Analysis of Lunar Locations for Future Missions

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Introduction

Should humanity decide to return to the Moon, we researched the ideal location for accessible lunar exploration and research opportunities. We analyzed craters and mountains in the polar regions for the purpose of finding permanently shadowed areas in craters and potentially frozen water molecules. Additionally, we sought a location that a long term lunar mission could have frequent earth communications, limited radiation exposure, and reasonable temperature variations. Using these guidelines further investigated: Malapert Mountain, M.5., Shackleton Crater, Lcross Crater, Scott Crater, Shoemaker Crater and Amundsen Crater.

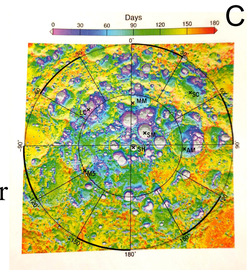
Purpose

The purpose of our research is to ensure that a new lunar mission could take full advantage of the various lunar research possibilities, and possibly act as a standing base for missions or colonization in the future. Our analysis of the data identified a location that suited as many of the scientific needs as possible: likelihood of water, warm temperatures, Earth visibility and Sun visibility.

Methods

Using various maps from the Lunar Reconnaissance Orbiter, we analyzed craters and mountains in the North Pole and South Pole. In our search for permanently shadowed regions that may hold water ice, we referred to Map C. Our intent was to locate an area with the highest number of sunlit days, or Sun Visibility.

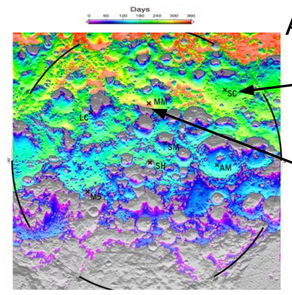
C



Methods contd.

Communication is an important factor for a lunar mission. Map A provided us with the earth visibility from locations on the moon, using this map we looked for locations that had frequent days where the earth was visible, providing reliable communication.

A

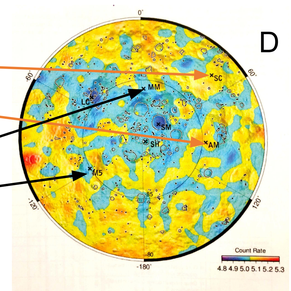


Scott Crater provides a high earth visibility.

Malapert Mountain offers the highest earth visibility.

Map D displayed the count rate for hydrogen volatiles, a desirable feature for research, as this may be the location of frozen water ice. Though many of the regions had about the same count rates, the regions further from the poles had higher count rate areas within a reasonable travel distance.

D

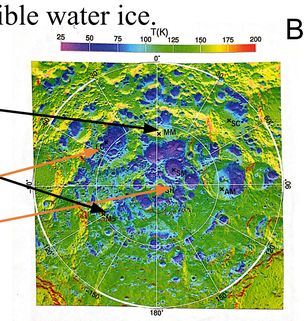


Scott Crater shares the highest hydrogen density with Amundsen Crater.

Malapert Mountain and M5 both neighbor regions with high volatile counts making them viable options for water.

Temperature, as shown in Map B, was a multi-sided issue, as scientists are more likely to find water ice in locations with lower temperature, however lower temperature decreases habitability. We ultimately decided to look for locations where temperature was moderate, but nearby regions with lower temperatures for possible water ice.

B



Malapert Mountain and M.5. provide the highest temperature.

Shackleton and Lcross provide the lowest temperatures.

Results

X

Initial Subjective Data of Lunar Locations

Locations	Water	Sun visibility	Commun-ication	Hydrogen
M.M.	6	8	9	9
Lcross	9	7	7	7
A.N.	8	8	3	3
M5	5	8	1	6
S.C.	7	7	8	4
S.H.	10	6	1	9
S.M.	9	2	3	7

Initially we created a chart using subjective values based off of the maps. This allowed us to easily compare every aspect of the craters and mountains, and get a baseline for how we would prioritize certain features over others. On our initial chart communication refers to earth visibility, while water refers to temperature, based off of the likelihood of of water ice being present at, or nearby the regions. We used this chart to begin planning how we would compare the craters, before moving into actual values for the features we decided to look at.

Y

Final Objective Data for Lunar Locations

Locations	Tempe-rature (K)	Sun visibility	Earth Comm-nication	Hydrogen Volatiles	Total Value
M.M.	180	170	350	5	68.04
Lcross	30	0	50	4.9	20.661
A.N.	100	100	120	5.1	44.002
M5	180	175	0	5	9.654
S.C	130	120	200	5.1	50.993
S.H.	30	0	0	5.0	5.313
S.M.	50	0	65	4.9	25.158

Our final data chart used objective values from the scales of each provided maps. We assigned a quantitative value to each color of the map. By finding the geometric mean of each region, we determined the location with the highest total value is the best site for a future lunar mission.

Conclusion

Following the use of the geometric mean equation to determine a total value of each location based off of all the observed features in chart Y, and comparison of the regions to each other in various fields and purposes, we decided that the optimal location for a return visit to the moon would be malapert mountain due to good earth communications, varying local temperatures for possibility of water ice, and good concentration of hydrogen molecules at, and around the location.

Acknowledgements

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Annotations

M.5. M.5. Mountain
S.H. Shackleton Crater
S.M. Shoemaker Crater
Lcross Lcross Mountain
S.C. Scott Crater
A.N. Amundsen Crater
M.M. Malapert Mountain

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