

Results of the Lunar Exploration Analysis Group GAP-SAT (Specific Action Team) I and II examination of Strategic Knowledge Gaps for the Moon First Scenario for Human Exploration of the Solar System. Members of the GAP-SAT Teams I and II. Reported by C.K. Shearer, Institute of Meteoritics, Department of Earth and Planetary Science, University of New Mexico, Albuquerque, NM 98122. (cshearer@unm.edu)

The Lunar Exploration Analysis Group (LEAG) was tasked by the Human Exploration Operations Mission Directorate (HEOMD) to establish a Specific Action Team (SAT) to evaluate and provide findings that define existing Strategic Knowledge Gaps (SKGs) in the context of implementing the “Moon first” option, which is one of the destinations being considered by NASA’s Human Space Flight Architecture Team and the International Space Exploration Coordination Group’s Global Exploration Roadmap (GER). The “GAP-SAT” analysis consisted of two teams (GAP-SAT I and II).

The LEAG “GAP-SAT” team I identified important SKG and placed them within the context of (1) enabling or enhancing components in the “Moon First” scenario, (2) the Planetary Science Decadal Survey, (3) the LEAG Lunar Exploration Roadmap, and (4) NASA’s Human Space Flight Architecture Team’s (HAT) mission scenario development. The SAT concluded that following the completion of Lunar Reconnaissance Orbiter mission (LRO) there are no SKGs that would inhibit the flight of an early Apollo-style mission (Apollo 11, 12, 14). However, in the context of a “Moon First Scenario” which develops assets and capabilities for human activity within the Earth-Moon system (EMS) and beyond EMS to Near Earth Asteroids and Mars, there are numerous SKGs that enable and enhance a more mature human exploration of the Moon. Specific SKGs are dependent upon the architecture of the “Moon First Scenario”. We concluded that resource exploration and utilization (ISRU) is a “game changer” in how humans explore the Solar System by creating an infrastructure that enables a sustainable human presence. Prior to robotic missions, SKGs can be filled with on-going missions, ISS, Earth-based technology development, and lunar samples studies. SKGs that can be partially or totally retired in this manner include: solar resources, regolith resources, lunar ISRU production efficiency, predicting solar activity, geodetic grid & navigation, maintaining peak human health, effect of dust on human and instrument performance, modeling blast ejecta, and lunar mass concentrations and distribution that influence the accuracy of navigation predictions, the ability to do precision landing and the stability of spacecraft left in orbit for long periods. A systematic robotic precursor campaign can be used to fill additional SKGs to enable and enhance a “Moon First Scenario”. Although these ro-

botic missions emphasize SKGs tied to investigating unexplored lunar terrains, prospecting for potential resources, and resource utilization, they are apt for filling SKGs relevant to plasma environment and electrical charging, radiation on the lunar surface, effect of dust on technology and biology, surface trafficability, and propulsion-induced ejecta. In addition to filling SKGs, robotic and early human missions both enable and enhance important lunar and solar system science that has been identified in the NRC Planetary Science Decadal Survey, other NRC studies, and the LEAG Exploration Roadmap. There are numerous SKG tied to the “Moon First” Scenario that cross-cut other destinations.

The LEAG GAP-SAT I analysis was the first step in exploring SKG for lunar exploration. A second LEAG SAT (GAP-SAT II) is currently involved in providing a quantitative description of measurements that are required to fill knowledge gaps, identifying the fidelity of the measurements needed, and if relevant, providing examples of existing instruments capable of making the measurements. The results of this analysis will be completed prior to the LEAG annual meeting taking place at the Goddard Space Flight Center on October 22-24, 2012. We will report the conclusions of the analysis conducted by both LEAG GAP-SAT Teams I and II.