

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

Author: Mr. Keshava Raaju Perumal  
Technische Universität Berlin, Germany

Mr. Chirag Singh Mukherjee  
TU Berlin, Germany  
Mr. Ashish Gahlot  
TU Berlin, Germany

THERMAL ANALYSIS OF AN MOON VILLAGE CONCEPT

**Abstract**

The Artemis program by NASA, plans to have a sustainable lunar base on the moon by 2028. The Moon Village concept has led to several ideologies and model-based technologies that shall aid in the survival of humans and to establish a settlement on the lunar surface. One of the main obstacles while living on the moon is the protection from radiation and extreme temperatures ranges during day and night. Based upon the extensive research, Shackleton crater near the south pole of the moon has been identified as an ideal location to set up the Moon Village. The Regolith soil on the moon has been found to have ideal characteristics to provide protection in the extreme climate of the moon. We use the ESA Lunar module for the lunar habitat and simulate the model with regolith coated habitat and compare the results with non-regolith coated habitat for the thermal control. Our findings indicate that the regolith coated walls maintain a stable temperature inside the habitat, which is well suited for human survival, while the latter doesn't thermally insulate the internal environment of the habitat from the extremes of lunar temperatures. This report is to summarise an attempt to study the thermal characteristics of a Human Habitat on the Shackleton crater on the south pole on the Moon. The present study is based on the conjugate heat transfer multiphysics module that couples the heat transfer in solids and liquids physics module and laminar flow physics module analysed computationally through COMSOL 5.6. The dependence on solar irradiance, ambient temperature, air flow, day and night conditions is studied. A comparison between having regolith as a thermal control device is also studied. COMSOL is the simulation engine to study the heat transfer and airflow pattern within the Lunar habitat and its evaluation of the interface of different thermal domains. The current focus is to optimise the different parameters regarding thermal comfort for humans in a habitat on the Moon.