IAF SPACE EXPLORATION SYMPOSIUM (A3)
Interactive Presentations - IAF SPACE EXPLORATION SYMPOSIUM (IP)

Author: Mr. Prathmesh Barapatre
National Space Society (USA) -Mumbai chapter, India

LUNAR MINING AND MAPPING USING MULTIPURPOSE AUTONOMOUS ROVER

Abstract

From the beginning of the space race, man's curiosity to explore space and other planets and eventually make it sustainable for humans to survive has brought a drastic change in technology that has reduced the cost of space exploration and risk of losing a life. To date, only 5% of the lunar surface has been explored, from the sample rocks brought from the Apollo mission we have known that lunar soil has potential elements to build and develop sustainable technology for further robotic space exploration missions and maybe human space exploration. Lunar Surface being dynamic in nature due to continuous asteroids striking the original lunar surface has wrapped up, to explore the inner layer we have to mine the external surface. Due to the absence of a lunar human outpost; a rover for digging the lunar surface is a potential option. The paper focuses on rover based lunar mining and mapping for exploration; rover consisting of a robotic arm with 6 Degree of Freedom (DOF) with a cutter and a foldable arm with a shovel and a drill integrated inside the rover to drill in the surface. The cutter tool will be made of titanium alloy for better heat dissipation while cutting; a lightweight material such as stainless steel is used for the cutter arm to reduce the overall weight providing better strength, balance and durability. It consists of a thermal camera, navigation camera and integrated 2D LIDAR for mapping the surface, and a particle spectrometer is present onboard to study collected samples from the mining process. The rover has a rocker-bogie mechanism for navigation and overcoming obstacles. The internal system will be easily portable with less wire harness, allowing for easy replacement of essential components for overall operation. Artificial Intelligence will be used for navigation, overcoming obstacles and optimize paths for saving time and energy, it also has solar panels to generate power and uses heat from the spectroscopic instrument to keep internal circuits warm. Application of Rover in Space Exploration is vast and with improvement in material science and Artificial Intelligence the weight and cost of rover decreases which provides an opportunity for exploration on another world including water planets.