SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 1 (2A)

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ANALYSIS OF LANDING SITE ATTRIBUTES FOR FUTURE MISSIONS TARGETING THE RIM OF THE LUNAR SOUTH POLE AITKEN BASIN

Abstract

The lunar South polar region is of high scientific interest and advantageous in many aspects for exploration missions. The polar terrain is located at the rim of the Aitken Basin, being the largest known impact crater in the solar system, where material from the lunar mantle has been ejected to the surface. This basin features a diameter of 2,500 km and variations in altitude as large as 14 km. Since the solar elevation never exceeds 1.5 at the pole, there exist mountain peaks in this area that are characterised by near eternal illumination. These summits provide a benign thermal environment for any long-term robotic or manned lander mission, and ideal conditions for photovoltaic power generation. The smaller impact craters in the polar region, on the other hand, possess depths with constant darkness. These craters are evidently harbouring water resources that remain conserved through the cryogenic temperatures inside them. The ice originates from the bombardment of comets throughout the billions of years after the formation of the lunar crust.

For this terrain updated analyses of the solar illumination and ground station visibility conditions have been performed. These are based on the refined lunar digital elevation model provided by the Japanese Kaguya/Selene mission, originating from its LASER altimeter instrument. The resulting maps for the South polar region will be presented in this paper. Some considerations on the geology of interesting locations within the South Pole Aitken Basin are complemented. With these prerequisites, several possible landing sites for a future lunar mission have been selected. For these sites a detailed analysis of illumination timelines and the associated implications for the power subsystem of any lander spacecraft will be presented. In addition, the terrain topology will be described and analysed for its impact on the landing trajectory.