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PRELIMINARY DESIGN REVIEW FOR EXPLORATION OF DWARF PLANET CERES

Abstract

This paper investigates the habitability of dwarf planet Ceres via scientific analysis of the Occator Crater. The analysis will be performed by collecting mineral samples indicative of water, organic compounds, and minerals necessary for the cultivation of life. These samples will be gathered by a rover designed to collect the aforementioned samples and traverse the surface of Ceres. The analysis of the samples will utilize UV(Ultraviolet) spectrometry with aims to determine if vital life-forming components such as carbon or silicates are present on Ceres. Additionally, the mission shall use VIR (Visual and Infrared Imaging Spectrometer) to determine the abundance of agricultural fertilization minerals by identifying Magnesium Sulfate and Ammonium Chloride concentrations within or near Vinalia Facuale which is present within Occator Crater. The collected data will contribute to our understanding of the potential habitability of Ceres as well as the extent of its potentially habitable zones. It may also increase our understanding of the evolution pertaining to the habitability of Ceres, as well as if the ingredients of life found on Ceres are indicative of said ingredients existing elsewhere in the solar system. The paper discusses on the mission statement and it's requirements along with it's criteria, design of rover, overall vehicle and system design which includes mechanical system, power system, communication and data handling system and thermal management system respectively. The paper also discusses the payload's objectives, success criteria, science instrumentation system and it's data analysis. Science Traceability Matrix (STM), experimental logic, approach and it's method of investigation, risk assessment and mitigation, project management and budget approach are discussed as well.