

14TH IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND  
DEVELOPMENT (D3)Strategies & Architectures as the Framework for Future Building Blocks in Space Exploration and  
Development (1)

Author: Dr. Samuel Wilkinson  
(*country is not specified*), swilkinson@fosterandpartners.com

PRELIMINARY FINDINGS FROM A MULTI-ROBOT SYSTEM FOR LARGE-SCALE  
EXTRA-PLANETARY ADDITIVE CONSTRUCTION**Abstract**

We present our findings from a 4-day workshop at SmartGeometry2016, during which the authors conducted an open-ended experiment to ascertain the viability of a multi-robotic system capable of large-scale additive construction with sand. The study and results pertain to robotic systems operating in extreme environments, such as in lunar or Martian conditions, where there is a need for autonomous construction of regolith structures for infrastructure or human habitat protection.

The purposes of this study were to: i) advance and document the practical knowledge of multi- or swarm robot systems in the field; ii) ascertain the feasibility of additive construction with many-simple rather than few-complex robots; and iii) explore individual behavioural rules for the robots which, although are indirectly controlled in themselves, can result in a controlled outcome. Behaviour is understood as the interactions between an individual and its environment where the behaviour of the individual affects its own perceptions, and thus its future actions and perceptions. Applying this concept to robots results in a field of autonomous behavioural machines capable of operating in partially unknown and changing environments without human intervention. In the paper we describe the design and mechanical operation of the multi-robot system, the local positioning and communication system, ending with a discussion of the programmed behaviours and the final built outcomes. The results of this workshop will be used to inform the next stage of the technology demonstration in which the whole process will be scaled up.