MARTIAN SURFACE SIMULATIONS +; R.W. Gaskell, JPL/Caltech

Current scenarios for a Mars landing involve the extensive analysis of the surface near the landing site. Pinpoint landing, for example, requires a detailed mapping of the area from orbit for landmark identification and landing site selection, and the use by the lander of its own imaging data to recognize these landmarks and to guide itself safely to the surface. Hazard avoidance requires sufficient orbital imaging to ensure that safe landing sites exist, with the lander using its sensory data to find one of them. Once on the surface, a rover must be able to avoid or surmount obstacles, travel across surfaces with varying compositions and slopes, and navigate to a desired destination. Computer simulated martian surfaces are being constructed to aid in the development of these exploration technologies.

These surface simulations attempt to mimic the specific geologic episodes which built the surface, such as cratering, lava flows, and aeolian activity. Each episode takes a preexisting surface as a starting point, alters it in some way, and stores the new surface for further processing. This modular construction makes it possible for new processes to be included without altering existing software.

All process models have random aspects. An early test image shown in figure 1 began as a fractally generated "shield". Heights were computed for a successively finer grid, with a scale dependent variation added at each stage. The surface was then bombarded in a cratering episode. Crater sizes and surface locations were randomly generated according to a given distribution function. A lava flooding then occurred, again with a fractally generated surface. This was followed by a layer of dust, mimicked by using a fractal surface with variations controlled both by scale and by the underlying slopes. Rocks were then added according to another distribution function controlling their size and location. Other features such as crevasses can now be included in the simulations.

The surfaces are currently presented as 25.6 km squares at 50 meter resolution, comparable to the highest Viking orbiter resolution. Any part of the surface can be explored in more detail, down to a resolution of about 20 cm. Physical properties of the surface and sub-surface materials can be extracted for radar, thermal inertia and rover simulations. Figure 2 shows such a 25.6 km square region, generated by the flooding and cratering of an initial shield. Figure 3 shows an 800 meter square portion of the same surface. The largest crater in the latter figure is found 4.0 cm from the top and 3.0 cm from the left in the former. The other craters shown in figure 3 are sub-resolution in figure 2.

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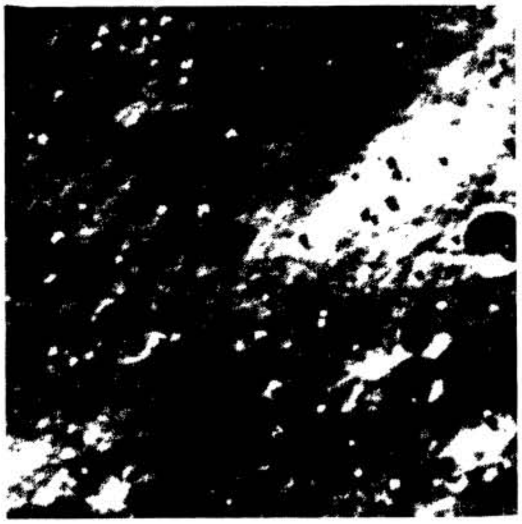

Figure 1

Figure 3

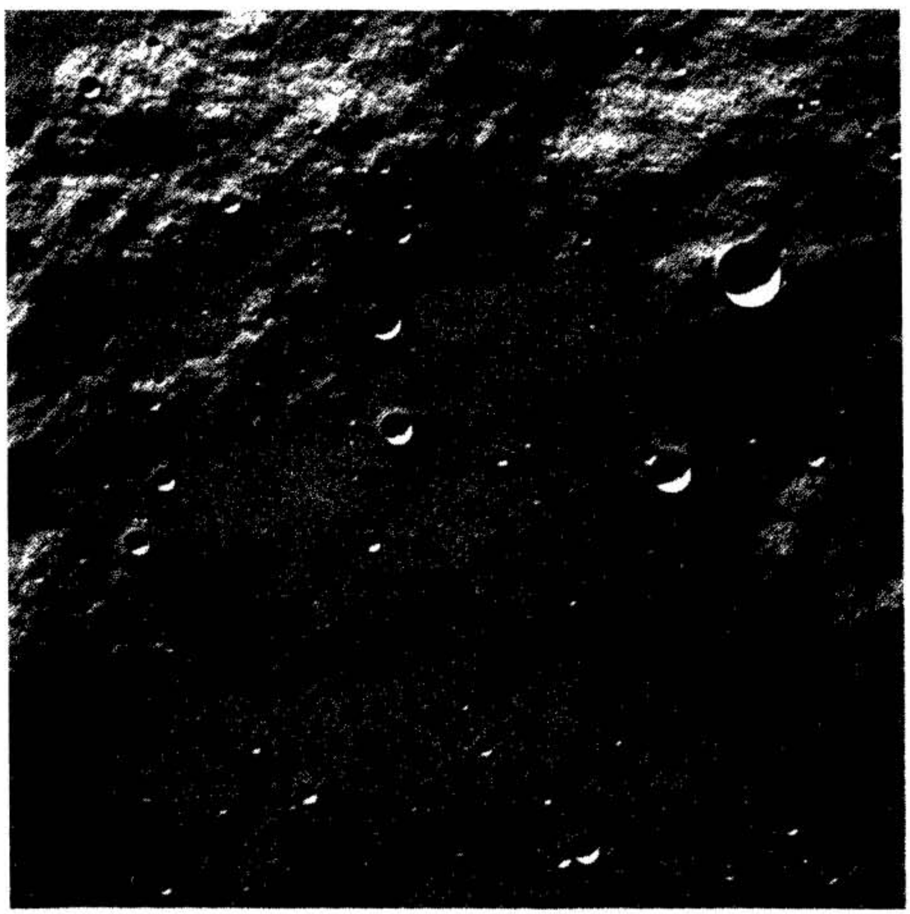

Figure 2