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Systems and Infrastructures to Implement Sustainable Space Development and Settlement - Systems (2A)

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ISRU IN SUPPORT OF AN ARCHITECTURE FOR A SELF-SUSTAINED LUNAR BASE

Abstract

The current direction for a return of humans to the moon is that this time we will return to stay. This being the case, future endeavors toward a long term or permanent presence will increasingly need to rely on exploitation of in-situ resources to establish and maintain productive operations. The evidence of substantial quantities of water ice, predominantly in the lunar polar regions, leads to the conclusion that these areas may provide accessible resources to enable an essentially self-sustaining presence, both for support of surface operations, as well as providing for the significant amount of propellants necessary for travel to and from the lunar surface.

A study is currently underway by the authors, investigating the implementation of a robotically-assembled, human-tended base architecture which will be capable of exploiting lunar ice resources to achieve operations and transportation self-sustainability. This paper focuses on the implementation of the lunar ISRU processes included in the base architecture. First the requirements are developed, including sizing of a reusable lander vehicle and surface transportation systems, as well as estimation of quantities of reactants needed for facility power and crew life support. A number of trades are presented, varying

concepts for base and resource location and resulting optimal methods for resource acquisition, processing and storage. The assumptions used in these trades have been incorporated into a larger operations model that is being developed for the study. This model integrates the performance of all base elements to assess the architecture with flexibility to alter assumptions as to resource quantities and accessibility, allowing evaluation of the impact of different ISRU scenarios on the overall architecture of the base.