

## **Cartography of the Apollo 17 landing site: Identification of Apollo panorama stations in high resolution Lunar Reconnaissance Orbiter Camera (LROC) Data**

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Image data obtained by the Narrow Angle Camera (NAC) on board of the Lunar Reconnaissance Orbiter (LRO) (image resolutions of 0.5 m/pix from its nominal 50 km orbit) are combined with ground based images taken by astronauts to provide accurate landing site maps and to precisely reconstruct rover traverses and astronaut tracks.

Using methods described previously [1], stereo DTMs and ortho-images of the landing site were derived. The Lunar landing module for which precise coordinates are known, and which can be identified in the NAC images, was used to provide correct alignment with the Lunar-fixed coordinate system.

Using an adapted Hasselblad camera the Apollo 17 crew took panorama photographs at each station of their Lunar surface activities. Each pan consists of at least 15 overlapping images covering a total of 360°. By using the traditional surveying method of three-point resection the panoramas were used to localize the astronauts' positions from where the images were taken.

In this study, completely assembled, high resolution panoramas [2] were used to measure preferably large numbers of azimuth angles (at least five) to prominent surface features. Cast shadows were used to determine the North direction to warrant correct absolute orientation of the panoramas. Line and sample coordinates of the prominent features are then identified in the rectified NAC images. In a least-squares adjustment, initial values for the locations of image acquisition, which are obtained by resection, are then optimized by using the observations made in the panoramas and NAC ortho-images.

While work is ongoing, the positional accuracies are expected to be within the NAC pixel size of 50 cm. Previously, the panorama stations were pictured in Apollo Traverses Lunar Photomaps, with accuracies lying within 10 m [3].

[1] Scholten et al.: LPI 1533, p.2051, 2010.

[2] Jones, E.: <http://www.hq.nasa.gov/alsj/>.

[3] Batson, R., et al.: Geological Survey Professional Paper 1080, 1981.