

Technology Roadmaps for Space Exploration (09)
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DEVELOPMENT OF AN EVA ROADMAP ENCOMPASSING SUIT DESIGN AND OPERATIONAL
PROCEDURES FOR LUNAR EXPLORATION

Abstract

Extravehicular Activity (EVA) is an essential component to allow for future human lunar exploration to succeed. An EVA roadmap is developed to identify and describe a technical development strategy, and encompass recommendations for a range of solutions for the architectures, technologies and operational concepts of advanced EVA systems for future lunar surface applications. Key design considerations for future lunar EVA needs will be investigated. Extravehicular mobility units (EMUs), spacesuits, with increased capabilities and flexibilities in their use will be required, containing the ability to withstand the lunar environment. Issues investigated in relation to EVA suit design include lunar dust. This in particular would pose a hazard to a human rated mission to the Moon and will be examined. A solution must be found for the abrasion of Apollo astronauts' spacesuits whilst taking part in lunar EVA. This abrasion affected both pressure retention and impaired visibility. Additional exposure to fine-grained particles of lunar dust has been indicated to be the cause of numerous health problems for the astronauts. These factors must be taken into account during the design process of an EVA suit for use on the lunar surface along with dust mitigation technologies. A robust training scheme forms the basis for a successful mission. The first step towards developing the needed infrastructure for exploration extravehicular activity (EVA) training is to define and understand the EVA operations that will be required to achieve lunar exploration. A review of Apollo and International Space Station (ISS) lessons learned, concerning EVA operations and training is conducted. Analyses from this review are modified in the context of future exploration missions, including the International Space Exploration Coordination Group (ISECG) reference architectures. The Global Exploration Roadmap (GER) will be used in particular to build upon previous work carried out utilizing the Global Exploration Strategy (GES). Recommendations for EVA suit design and training operational procedures are suggested, based on the aforementioned review and tailored modifications towards human exploration. Initial theories to develop these designs and recommendations will be presented based on my conclusions and successive independent analysis.