MAPPING OF LUNA-17 LANDING SITE AND RECONSTRUCTION OF LUNOKHOD-1 STEREO PANORAMAS.

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Introduction: Unmanned interplanetary probe Luna 17 was launched from the Earth towards the Moon on 10 November 1970 and entered the lunar orbit on 15 November 1970. The spacecraft successfully landed on the Moon 17 November 1970 and Lunokhod-1 descended to the lunar surface. During the operation Lunokhod-1 sent to the Earth 211 lunar panoramas and 25 thousands images [1, 2].

Sources: Based on results of LRO image data processing we have carried out mapping of the Luna-17 landing site area [3]. We have reconstructed the Lunokhod-1 traverse and identified coordinates of surveying points from which panoramic images were obtained. New DEM, based on LRO NAC images was generated using PHOTOMOD software [4]. Bundle block adjustment was performed using tie-points, determined by automatic correlation of LRO NAC stereo pairs. Afterwards 2-pixels (1.1 meters) step detailed DEM was derived. Ground sample distance (GSD) is 0.55 m. Results of GIS-mapping and new DEM will be used for 3D reconstruction of the Lunokhod-1 stereo panoramas.
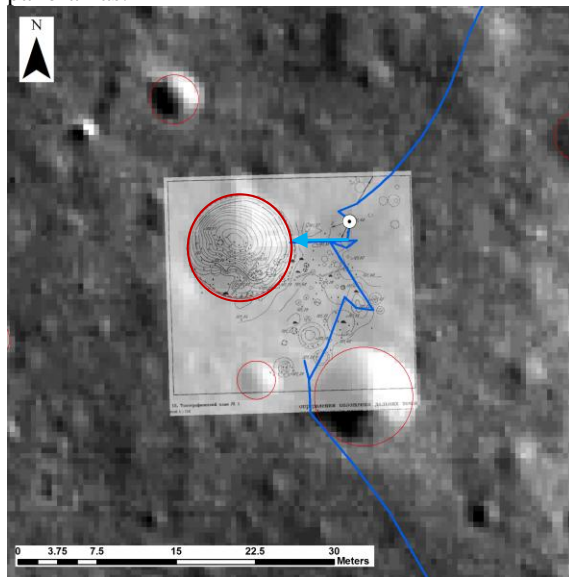

Figure 1. Large-scale map № 5, derived from Lunokhod-1 panoramas stereo-processing [1, 2] and integrated into GIS with traverse and crater data (background – LRO NAC orthomosaic)

Methodology: We have done GIS-analyses of the Lunokhod-1 traverse area using high resolution DEM, LRO NAC orthomosaics and large-scale maps (Fig. 1), derived from Lunokhod-1 panoramas [2]. We identi-fied Lunokhod-1 wheel tracks and coordinates of surveying points from where stereo panoramas (Fig. 2) were acquired by Lunokhod-1 cameras.

Lunokhod-1 panoramic images were obtained from the Moscow State Archive. We have selected some stereo panoramas of Lunokhod-1 from which the previous large-scale maps were derived. While final results of Lunokhod-1 mission mapping were published in the form of 7 individual maps [2], other data and descriptive camera information probably have been lost, unfortunately. So Lunokhod-1 panoramas were reconstructed as 3D free model without referencing (Fig.3). We expected that the model will be reference to new LRO NAC DEM and the high detailed DEM will be derived with panoramas which were obtained by Lunokhod-1 camera from the lunar surface.

Figure 2. Example the original stereo panorama image We presuppose that the crater indicated with red circle and the part of track indicated with blue arrow are the same on the map № 5 (see Fig. 1)
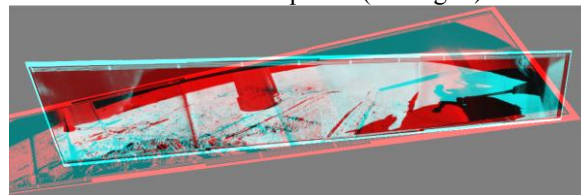

Figure 3. Example of Lunokhod-1 stereo panoramas processed without referencing. 3D reconstruction for map № 5 (anaglyph image)

References: [1] Vinogradov A.P. ed. Mobile laboratory on the Moon Lunokhod-1, Volume 1 (Peredvijnaya laboratoriya na Lune Lunokhod-1, I) – Moscow, Nauka, 1971 (in Russian). [2] Barsukov V.L. et. al. (1978) Peredvijnaya laboratoriya na Lune Lunokhod-1, Vol. 2. Nauka (in Russian). [3] Gusakova E. et al. (2012) Mapping and GIS-Analyses of the Lunokhod-1 Landing. Abstracts of 43 LPSC, # 1750. [4] http://www.racurs.ru/?lng=en&page=634