

35th IAA SYMPOSIUM ON SPACE AND SOCIETY (E5)  
Interactive Presentations - 35th IAA SYMPOSIUM ON SPACE AND SOCIETY (IP)

Author: Ms. Ilaria Pia Fiore  
Space Exploration Project group, Space Generation Advisory Council (SGAC), Italy

Mr. MohammadMahdi Karbalaee  
Tarbiat Modares University, Iran

Mr. Charles Henrique M. F. Fernandes  
Instituto Tecnológico de Aeronáutica (ITA), Brazil

Mr. Miguel Correa  
Comision Colombiana del Espacio, Colombia

Mr. Jay Kamdar  
Missouri University of Science and Technology (Missouri S&T), United States

Ms. Gagandeep Kaur  
Space Generation Advisory Council (SGAC), India

Mr. Duke Larbie  
Kwame Nkrumah University of Science and Technology, Ghana

LUNEX SPACEHOMES PROJECT

INNOVATIONS AND CHALLENGES IN LUNAR HABITAT DEVELOPMENT. A SUSTAINABLE  
FUTURE ON THE MOON THROUGH THE USE OF ARTIFICIAL INTELLIGENCE (AI)

**Abstract**

Space colonization has always been a topic of human interest, and now, about half a century after man's first journey into space, we are contemplating the possibility of short-term and long-term stays beyond Earth. With the prospect of establishing a presence on the Moon and Mars, the realization dawns that the journey on celestial bodies demands innovative solutions to multiple challenges. The Lunex SpaceHomes Project serves as a framework to delve into the intricacies of lunar habitat development.

The first phase of the project is to identify the main critical features. It's know that traditional construction paradigms are not suitable for extraterrestrial environments. With the prohibitive costs and challenges of transporting construction materials from Earth, the concept of in situ resource utilization (ISRU) emerges as a linchpin for sustainable lunar habitation. The Moon presents tantalizing opportunities in habitat construction. Lunar soil, rich in silicon and magnesium, coupled with basalt aggregates, promises to form the cornerstone of habitat composition. Moreover, the potential presence of frozen water in the lunar subsoil offers a pristine source of liquid, essential for sustaining life and facilitating construction processes. The high solar radiation on the Moon presents both a boon and a challenge, serving as an abundant energy source while necessitating robust protection measures for inhabitants. Radioisotope Power, Nuclear Fission, and Vertical PV Arrays emerge as viable options, ensuring a reliable energy supply even during prolonged shadow periods.

Artificial Intelligence (AI) with Machine Learning (ML) integration can make a difference in resource management, they can be used to analyze and predict resource availability, optimize resource usage, and develop automated systems for extraction and processing. They can also play a crucial role in environmental monitoring and hazard prediction on the moon. These technologies can analyze data from sensors and

satellites to detect potential hazards such as meteorite impacts or solar radiation spikes, allowing for early warning systems and proactive measures to protect lunar colonies. AI and ML can be used to develop autonomous systems for various tasks, such as maintenance, construction, and transportation, reducing the need for human intervention and increasing efficiency in lunar operations. Overall, the contribution of AI with ML to overcoming lunar colonization challenges is significant.

In conclusion, the Lunex SpaceHomes Project studies and analyzes what are the challenges we will face and how through the development of artificial intelligence-based technologies we approach lunar exploration and colonization, making it more sustainable, efficient, and safe.