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LUNAR LANDING SITE ANALYSIS: CRITERIA AND METHODOLOGY FOR TEAMINDUS LUNAR LANDING MISSION

Abstract

This paper explains the criteria used to select candidate landing sites on the Moon for soft-landing the TeamIndus Lunar Lander (HHK-1). The Google Lunar XPRIZE (GLXP) competition has a three-point problem statement- landing on the Moon, traversing 500m and returning images to the Earth. For this, it was necessary to minimize landing risk contribution from the terrain itself. Digital Terrain Models (DTMs) built using stereo-correlated LRO NAC images, lunar altimetry and data collected during the Apollo, Lunokhod and Chang'e-3 surface missions in the Mare areas helped quantify the probability of a successful touchdown given a landing ellipse size and orientation on the surface.

Some of the constraints that drove this analysis include the latitude limits from Thermal and Power system design teams, the size of the landing ellipse from the Descent and Landing team and the ground-trace and orbital inclinations related to a monthly-repeating launch attempt from the Mission Planning team. Magnitude and directionality of terrain slopes, distribution of rocks and craters and keep-out distance from large features were the constraints from the Lander structural design team. The limited availability of NAC DTMs in the lunar mid-latitude regions also reduced the search space.

The team followed a systematic down-selection methodology that quickly eliminated large portions of the Lunar surface through logical filters. The final set of Landing Sites were ranked based on a synthetic metric computed from the engineering parameters that relate to probabilities of success for safe touchdown.

The outline of the paper paper is as follows: introduction followed by brief literature survey of the state-of-the-art. This will be followed by an overview of the mission, derived problem statement of Landing Site selection, methodology and details on the synthetic metric employed, algorithmic details. This will be followed up with a section on analysis performed, results, discussion and conclusion.