CONSTANT SUNLIGHT AT THE LUNAR NORTH POLE.

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Introduction: The existence of permanent sunlight in the lunar polar regions has important ramifications for long duration operations on the lunar surface. Regions which are permanently sunlit would not only have the availability of constant solar power generation but these areas would permit operations in a reasonably benign thermal environment. It has been modeled that the temperature of a permanently sunlit region close to a lunar pole would be 223 10 K [1].

Clementine Data: The Clementine spacecraft acquired images of each pole once every 10 hours for 71 days in 1994. These show how the lighting varies for a range of different insolation conditions. These data were collected during summer in the northern hemisphere.

Quantitative illumination map. Clementine UVVIS data have been used to produce the first quantitative illumination map of the lunar north pole region. This map shows the percentage of time that a point on the surface is illuminated during an entire day. An analysis of this map has identified four regions on the rim of Peary crater (88.6° N 33.0° E, 73km) that were illuminated for an entire lunar day (708 hours)[2]. As these data were collected just after mid summer it is not possible to claim that they are permanently lit, however they do represent the most likely sites on the Moon that could be constantly sunlit.

Qualitative study of expanded area. Due to the technique used to produce the quantitative map, the spatial coverage of the map is limited to between 1° and 1.5° of the north pole. Examination of obliquely acquired data has expanded our knowledge of the illumination conditions near the pole by providing qualitative information on other regions that appear to receive large amounts of illumination. These data cover a greater distance over the pole, and therefore into the nominal "darkside", thus showing topographically high regions that are tall enough to be in sunlight. We have identified three regions, between 2° and 3° from the pole which were illuminated. These occur on the rims of the impact craters Hermite, Rozhdestvensky, and Peary.

Galileo: Galileo acquired images of the lunar surface during its 2 lunar flybys. Some of these covered the north pole of the Moon. Whilst this only shows a snapshot of the illumination conditions in this area, it is of particular interest because the data were acquired during a different part of the year compared to the Clementine data. Specifically, it was Autumn in the northern hemisphere. A mosaic of Galileo SSI images shows that the northern rim of Peary (that contains the 4 constantly illuminated areas in our quantitative map) is illuminated. Additionally, so is a portion of the rim of Hermite crater, even though this should nominally be in darkness. This is the same area that was identified in the qualitative Clementine study as potentially tall enough to receive large amounts of continuous sunlight.

References: [1] Heiken G. D. et al. (1991) The Lunar Sourcebook *CUP 736pp*. [2] Bussey D. B. J. et al. (2004) LPSC XXXV, #1387.