31st IAA SYMPOSIUM ON SPACE AND SOCIETY (E5)
Space Architecture: Habitats, Habitability, and Bases (1)

Author: Ms. Melodie Yashar
SEArch+ LLC, United States

Mr. Jason Ballard
United States

PROJECT OLYMPUS: OFF-WORLD ADDITIVE CONSTRUCTION FOR A PERMANENT MOON BASE

Abstract

By 2028 NASA seeks to deploy additive manufacturing technologies for the construction of permanent Lunar surface infrastructure. Minimizing the amount of construction material launched from Earth will prove critical to manufacturing robust, durable, and resilient structures on the Moon. While Lunar construction will undoubtedly depend on multiple advanced construction technologies working in-concert, NASA has committed to developing ISRU additive manufacturing (3D-printing) capabilities with excavation and handling technologies to realize surface site establishments. Lunar surface construction technologies must support the manufacturing of critical infrastructure elements such as: landing pads, rocket engine blast protection berms, garages, roads, dust free zones, equipment shelters, and of course human habitats and radiation shelters. Multiple sheltering aspects will be needed for early settlements to reliably protect crews against radiation, micro-meteoroids, and provide exhaust plume protection during subsequent launches. 3D-printing provides unprecedented versatility to manufacture a wide range of structural geometries on-demand. In Project Olympus, NASA, ICON, and SEArch+ develop the schematics for the construction of a permanent moon base and develop additive manufacturing technologies to eventually deploy on the Lunar surface. ICON, the first company in the United States to secure a building permit for and build a 3D-printed home, has demonstrated the viability of large-scale additive manufacturing for terrestrial construction in a variety of environmental conditions and seismic regions. Using proprietary robotics, software, and advanced materials, ICON has initiated a multi-year effort to develop deployable robotics for Lunar surface construction. SEArch+ (Space Exploration Architecture) won first prize in both of NASA's Centennial Challenges soliciting "virtual designs" for 3D-printed Habitats on Mars. Having collaborated with private aerospace corporations as well as NASA Johnson, Langley, and Marshall, SEArch+ develops human-supporting design concepts for off-world habitation. The design of the Moon Base celebrates human factors driven design with evidence-based systems engineering to ensure the safety and security of future crew. Project Olympus makes critical advancements advancing the state-of-the-art in off-world additive manufacturing capabilities and introduces a roadmap for the deployment and construction of durable, self-maintaining, and resilient surface structures optimized by advanced 3D-printing technologies.