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DEVELOPMENT OF A LUNAR CUBESAT FOR THE IN-SITU GEOLOGICAL SPECTRAL DETERMINATION AT SHACKLETON CRATER

Abstract

"Expédition lunaire" has always attracted mankind from Apollo missions to the Artemis program. For a versatile spacecraft that gives positive results from the Moon without requiring an immense amount of fuel by the launch vehicle, CubeSats serve to be the best candidate. Development of a CubeSat for Lunar research will leverage the abode of materials for the power generation and cost reduction for future space missions to establish a sustained presence. The primary scientific goals in the presented paper are to investigate the spatial distribution of forms of water and other volatile compounds as a function of time of day, latitude, and the topographic composition of lunar regolith. In addition to the geological spectral determination of minerals, the CubeSat will provide the real-time swaths of the surface to the ground station with the High-Resolution Infrared Spectrometer. The in-situ investigation and research will be at the Shackleton crater where the Moon Mineralogy Mapper of Chandrayan-1 found the evidence of water. Despite the mass constraint of having a payload and thrust imparting system onboard, the CubeSat will be powered by Electric Propulsion to verify the efficiency of its operation. Additionally, the paper encompasses the trade-off study of the various electric propulsion systems that can be utilised in 1U, 2U and 3U CubeSats for the scientific goals to achieve. Thus, the cynosure of the presented paper lies in the complete development of the CubeSat for the moon with the purpose of low cost CubeSat communication capabilities. Some of its characteristic subsystems are the on-board computer, payload, attitude determination and control system.

Keywords: Lunar CubSat, Lunar regolith, Moon Mineralogy Mapper, Spectrometer, Electric Propulsion