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PEACE - PLANETARY EXPLORATION IN ASTRONAUTICAL CAVE ENVIRONMENTS: A FIRST  
HOME FOR ASTRONAUTS IN LUNAR LAVA TUBES**Abstract**

For decades, the International Space Station (ISS) has been serving as a beacon of international collaboration. However, it is facing its retirement at a time after 2024 not yet specified. In this paper, the concept and design of using lava tubes as initial settlement facilities on the Moon called Planetary Exploration in Astronautical Cave Environments (PEACE) is presented as a form of peaceful international collaboration aligned with current plans for lunar and martian exploration in the 2030s as outlined in the Global Exploration Roadmap of the International Space Exploration Coordination Group space agencies. The idea proposed in this abstract is issued from the work of an international team of young professionals who participated in the 2nd International Space Exploration Forum 2018 (ISEF2) held in Tokyo, Japan. This has been demonstrated by the two prizes we were awarded, the special Mitsubishi Electric prize and the second place for Y-ISEF. Building human settlements on the Moon is difficult to achieve due to numerous environmental threats such as radiation, meteoroids or differences in surface temperature. We propose to overcome these problems by making use of the existing caves on the Moon which could serve as a possible shelter for humans in absence of hazardous space radiation. The Moon has surface temperatures ranging from about -160 C to 130 C. Especially the high temperatures on the lunar day could be used to heat the habitat inside the cave. A heat storage could provide the thermal energy for the lunar night. Offering sufficient solar radiation protection and having near constant temperature of -20 C, these caves could be made a good candidate for a place to expand human settlement beyond Earth. In this paper, a human settlement shelter or facility in lunar caves was designed using sunlight for a thermal management system. In order to make feasible the implementation of such an ambitious project, numerous resources ranging from research and engineering work to material supplies and funding supports are required. The key solution in achieving our goal is represented by the creation of an international collaboration project that will fully support the implementation of the idea proposed in this work. Furthermore, the following steps of the PEACE project would be the expansion of the base up to a village or moon city since the dimensions of the lava caves are large enough to achieve it.