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Space Architecture: Habitats, Habitability, and Bases (1)

Author: Mr. Robert Mueller
National Aeronautics and Space Administration (NASA), United States

NASA CENTENNIAL CHALLENGE: THREE DIMENSIONAL (3D) PRINTED HABITAT, PHASE 3

Abstract

The 3D-Printed Habitat Challenge seeks to develop and demonstrate capabilities to manufacture, with 3D-printing technologies, a habitat on another planetary body using mission recycled materials and/or local indigenous materials. The vision includes autonomous construction machines deployed to planetary surfaces to build shelters for human habitation. On Earth, these same habitat construction capabilities could be used to produce sustainable housing where access to conventional building materials and skills are limited. It is envisioned that local terrestrial indigenous materials (gravel, clay, sand, etc.) could be combined with readily available recyclable materials and used to construct durable shelters for human habitation.

The Challenge is divided into phases described below. This paper will focus on the requirements and rules associated with the On-site Habitat Competition (Phase 3) only. Descriptions and results of previous phases of the competition have been published and are available in the literature.

Design Competition (Phase 1) - focused on developing innovative habitat architectural concepts that take advantage of the unique capabilities that 3D-printing offers. This phase was completed in September, 2015.

Structural Member Competition (Phase 2) - focused on the core 3Dprinting fabrication technologies and material properties needed to manufacture structural components from indigenous materials combined with recyclables, or indigenous materials alone. This phase was completed in August, 2017.

On-Site Habitat Competition (Phase 3) – focuses on autonomous 3D printing of a subscale habitat design (conducted at the head-to-head competition), using indigenous materials combined with recyclables, or indigenous materials alone. In addition, the use of a Building Information Model (BIM) and virtual construction tools and techniques has been included to leverage those capabilities and advance the state of the art in that field.