Paper ID: 75744
student

34th IAA SYMPOSIUM ON SPACE AND SOCIETY (E5)
Space Architecture: Habitats, Habitability, and Bases (1)

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X-PLOR: LUNAR EXPLORATION ROVER

Abstract

Human space exploration helps to address fundamental questions about our place in the Universe and the history of our solar system. For as long as humans have gazed skyward, the Moon has been a focus of fascination. NASA's Artemis program is the first step in the next era of human exploration and has sparked excitement around the world and catalysed new interest in exploring the Moon since the agency declared landing of the astronauts on the lunar South Pole in 2024. To provide a place to live and work on the Moon, NASA's Artemis Base Camp concept aims to develop a modern lunar habitat, a rover and even a mobile home that is referred to as a habitable mobility platform.

X-plor is a self-deployable exploration and habitation vehicle designed as an integrated part for the Artemis Base Camp. It supports astronaut safety and performance during lunar exploration and crew operations of 2+2 members for multiple short term missions on extreme and complex surfaces. It achieves a high level of mobility, flexibility, and habitability on the Moon, while the dynamic design allows astronauts to extend exploration, discovery and observation of the lunar South Pole safely and comfortably. This combination of features aims to increase the productivity of suited crew time and eliminate the overhead of returning to the outpost or lander at the end of each day, since the rover is capable of supporting multi-day or weeks-long missions.

X-plor addresses the challenges imposed by the extreme lunar environment alongside structural, technical and habitability requirements by using autonomy and modularity to improve performance and flexibility in lunar transportation and habitation. It's self-deployment architecture is capable of adjusting the appearance and size to the mission requirements and mission duration and represents a significant advance in the way in which human planetary surface exploration can be conducted. The self-deployable transit and habitation system that allows the rover to be optimized for four different configurations; the transport configuration, mobile, habitation and separated configuration will be explained in detail in this paper.