CHARACTERIZING POTENTIAL LUNAR LANDING SITES USING SYNTHETHIC DEMs. G. Wesley Patterson[1], N. R. Lopez[1], David T. Blewett[1] , and J. A. M[c]Govern[1], [1]Johns Hopkins University Applied Physics Laboratory, 11100 Johns Hopkins Rd., Laurel, MD 20723 USA (wes.patterson@jhuapl.edu).

Introduction: In support of the Autonomous Landing and Hazard Avoidance Technology (ALHAT) project, the Applied Physics Laboratory (APL) has developed software capable of generating realistic synthetic Digital Elevation Models (DEMs) of the lunar surface at scales pertinent to terrain relative navigation and hazard avoidance. These DEMs currently incorporate established relationships invoving crater morphology [1] and size/frequency distribution [e.g., 2-4], with work to incorporate realistic rock distributions [e.g., 5] ongoing. We are using these synthetic DEMs to develop tools for assessing how hazard detection is affected by illumination geometery [6] and the statistical probability of locating 'safe' landing zones [7].

Synthetically Derived Topography: The software package developed by APL can currently generate synthetic DEMs of cratered surfaces (at any prescribed resolution) that are purely or partially synthetic. Purely synthetic DEMs (Fig. 1) are useful as a first order approach to evaluating potential landing hazards and, given the the current lack of high resolution data, are typically necessary to represent the distribution of craters at diameters < 100s of meters. At lower spatial resolutions we have the capability of incorporating both Goldstone radar data [8] and Unified Lunar Control Network (ULCN) data [9] into otherwise synthetic DEMs to provide a realistic 'basemap' for the distribution of craters in a particular region.

Impact Crater Statistics: A key to producing realistic synthetic DEMs for the Moon is understanding how impact craters affect topography. To accurately represent the topographic expression of individual impact craters in our synthetic DEMs, we use established scaling relationships involving morphology and crater diameter [1]. For representing the population of craters, we use size-frequency distributions based on crater-counting statistics [e.g., 2-4]. Variations in these distributions are dependent on the age of the surface that is being examined.

Shackleton crater, near the lunar South Pole, has been established as the target location for the next manned mission to the Moon. Mapping of Shackleton has been used to suggest that it may be as young as ~1.1 Ga [10]. However, more recent analysis indicates the crater likely formed ~3.6 Ga [11]. Using incremental crater size-frequency distributions described by [2,3], we have generated DEMs with two end-member distributions for the potential crater size-frequency associated with Shackleton crater (Fig. 1). One represents an 'average mare' distribution (~3.2 to 3.5 Ga) and the other represents a 'highlands' distribution (~3.9 Ga). These DEMs illustrate the potential variability in the distribution of craters in and around Shackleton crater and provide data useful in characterizing landing hazards for future manned missions to the lunar South Pole.

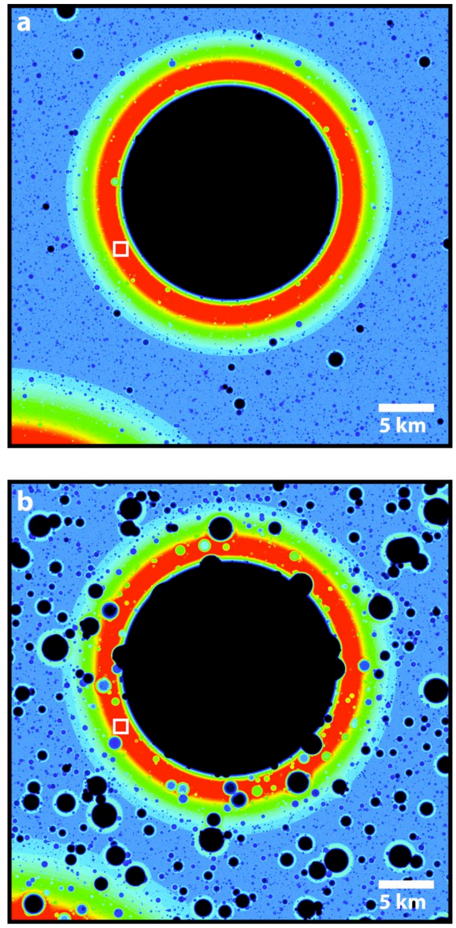

Fig. 1. Sample synthetic DEMs of the lunar South Pole surrounging Shackleton crater (center). (a) Cratered surface simulating an 'average mare' surface. (b) Cratered surface simulating a 'highland' surface. White box represents location where landing site statistics have been calculated [7].

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