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HUMAN EXPLORATION OF THE SOLAR SYSTEM SYMPOSIUM (A5)
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LUNAR REGOLITH SHIELDING FOR MANNED MISSIONS

Abstract

As more specific long term lunar missions are proposed, environmental parameters such as high-energy, charged-particle radiation from solar flares and Galactic Cosmic Rays (GCR) become very important. Unlike on Earth, lunar inhabitants will not have the protective cover of an atmosphere or magnetic-field regions as a shield against these radiations. As a result, manned missions to the moon will be exposed to a continuous flux of galactic cosmic rays and intense fluxes of Solar Energetic Particles (SEP).These radiations from the space environment can cause damage to DNA and thereby increase cancer morbidity or mortality risk in astronauts and the reliability of crucial on-board electronic equipment. This risk may be influenced by other space flight factors including micro-gravity and environmental contaminants. In addition to this, the moon surface is frequently exposed to impacts by micrometeorites which could have a serious impact on the shielding material used. As a result, a Lunar or Mars mission will not be feasible unless improved shielding is developed or transit time is decreased. This paper provides a lunar environmental human life threat assessment and an evaluation about the effectiveness of the in-situ resource, lunar regolith, to mitigate the effects of the radiations on lunar station and its inhabitants, when used as a shield. A detailed assessment of Aluminium, the conventional spacecraft material, Lithium Hydride, a common shielding material used in nuclear reactors, and Lunar Regolith shielding have been carried out based on various factors such as radiation shielding capability, impact resistance, technological feasibility and weight of the material. In addition to its shielding properties, other potential applications of lunar regolith, such as a viable and effective in-situ life support system resource for the future missions due to its high mineral content and oxygen generating properties, will also be discussed in the paper. Based on the assessment carried out, lunar regolith is recommended as an effective shielding material for future space missions.