Vertical Regolith Transport System for Lunar and Mars ISRU Applications. James. G. Mantovani[1], Aaron D. Olson[2], Beverly Kemmerer[3], and Jonathan Gleeson[4], [1]Mailcode UB-E-2, NASA Kennedy Space Center, FL 32899 (james.g.mantovani@nasa.gov), [2]Mailcode UB-G, NASA Kennedy Space Center, FL 32899 (aaron.d.olson@nasa.gov) [3]Mailcode UB-E-2, NASA Kennedy Space Center, FL 32899 (beverly.kemmerer@nasa.gov) [4]Mailcode LASSO-014, NASA Kennedy Space Center, FL 32899 (jonathan.r.gleeson@nasa.gov).

Introduction: In-Situ Resource Utilization (ISRU) can significantly reduce the overall cost of future human exploration missions on planetary surfaces if technologies can be demonstrated that are able to extract and store material resources contained in regolith found on the Moon, Mars, and Asteroids. ISRU can then enable self-sustainability for human exploration missions and lessen the need for resupplying certain substances from Earth, especially water, oxygen and hydrogen, which are essential for life support and propellant production. The re-cycling of materials that are brought on the mission from Earth will also benefit sustainability on non-terrestrial bodies. Regolith can be mined for scientific investigations and surface construction needs as well as for ISRU. The development of technologies for ISRU applications that demonstrate reduced failure modes, low energy consumption, and increased material transfer rates for excavating, transporting and conveying regolith will be essential to enabling successful ISRU applications.

NASA KSC's Granular Mechanics and Regolith Operations Lab has developed mechanical and pneumatic systems for regolith handling and excavation for ISRU field demonstrations since 2008 [1], and recently supported a 2019 ISRU Study of a Lunar Production System for Extracting Oxygen from Regolith [2] that included a vertical regolith conveyor system to transfer regolith from the lunar surface up to ISRU reactors located on a lander deck that was based on a vibratory regolith conveyor system concept first demonstrated at NASA KSC in 2010 [1].

Approach: In 2021, the NASA ISRU GCD project Fundamental Regolith Properties, Handling, and Water Capture (FLEET) [3] at NASA GRC included a Regolith Transport task for NASA KSC to develop a vibratory lunar regolith conveyor (VLRC) based on KSC's 2010 regolith conveyor system to be operating at NASA GRC in 2023 under relevant vacuum and low temperature thermal conditions. In addition, a set of reduced-scale VLRCs (also vacuum compatible) are being developed to test vertical regolith transport under simulated lunar gravity conditions as a payload experiment on a suborbital LGA rocket flight opportunity in 2023.

This SRR presentation will provide a review of test results for previous regolith conveying systems developed at NASA KSC since 2008, and provides updates on recent testing of a vertical regolith conveying system being developed for the ISRU GCD FLEET project including updates on the status of DEM modeling of this particular regolith transport process.

References: [1] Townsend, I. I. and Mantovani, J. G. (2013) *J. of Aerospace Engineer., 26,* 169–175. [2] Linne, D. L. et al. (2021) *J. of Aerospace Engineer., 34,* 04021043-1. [3] Sanders, G. B. (2021) "Aspects of ISRU on the Moon," in the *NAS Decadal Survey on Planetary Science and Astrobiology: Panel on Mercury and the Moon.*