AN INVESTIGATION INTO USING ADDITIVE MANUFACTURING TECHNIQUES FOR CONSTRUCTING STRUCTURES USING INDIGINOUS LUNAR MATERIALS. M. Drever[1] T. Shelfer PhD, R. Gaza PhD, K. Deighton, and J. Posey[2], [1]Lockheed Martin (mike.drever@lmco) [2]Affiliation for second author (full mailing address and e-mail address).

In-situ resource utilization increases the sustainability of a lunar facility by minimizing the amount of material transported from Earth.

The very fine materials in lunar regolith can be used to construct structures that can be outfitted and used as part of a lunar facility including pressure vessels, retaining walls and other structures. [1][2][3]

Structures of different shapes can be constructed using a combination of well established fabrication methods using just lunar materials. Additive manufacturing creates functional parts from a variety of powdered materials, including plastics, ceramics and metals. These part can be inspected during and after manufacture using non-destructive evaluation methods.

Fine lunar materials can be manipulated using electrostatic adhesion to allow thin layers on fine materials to bond to a thin form. [2] Materials that have been loosely bonded to the form with electrostatic adhesion can then be flash melted and bonded to each other using a variety of methods. [3] This process can be repeated until the final thickness has been obtained. This approach of gradually increasing the thickness allows for a structure tuned to its requirements. For enclosed volumes such as pressure vessels the form provides a gas barrier and for unenclosed volumes the form can be reused.

The structure can be tested and evaluated using non-destructive evaluation methods as the thickness increases. Known flaws can be logged and material added as needed until the flaws has been repaired or mitigated. The process is terminated when sufficient material has been applied to pass the inspection criteria and other design requirements are met. [4]

This method provides a means to create the primary structure of lunar habitats using indigenous materials in a wide variety of shapes, including flat plates, cylinders and other shapes. [1][2][3] Inspecting structures as they are built provides confidence in the structural integrity of the structure prior to being placed into service. [4]

Methods such as these allow fabrication of primary facility structures on the moon with only select components being flown from Earth for some structures. Volumes constructed using this method can provide load bearing structure, radiation shielding, micrometeoroid protection, retaining walls, aerial masts, etc.

[1] Haywood H. (1971) *Proceeding of the Second Lunar Science Conference, 3,* 1989-2001. [2] Agosto W. N. (1985) *Lunar Bases and Space Activities of the 21st Century.* 453-464. [3] Committee on Ceramic Processing. (1968) *Ceramic Processing,* p165. [4] Raj B., Jayakumar T., Thavasimuth M., *Practical Non Destructive Inspection*, p4

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