IAF SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 1 (2A)

Author: Ms. Nafisa Zian Imam Shafi
Sharjah Academy for Astronomy, Space Sciences and Technology (SAASST), United Arab Emirates

Ms. Tarifa AlKaabi
Sharjah Academy for Astronomy, Space Sciences and Technology (SAASST), United Arab Emirates
Ms. Amel Alhammadi
Sharjah Academy for Astronomy, Space Sciences and Technology (SAASST), United Arab Emirates
Mr. Ahmed Altunaiji
Sharjah Academy for Astronomy, Space Sciences and Technology (SAASST), United Arab Emirates
Mr. Ali Almajedi
Sharjah Academy for Astronomy, Space Sciences and Technology (SAASST), United Arab Emirates
Dr. Antonios Manousakis
Sharjah Academy for Astronomy, Space Sciences and Technology (SAASST), United Arab Emirates

DESIGNING A ROBOTIC DELIVERY SYSTEM FOR LUNAR SURFACE EXPLORATION

Abstract

Humanity's pursuit of space exploration has emphasised the necessity of studying and analyzing space and extraterrestrial environmental conditions to broaden our presence beyond Earth. The moon, our nearest celestial neighbor, has been the focus of numerous studies as it provides an ideal testing ground for experimentally developing and enhancing our technological capabilities for space travel, as well as a valuable target for scientific research aimed at understanding planetary interactions, its astronomical history, and the evolution of its geophysical environment.

This paper examines the mission design concept of a lunar mission involving the deployment of a network of stationary payloads at various locations across the moon. This network is intended to collect data over an extended period to study the lunar surface and environmental properties, aiding in various analyses crucial for the potential establishment of a lunar outpost. These payloads will be housed in a central mission rover, which may also serve other objectives. Through this decentralized setup, the rover will not need to remain in one location for extended periods, thus optimizing the efficiency of data collection without compromising the number of observations needed to accomplish additional tasks.

The targeted payloads will be delivered to predetermined locations in a safe and controlled manner by a robotic delivery system to ensure the integrity of its systems. This paper examines various mechanisms to accomplish this task, including design comparisons and analyses of robotic subsystems that can be mounted on the rover for payload delivery. The robotic apparatus designed for this purpose will be responsible for the safe storage, transportation, delivery, and subsequent retrieval of payloads at the mission's conclusion. In summary, this paper discusses an in-space robotic delivery system suitable for handling small, sensitive payloads, with potential scalability for delivering various types of payloads for a comprehensive planetary outpost in the future.