrammetric mapping of Mars

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The Viking Orbiters acquired quality stereo coverage of a significant fraction of Mars in 1976-1980. Several groups have been using this stereo coverage to produce global and regional scale topographic maps of Mars. The LPI group has been using these data to map the topography of specific geologic structures and landforms. Our software uses scene-recognition to map parallax to 1/5th pixel (being upgraded to 1/10th pixel) precision. It also allows us to automatically trim our DEM data on the basis of height error or correlation coefficient (of the scene matching). Manual editting is also performed. On some targets (e.g., Ganymede and Mercury), virtually no clean up is required. Like Io, however, Mars is plagued by featureless deposits and photometric and seasonal variability (in the case of Mars due to long time lags between images). This results in significant gaps in our DEM maps in some locations. Viking stereo quality (convergence angle, resolution) also varies wildly over the surface Mars, however. One of our projects focused on debris aprons, which have not been previously mapped topographically. We find that these aprons can be 300 to 1 km thick, thicker than has been generally assumed, and have surface slopes of 1 to 10 degrees. These data are robust but like all Mars topography data suffer from an unreliable global datum. While stereo-derived DEM can provide higher spatial resolution than altimeter data, they degrade seriously when smooth featureless terrain is mapped and at present cannot be reliably 'controlled.' This problem will be solved by MOLA. Stereo- and altimeter-derived topography thus compliment each other very effectively to solve specific geologic problems on Mars. A dedicated high-resolution stereo mapping camera should be a high priority for later Mars missions in the current Mars exploration program.