IDEAL LANDING SITES NEAR THE LUNAR POLES. K. Fristad[1], D. B. J. Bussey[2], M. S. Robinson[3], and P. D. Spudis[2], [1]Macalester College, 1600 Grand Ave, Saint Paul, MN 55105, [2]The Johns Hopkins University Applied Physics Laboratory, 11100 Johns Hopkins Road, MP3-E180, Laurel MD 20723 (ben.bussey@jhuapl.edu), [3]Northwestern University, Locy Hall 309, Evanston IL 60201.

Introduction: Recent studies have indicated that there are areas of permanent shadow and possibly also permanent illumination in the region surrounding the lunar poles [1,2]. These facts, in addition to the possible presence of volatiles, make the lunar poles the ideal locations for future landing sites.

Rationale for the Poles: Permanently shadowed regions, primarily the floors of impact craters, have been modeled to have a surface temperature of less than 100 K [3]. These areas represent cold traps for any water molecules that enter them. They are the prime locations for water ice deposits, the existence of which has been suggested by both the Clementine and Lunar Prospector missions [4,5].

The temperature at the lunar equator fluctuates from 123 to 373 K [6]. By contrast the temperature of an area close to a pole which is constantly illuminated is likely to be approximately 223 ± 10 K. This represents a much more benign thermal environment for prolonged surface operations. Not only is the temperature fairly mild but also the small range in surface temperature is easier to design equipment for. Additionally constant sunlight equates to constant solar energy and abundant solar energy may mean that a RTG is not required thus simplifying the design for a habitat.

Ideal site: The ideal landing site has several criteria. First it should receive large amounts of sunlight with relative short eclipse durations. Second it should be close to several permanently shadowed regions, permitting the investigation of possible ice deposits. Third the area for landing needs to be as large as possible, flat, and devoid of craters and boulders. Whilst the high resolution data necessary to map out the ideal site does not yet exist, we have used available data to identify several good landing sites.

South Pole. A quantitative analysis of the lighting conditions at the south pole revealed which areas receive the most illumination. One key finding was that nowhere at the scale of the Clementine UVVIS data (500 m/pixel) was constantly illuminated. However several places exist that receive more than 70% illumination during a lunar day in winter. All these areas will receive more sunlight during the summer and may be constantly illuminated for long periods without interruption. A detailed analysis of eclipse durations showed that two areas close to the rim of Shackleton crater, only 10 km apart, are collectively illuminated for more than 98% of the time [1]. We have produced Clementine high resolution mosaics of this area to investigate these potential landing sites. These high resolution images show that the two highly illuminated areas close to Shackleton lie along a ridge (Figure 1). A third illuminated region on the rim of de Gerlache crater is revealed in the high resolution mosaic to be associated with a small hill superposed on the rim of that crater (Figure 2). All three of these regions are close to several areas of probable permanent shadow that may harbour ice deposits.

North Pole. An ongoing analysis of the lighting conditions at the Moon's north pole has identified several areas that may be permanently illuminated [2]. Four regions on the rim of Peary crater were constantly illuminated for an entire lunar day in summer. These lit regions are also close to several permanently shadowed areas and both lie within a zone of enhanced hydrogen measured by the Lunar Prospector spacecraft.

As a result of the field of view of the Clementine UVVIS instrument the quantitative lighting map only covers a region within 1° to 1.5° of the pole. To expand our knowledge of possible regions of interest we have begun a qualitative analysis of the illumination conditions using orbit strips movies. Several of the Clementine orbits contain two separate imaging strips of the polar region. Both a standard nadir strip and a oblique strip of images were acquired. The oblique images have the advantage they look further over the pole into the dark hemisphere of the Moon (Figure 3). This has allowed us to identify mountain peaks, located in the nominal darkside, that are tall enough to be illuminated.

Conclusions: Based on our criteria for an ideal landing site we have begun to identify areas at both lunar poles that represent good places for a mission to explore the permanently shadowed regions that may contain ice deposits.

References: [1] Bussey D. B. J. et al. (1999) *GRL V.26 No. 9* 1187-1190. [2] Bussey D. B. J. et al. (2004) *LPSC XXXV*. [3] Vasavada A. D. et al. (1999) *Icarus 141*, 179-193. [4] Nozette S. et al. (2001) *JGR 106*, 23253-23266 [5] Feldman W. C. et al.

(2001) *JGR 106*, 23232-23252. [6] Heiken G. D. et al. (1991) The Lunar Sourcebook *CUP* 736pp.

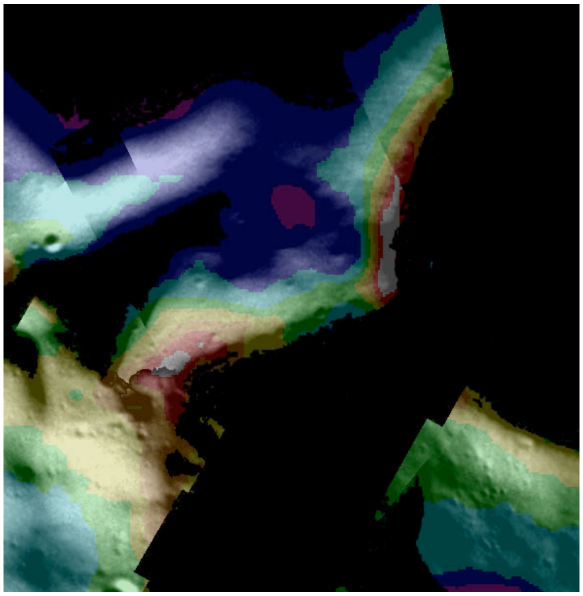

Figure 1. The image shows two sites near the rim of Shackleton, only 10 km apart, which are collectively illuminated for greater than 98% of a lunar day in winter.

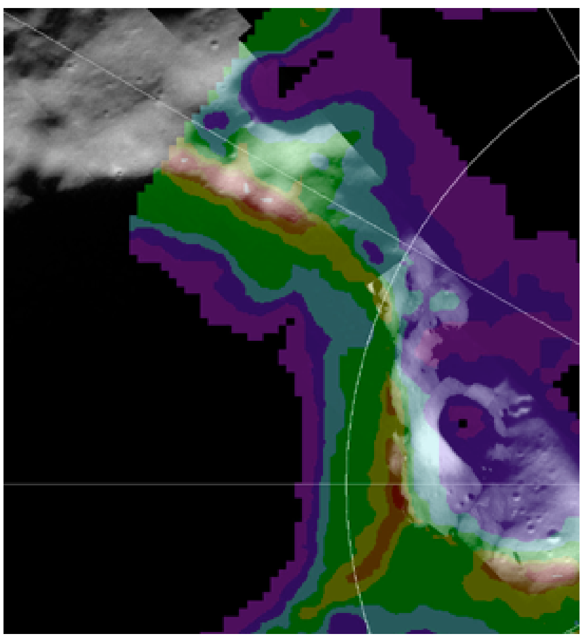

Figure 2. The rim of de Gerlache crater where a small hill contains one of the most illuminated places in the south polar region.

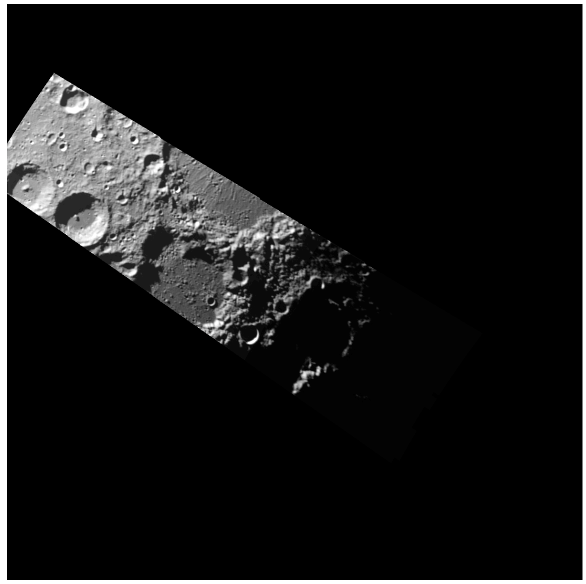

Figure 3. An oblique orbit strip taken during Clementine orbit 081. This strip images almost 4° over the pole and identifies regions on the nominal darkside which are tall enough to be illuminated.