EPSC Abstracts
Vol. 12, EPSC2018-1015-1, 2018
European Planetary Science Congress 2018

Surface characterization of potential lunar polar landing sites with accuracy up to 7 meters

Maya Djachkova, Igor Mitrofanov, Anton Sanin, Maxim Litvak and Vladislav Tretiyakov
Space Research Institute of the Russian Academy of Sciences, Moscow, Russia (djachkova@np.cosmos.ru)

Abstract

The landing site selection method primarily developed by our team for Luna-25 mission allowed us to identify several scientifically interesting and safe for landing locations in the Polar Regions of the Moon. These locations can be considered as possible landing sites for future lunar missions.

1. Introduction

Russian space agency is planning to launch two lunar landers in the upcoming years – Luna-25 and Luna-27. Instruments installed on board the landers are designed to study volatiles and water ice, lunar exosphere, dust particles and regolith composition. As primary scientific interest is concentrated in the polar region, the landing sites for both landers are selected there.

2. Data and Methods

The landing site selection method primarily developed by our team for Luna-25 mission allowed us to select the main and reserved landing sites in the South Polar Region of the Moon [2]. Furthermore the method provided us with several scientifically interesting and safe for landing locations in the Polar Regions of the Moon. These locations can be considered as possible landing sites for future lunar lander missions.

The method of map overlaying developed for landing sites selection [2] combines the input maps and estimates the optimal locations for landing based on the spacecraft characteristics. Input maps depict the scientific criteria for the mission success and engineering constraints of the spacecraft. In this study we used data from LEND [4], LROC [6], Diviner [5] instruments as well as LOLA data [7] to create the input maps of surface slopes, roughness, temperatures, water content, etc. and the analysis area extended from the latitudes of 85° up to the Poles on the near side of the Moon. The spatial resolution of the data varied from about 10 km for LEND data [4] up to 7 m for the LOLA SLDEM2013 dataset [1]. The minimum size of the resulting area was set up to 1 km corresponding to the possible high-precision landing technique. The method with the parameters set as described above provided us with about 15 areas suitable for landing and surface operations in both Polar Regions of the Moon.

Further detailed analysis of the areas included estimation of such parameters as mean surface slope, mean sun illumination, mean earth visibility and mean water equivalent hydrogen content of the regolith for each area as well as understanding its geologic context [3]. Then multi-parameter prioritization based on the estimated parameters was performed and the top three areas in each Polar Region were determined. Their main features will be discussed.

3. Conclusions

The performed analysis of the Moon polar surface indicated an extensive area suitable for landing (with the 1 km precision) and surface operations in both North and South Polar Regions of the Moon.

References

[1] Barker, M. K., Mazarico, E., Neumann, G. A., Zuber, M. T., Haruyama, J., Smith, D. E.: A new lunar digital elevation model from the Lunar Orbiter Laser Altimeter and SELENE Terrain Camera, Icarus, Volume 273, p. 346-355, 2016.

[2] Djachkova M. V., Litvak M. L., Mitrofanov I. G., Sanin A. B. Selection of Luna-25 landing sites in the South Polar Region of the Moon, Solar System Research, Volume 51, Issue 3, pp. 185-195, 2017.

[3] Fortezzo C. M. and Hare T. M.: Digital renovation of the 1:5,000,000 lunar geologic map series, 43rd Lunar and Planetary Science Conference, 2012.

[4] Mitrofanov, I. G. et al.: Lunar Exploration Neutron Detector for the NASA Lunar Reconnaissance Orbiter, Space Science Reviews, Volume 150, Issue 1-4, pp. 183-207, 2010.

[5] Paige, D.A. et al.: The Lunar Reconnaissance Orbiter Diviner Lunar Radiometer Experiment, Space Science Reviews, Volume 150, Issue 1-4, pp. 125-160, 2010.

[6] Robinson, M.S. et al.: Lunar Reconnaissance Orbiter Camera (LROC) Instrument Overview, Space Science Reviews, Volume 150, Issue 1-4, pp. 81-124, 2010.

[7] Zuber, M.T. et al.: The Lunar Reconnaissance Orbiter Laser Ranging Investigation, Space Science Reviews, Volume 150, Issue 1-4, pp. 63-80, 2010.