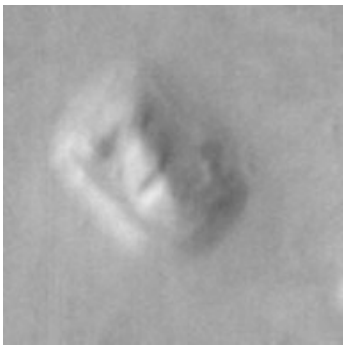
Malin Space Science Systems



The "Face on Mars"

Introduction

In July, 1976, Viking Orbiter 1 was acquiring images of the Cydonia region of Mars as part of the search for potential landing sites for Viking Lander 2. On 25 July, 1976, it photographed a region of buttes and mesas along the escarpment that separates heavily cratered highlands to the south from low lying, relatively crater-free, lowland plains to the north. Among the hills was one that, to the Viking investigators scrutinizing the images for likely landing sites, resembled a face. Owing to the importance of the landing site search, and with a desire to provide the public with at least one familiar-looking landform amid the craters and exotic terrains found all over Mars, an image including the face-like hill was released as part of the Jet Propulsion Laboratory's public relations effort. The text of that release notes the face-like hill.

Subsequent to this release, some people have argued, mostly in the lay literature, that the face-like hill is *artificially* shaped. Although their argument has been expanded to a host of nearby features, none commands public interest like the "Face." This page will provide interested persons with both the raw Viking images, transformed to GIF format, and a brief tutorial (with examples) of image processing techniques applied to create "better looking" images.

The Raw Images

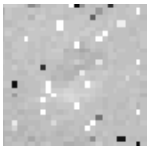
Table 1, below, lists all Viking Orbiter images of the "face," in order of decreasing resolution. Following the table are the images acquired at resolutions better than 400 meters/pixel. The icons show the "face" as seen in the raw data, but contrast enhanced for visibility. The actual images have not been processed other than conversion to GIF format. As a reminder, *each raw Viking Orbiter image is 1204 samples wide by 1056 lines high*.

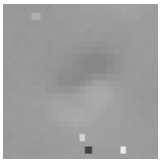
Table 1: List of Viking Orbiter Images of the "Face on Mars"

PICNO	Res.	PICNO	Res.
*070A13	43 m	753A06	588 m
*035A72	47 m	753A03	596 m
*561A25	163 m	717A04	723 m
*673B56	226 m	771A94	735 m
673B54	226 m	257S41	780 m
*753A34	233 m	220S38	808 m
753A33	233 m	257S69	821 m
753A05	578 m	220S37	863 m
859A05	582 m	590A24	889 m

*images included in this Web page


561a25.raw.gif (451 KBytes)


753a34.raw.gif (602 KBytes)


673b56.raw.gif (447 KBytes)

Label Information (Ancillary Data)

Explanation of Label Information

035A72 - 070A13 - 561A25 - 753A34 - 673B56

Processing of "Face" Images

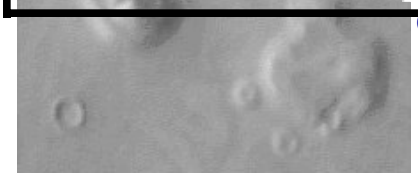
The following images were subjected to image processing techniques to improve the visibility of features in the images. A step by step description of image processing techniques as applied to these images is also on-line. The processing applied includes bit-error correction, reseau removal, very slight brightness alteration, and projection to a standard map view (mercator projection) with north at the top. Contrast/Brightness enhancements and image sharpening were not performed as these would create images that would differ depending on the nature of the monitor on which they were being viewed. Examples of this type of processing are given elsewhere. Map projection resamples the raw image format, and these images are larger than the raw data. The following table lists the dimensions of these images:

Table 2: Dimensions of Mercator Projected Images of "The Face on Mars"

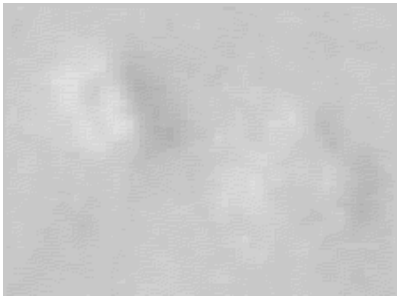
PICNO	#lines	#samples
035A72	2135	1973
070A13	1899	1669
561A25	1552	1729
673B56	1757	1611
753A34	2129	1980

Map Projected Images

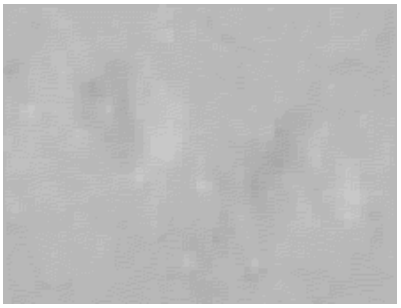

035a72.map.gif (GIF = 1.44 MBytes)



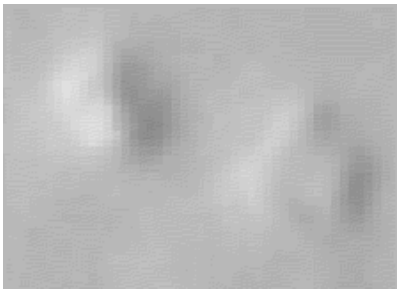
070a13.map.gif (GIF = 1.45 MBytes)



561a25.map.gif (GIF = 1.20 MBytes)



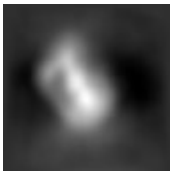
753a34.map.gif (GIF = 1.34 MBytes)



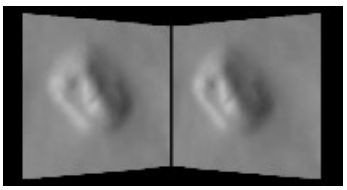
673b56.map.gif (GIF = 1.22 MBytes)

Topography

Derivation of a model of the relief of an object from the way it reflects light seems reasonably straightforward: slopes facing a light source appear brighter than those facing away. However, in practice this is a difficult problem to solve, and the results are often non-unique. Based on the computer vision literature, MSSS scientists have developed a "shape-from-shading" technique that can be applied to planetary images. The following images are the vertically viewed height field (exaggerated to fill an 8-bit, 255-level range) and a stereoscopic view of the original image draped over the height field in both stereopair and anaglyph form.



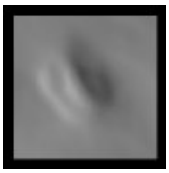
Topography (GIF = 38 KBytes)



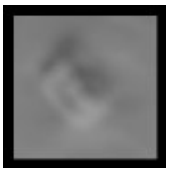
Stereopair (GIF = 52 KBytes)

Changes of Appearance with Illumination Direction

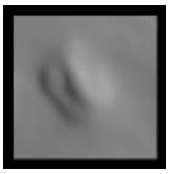
Using the height field, it is possible to view, at the admittedly lower spatial resolution of that field, what the "Face" looks like under different illumination conditions, in particular from illumination at different hour angles. Since the "Face" is above the martian "Tropic of Capricorn" (+25 deg), illumination in reality will always be from a southernly direction, but in these simulations, illumination can come from other directions as well.



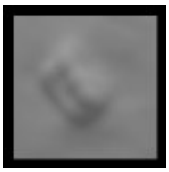
Illumination from southwest (GIF = 22 KBytes)



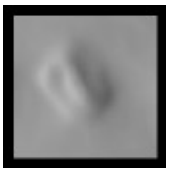
Illumination from south (GIF = 18 KBytes)



Illumination from northeast (GIF = 22 KBytes)



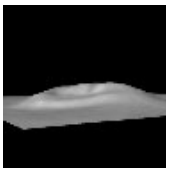
Illumination from north (GIF = 18 KBytes)



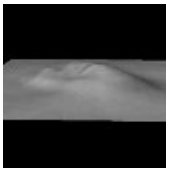
MPEG of 360 deg rotation of illumination direction (MPEG = 79 KBytes)

Changes of Appearance with Viewing Direction

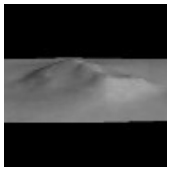
Using the height field, it is also possible to view the "Face" from different look directions, by mapping the Viking Orbiter image directly on the the topography and then placing the "viewer" at different locations.



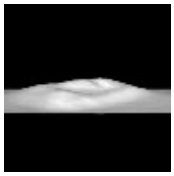
View from southwest (GIF = 12 KBytes)



View from south (GIF = 16 KBytes)



View from northeast (GIF = 17 KBytes)



View from north (GIF = 17 KBytes)

MPEG of 360 rotation of viewing direction (MPEG = 70.2 KBytes)

Discussion of the "Face on Mars:" Mars Global Surveyor Plans

A brief discussion of the controversy surrounding the "Face" and the planned MOC observations.

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