OPERATIONS MODELING OF ISRU LUNAR BASE ARCHITECTURES. J. O. Elliott¹, A. Austin¹, and B. Sherwood¹, Jet Propulsion Laboratory, California Institute of Technology (4800 Oak Grove Dr., Pasadena, CA 91109, jelliott@jpl.nasa.gov)

**Introduction:** The moon is rapidly returning to prominence as a near-term destination for robotic and human exploration. The framework for the development of architectural elements outlined by NASA and the rapid progress being made by the commercial sector are combining to form the seeds of a sustainable architecture that may allow global exploration in a manner not previously achievable. A central theme is the establishment of a lunar “base”, i.e., a hub for surface activities, including production of consumable volatiles for transportation and life support.

Our team is investigating robotically constructed base architectures to support human and robotic exploration. Our analysis method starts with defining an operational base, then “works backwards” to understand requirements and concepts of operation at each stage of construction. A driving base requirement is production of useful quantities of water-based volatiles (liquid oxygen and hydrogen), primarily for propellant for a surface-based, reusable lander.

Our operations model takes as input fundamental parameters, including regolith ice content, energy per ton for excavation, transportation, etc., and a range of technologies and infrastructure elements; then sizes the systems to meet operational requirements. By FY20 the model will accommodate a wide range of base scenarios, allowing comparative assessment of exploration concepts.

**New Findings:** To develop the model, we defined distinct base scenarios. One locates the base including ISRU production facilities entirely in a permanently shadowed region (PSR). Here ice content in the regolith is predicted to be relatively high (of order 5 wt%), imposing challenging excavation and processing geotechnical properties and complications for physical access, cold operations, and provision of power and telecomm. A second locates the base in a “persistently illuminated” region, simplifying power and telecomm, but relying on regolith with lower ice fraction (≤ 2 wt%).

By exercising the model on these two scenarios, we demonstrate how integrated operations-based analysis of base architectures yields surprising findings not accessible to suboptimized analysis methods.