IASS Annual Symposium 2019 – Structural Membranes 2019
Form and Force
7 – 10 October 2019, Barcelona, Spain

Inch by inch, row by row: Making Structures Grow

Mark C. WAGGONER*

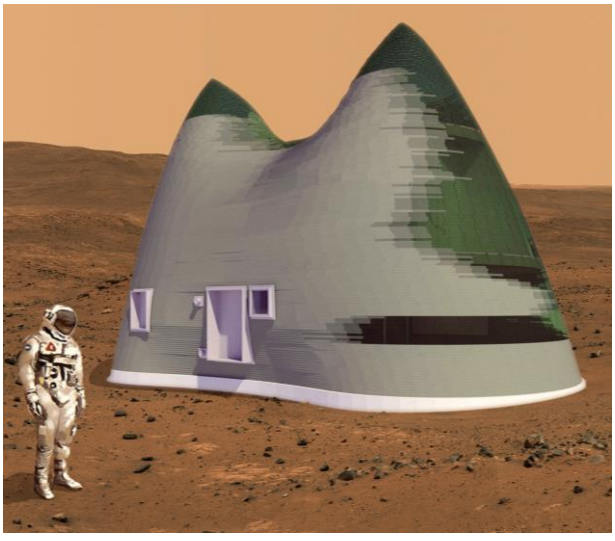
*Walter P Moore
Austin, Texas, USA
mwaggoner@walterpmoore.com

Abstract

Modern design processes focus almost exclusively on envisioning a completed building or structure in its final form. Constraints and opportunities that inform the design decisions for a particular structure center around the completed condition to the exclusion of any understanding of how the structure came to be in its present state. For complex structures, this leaves the builder to invent increasingly intricate man-made solutions to the puzzle of how to bring these structures to their final condition. Often a complete and intentional disconnect exists between the design and construction teams, meaning erection techniques have little bearing on the final form of a structure.

While recent developments in parametric modeling and optimization have brought about new form-finding paths in design, for the most part these techniques have still focused on conjuring the final form of the structure. Biomimicry efforts are often truly only mimicking the final state of biological systems but skipping how they came to be in that state. In natural forms, whether plant life or animal-built, none of these distinctions exist and the final form is heavily influenced by the simple mechanics involved with sowing each tiny unit of the structure. As new construction technology such as large-scale 3d printing becomes more widely available, a careful study of structural growth techniques informed by biological structures opens a new world of form-finding that hinges around the 4d process of a structure coming into being.

This paper will present various studies in form-finding that incorporate growth techniques that are informed by biological processes. A case study using such techniques for design of a 3d printed Mars habitat for a design competition sponsored by NASA will also be presented. By incorporating thinking of the growth of a structure to its final form many efficiencies are possible in structural construction.



NASA Mars Habitat, courtesy FormForge/Austin Commercial