

LUNAR EXPLORATION SURFACE SCENARIOS MEASURED BY SCIENTIFIC GOALS AND OBJECTIVES J.E. Gruener, NASA-Constellation Lunar Surface Systems Project Office, Mail Code ZS, NASA-Johnson Space Center, 2101 NASA Parkway, Houston, TX 77058, john.e.gruener@nasa.gov.

Introduction: The current United States Space Exploration Policy emphasizes a human return to the Moon as a location near the Earth where the nation can learn how to work and live on a planetary body. Major goals for this program are to: extend human presence to the Moon to enable eventual settlement; pursue scientific activities that address fundamental questions about the history of Earth, the solar system and the universe - and about our place in them; test technologies, systems, flight operations and exploration techniques to reduce the risks and increase the productivity of future missions to Mars and beyond; provide a challenging, shared and peaceful activity that unites nations in pursuit of common objectives; expand Earth's economic sphere, and conduct lunar activities with benefits to life on the home planet; and use a vibrant space exploration program to engage the public, encourage students and help develop the high-tech workforce that will be required to address the challenges of tomorrow. The National Aeronautics and Space Administration (NASA) is conducting engineering trade studies to develop lunar transportation architectures, lunar surface system concepts, and lunar surface scenarios. This presentation discusses the current lunar exploration surface scenarios and their ability to address the goals and objectives of the scientific community.

Science Objectives: In 2007, several reports were published discussing the goals and objectives of the scientific community for lunar exploration activities. The National Research Council's (NRC) "The Scientific Context for Exploration of the Moon" primarily focused on the science concepts and goals of the planetary science community. More recently, the NRC report "Earth Science and Applications from Space: National Imperatives for the Next Decade and Beyond" focused on earth science. The NASA Advisory Council's (NAC) "Workshop on Science Associated with the Lunar Exploration Architecture" listed recommendations based on the NAC's Planetary Science, Astrophysics, Heliophysics, Earth Science, and Planetary Protection subcommittees, while the NAC "Lunar Biomedical Workshop" focused on life science. NASA's recent report "Heliophysics Science and the Moon" lists the goals and objectives of the heliophysics community.

Reference Scenarios: During the past several years, NASA has developed a number of lunar surface scenarios describing the types of systems needed on the Moon to allow humans to work and live in that hostile environment. Through the work of the Lunar Architecture Team (LAT) and the Constellation Architecture Team-Lunar (CxAT-lunar), conceptual designs for habitats, power systems, surface mobility, and other surface systems have been developed. The accumulation of these systems on the Moon provides certain sets of capabilities for user communities, such as the scientific community. Most of the surface architecture work has focused on the lunar South Pole, particularly the area near Shackleton crater. The primary drivers for the location of these scenarios were engineering in nature, namely the relative ease of access to the landing site as opposed to other locations on the Moon, almost continuous sunlight in elevated locations near the south pole, and the relatively benign thermal environment of the poles compared to the rest of the lunar surface. New scenarios are currently being worked that include not only a polar outpost, but also human sortie missions to other locations on the Moon.

Scenario Evaluation: Traditionally, the merit of a lunar surface scenario, has been measured and evaluated by engineering and cost parameters. However, how well a particular scenario addresses scientific goals and objectives is also an important metric to consider. To that end, work is underway within NASA's Constellation Program Office to not only measure how well the existing lunar scenarios are addressing the goals and objectives of the scientific community, but to influence new lunar scenarios during their creation, and also the surface system concepts that the scenarios are built around.