

ISRU ADVANCEMENTS: REGOLITH BENEFICIATION & PROPELLANT PRODUCTION OVERVIEW. K. Kulkarni¹, P. Zabel¹, L. Kiewiet¹, M. R. Lopez¹, ¹German Aerospace Center (DLR), Institute of Space Systems, Bremen, Germany (Robert-Hooke-Straße 7, 28359, Bremen Germany, kunal.kulkarni@dlr.de)

Introduction: The Synergetic Material Utilization (SMU) research group at the DLR Institute of Space Systems focuses on key ISRU research areas of regolith beneficiation and in-situ propellants and consumables production. These have been identified as the primary foci of the group to support the upcoming ISRU missions and enable sustainable space exploration in the future.

The regolith beneficiation research has resulted into the development of a laboratory scale model for a multi-stage beneficiation testbed. The testbed was optimized for ilmenite enrichment of lunar mare regolith. It underwent an experimental test campaign and the performance of the testbed was optimized to achieve about three-fold increase in the ilmenite grade compared to the unprocessed input material. The group further aims to use this experience and develop a demonstrator payload for beneficiation that can aid the in-situ extraction infrastructure on Moon and Mars.

Simultaneously, our efforts in in-situ propellant and consumables production are propelled by the ongoing EU-funded project LUWEX. This project is geared towards testing and validating thermal water extraction from icy regolith under lunar atmospheric conditions. The comprehensive process chain also includes purification of the extracted water, thus simulating the entire water extraction value chain crucial for sustaining human presence beyond Earth. The project is currently underway at the Technical University of Braunschweig, Germany.

Through interdisciplinary collaboration and innovative methodologies, our research group aims to further develop the respective disciplines, thereby facilitating long-term human exploration and habitation in space. This presentation provides insights into the development, challenges, and future prospects of our endeavors in advancing lunar resource utilization.