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SELECTED PRECEPTS IN LUNAR ARCHITECTURE

Marc M. Cohen, Arch.D., Architect
Senior Member, AIAA
P.O. Box 243 Moffett Field, California USA
mcohen@mail.arc.nasa.gov

ABSTRACT

The 1997 NASA Habitats and Surface Construction Roadmap defined three classes of lunar and planetary architecture, ranging from habitats built entirely on Earth to habitats built on the extraterrestrial surface. The definitions are: Class 1 – Pre-integrated, landed complete; Class 2 – Pre-fabricated, assembled, deployed or inflated on the surface; Class 3 – In-Situ Resource Construction.

The extreme environmental conditions on the Moon shape and constrain Lunar Architecture in far-reaching ways. These environmental threats and stressors include vacuum, .18 G partial gravity, radiation, micrometeoroid impacts, the 28-day diurnal cycle, extreme thermal cycling, and pervasive dust. Also, the unique instance of the landing zone poses a human-made potential environmental hazard. The design and development of lunar construction technologies and habitats must respond effectively to these threats. For this reason, developing Lunar Architecture will be challenging and complex.

Although it is reasonable to characterize the individual elements of a lunar base as Class 1, 2, or 3, in actuality, none of them on the Moon (or Mars) would be purely of one class. To explicate this "hybrid" character of surface construction, this paper presents three further units of analysis in architectural design research: taxonomy, typology and morphology.

INTRODUCTION

This paper presents an overview of selected approaches to Lunar Architecture to describe the parameters of this design problem space.

The paper identifies typologies of architecture based on lunar site features, structural concepts and habitable functions.

In 1993, Haym Benaroya, Professor of Mechanical and AeroSpace Engineering at Rutgers University edited a special issue of Applied Mechanics Review dedicated to lunar base construction (Benaroya, 1993). In this issue, A. Smith of the US Army Construction, Engineering and Research Laboratory in Champaign, IL proposed a three-phase evolutionary development process for lunar base construction. In Smith's prospectus, these three phases involved

- Prefabricated and pre-outfitted modules;
- Assembly of components fabricated on Earth with "some assembly required!"
- Building structures comprised substantially of indigenous materials (Smith, 1993, pp. 268-271).

In 1996-1997, NASA undertook an initiative to create "technology development roadmaps" for a variety of technical and scientific areas critical to exploration of the Moon, Mars and beyond the inner planets. The NASA Habitats and Surface Construction Working Group adopted a parallel but more sharply focused set of definitions.