

SEMI-AUTOMATED EXTRACTION OF A DEM FOR STUDIES OF ARES VALLIS USING VIKING ORBITER IMAGERY; C.A. Robinson, A.C.Cook and W. Zeitler (DLR, Institute of Planetary Exploration, Rudower Chaussee 5, D-12489 Berlin, Germany)

Ares Vallis is one of a vast system of unconfined outflow channels that emerges close to the equator at 18°W , and is likely to be the landing site for Mars Pathfinder. Extensive studies have been performed to determine the sedimentary history and geological development of Ares [1, 2]. These suggest that until 3.5 Ga ago Ares may have been formed by glacially-related processes, with some fluvial activity, and that localised volcanic resurfacing followed until 1.6 Ga ago at more northerly locations. As an extension to these studies, this abstract describes the generation of a DEM for this region. The DEM indicates Ares is approximately 1.5km deep, between -2.5°S to 7°N and 17°W to 19°W .

We have generated a Digital Elevation Model (DEM), using semi-automatic techniques described in [3, 4, 5], for Viking Orbiter imagery of the southern limits of Ares (-2.5°S to 7°N , 17°W to 19°W). The technique uses geometrically-corrected (but not radiometrically-corrected) digital imagery of the martian surface that is automatically stereo matched with the "Gotcha" software, developed at University College London. After each stereo pair is matched, the matched points are passed through a stereo intersection camera model, and with the aid of some manually derived control points a set of longitude, latitude and height points are produced. Using interpolation, a gridded DEM is output. This entire process can be performed rapidly using a SUN Sparcstation 20. Six stereo pairs were used for the generation of the DEM. These are: 593A08 655A90, 593A08 655A89, 378S10 666A38, 378S10 666A34, 378S12 729A33 and 378S12 729A31. They have a ground resolution ranging from 593m to 829m, with a theoretical stereo height accuracy of between 178m to 459m.

A preliminary DEM of the valley is shown in Fig. 1. The valley runs from top left of the figure and the mouth is reached at the centre, where it divides. The total height range of the valley is from -1 to +3km. The height information yielded from the DEM indicates that Ares is approximately 1.5 km deep in these regions; direct measurement shows it to be 25km wide. Thus, if these regions are glacially eroded, as suggested by [1,2], then the glacier causing the erosion may have been approximately 1.5km deep and 25km wide. In further studies, we hope to improve the quality of the DEM to allow us to calculate the gradient of the channel walls and, hopefully, also slopes within the channel. This will be attempted by regenerating the DEM using different starting conditions for each stereo pair, meaning slightly different correlation patch sizes (between 7 and 12 pixels) and different initial seed points will be used. By doing this, errors that arise because of inconsistencies (or stereo match blunders) brought about by poor matcher correlation over low texture areas, will be minimized by an averaging

ARES VALLIS: ROBINSON C.A., A.C. COOK AND W. ZEITLER

process when all the matched points are combined. As a further attempt to improve the results, we shall generate the same DEM using stereo software developed within the DLR for the Mars 1996 mission. Of course, with the new high-resolution stereo images anticipated to be returned by the Mars 96 mission, the height accuracy and spatial resolution of a DEM of this area will be improved by at least an order of magnitude.

References: [1] Robinson, C.A., Neukum, G., Hoffmann, H., Marchenko, A., Basilevsky, A.T., and Ori, G.G (1996) *LPSC XVII*, this issue. [2] Robinson, C.A., Neukum, G., and Ori, G.G. (1996) *EGS*. [3] Day, T., Cook, A.C., and Muller, J-P. (1992) *Vol. XXIX, Part B4, Commission IV*, 801-808. [4] Cook, A.C., Day, T., Illiffe, J.C., Muller, J.P., Rothery, D.A., Thornhill, G.D., and Murray, J.B., (1992) *Vol. XXIX., Part B4, Commission IV*, 788-794. [5] Thornhill, G.D., Rothery, D.A., Murray, J.B., Cook, A.C., Day, T., Muller, J.P., and Illiffe, J.C. (1993) *J. Geophys. Res. (Planets)* 98, No. E12, 23581-23587.



Fig. 1 DEM for Ares Vallis (-2.5°S to 7°N, 17°W to 19°W). The DEM is scaled so black corresponds to a height of -5km and white a height of +5km (areas with no data are also indicated as black). The actual height range of the valley region is between -1 to +3km.