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MARS LANDSCAPES FROM VIKING LANDERS IN NEW HIGH-RESOLUTION COLOR

Abstract

Advances in imaging processing techniques enabled the creation of new high-resolution color pictures with raw Viking Lander imaging data (taken from 1976 to 1982).

Each lander has two cameras which viewed 342.5deg of the surface from an height of 1.3m and from +40deg to -60deg relative to the lander body, with two imaging modes :

- an high-resolution panchromatic mode (pixel size : 0.04deg), with four focusing options. Two imaging sets were taken for Lander 1 at 7:00 - 8:00 (Mars local time) and at 14:00 - 15:30, and three sets for Lander 2 (7:00 - 8:00, noon, 17:00 - 18:00) ;

- two low-resolution modes (pixel size : 0.12deg) : (i) a panchromatic survey mode and (ii) a color mode taking three images (blue, green, red) which are superimposed for color reconstruction.

The color images had to be processed to compensate from :

- a response from the blue filter inside the red channel, resulting with bluer global renderings. Color balancing techniques were then used ;

- seasonal brightness variations in the sky induced by the amount of dust in the atmosphere, which changes also the incident light on the surface.

Assessing the real colors from the surface of Mars is difficult, because they may change quickly. The color of the sky, an orange-pink, depends on the amount of dust in the atmosphere and may turn to a dull yellow-grey at minimum dust opacity. Clouds passing over the landing sites are lowering luminosity, contrast and color saturation. Also, variations in sunlight during a Martian day (24 hours 37 minutes) make the surface vary from coppery-brown to yellowish-brown.

The high-resolution images were patiently corrected for luminosity and contrast and then pieced together to produce large mosaics with a uniform rendering. Those were then merged with the low-resolution color mosaics which can be used separately for other purposes.

Now, the Viking panoramas can be contemplated in high-resolution color. Those were issued in 2016 to celebrate NASA's 40th Viking landing anniversary, in coordination with the Viking Mars Missions Education Preservation Project (VMMEPP), a non-profit organization for the collecting and curating of the artifacts and team recollections of the Viking missions. The new products are showing :

- Pictures taken after the two landings on Mars ;
- Trenching activities performed by the two landers ;
- Seasonal variations : fogs, dust storms, surface changes and frost coverage (for Viking Lander 2).