

Space architects role on the lunar exploration

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Abstract

Most of the lunar explorations are primarily concerned with the function of the critical systems and safety with disregard to the human interfaces. Everything at space agencies is built to performance specifications, which require, basically that everything is Function. It has been shown in the previous studies that involvement of Space Architects in the early design phase has great benefits for development human habitats in space. Space Architects can define dwelling problems and reach the points of success. Collaboration between Architect, Engineer, and Scientist will have the best result in lunar habitat, especially once consideration of human factor is the key of success in the long term missions. This paper focuses on lunar habitat which is an important issue of Moon Exploration and represents space architects role in the future lunar exploration.

1. Introduction

The future lunar missions will become greatly extended as much as six month, because Moon is an ideal “Staging Post” [1], from the Moon we can send missions into deep space and Mars. During this exploration, the most important factor to success is Habitation System; the place that crew will live and work. The habitat serves as “home away from home” [2]. There are not many information available about habitat on the Moon. Our knowledge of space station habitat is limited with constraints and lesson learnt. Architecture on the Moon is fundamentally different in many respects than on Earth.

Architects must be aware of unique human adaptation, performance and safety requirements and the Moon conditions. Space Architects can enhance crew effectiveness, productivity, health and safety with good design. Architecture defines and organizes goals, requirements, strategies, concepts and

components within coherent concepts of configuration and function.

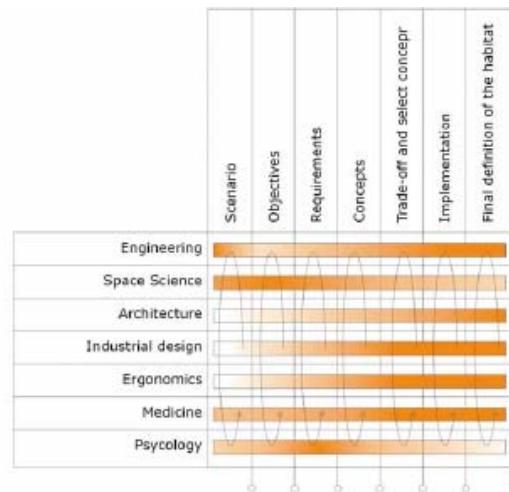


Table 1: *Scheme of the design approach, Courtesy of ESA*

2. Space Architecture

The characteristics of the inhabited environment are strongly driven by engineering and science requirements (Table 1). Although the effort of engineers and scientists are focused on making all parts work together in the most efficient and economical way. Many faces of human inhabited space systems are missing, leading to problems later once the system is used. Current space proposals and projects consider solving technical and functional problems. Moreover the satisfaction of some engineering and science requirements, such as safety and reliability, does not ensure a sufficient habitat (Fig 1).

The realized lunar habitat designs are defined by the Configuration and function. This means that Architects and Industrial designers start from the already defined architecture of the space module, with little chance to modify it. There are certain

architectural inputs which are not currently included in the design of lunar habitat. This has consequences on the effectiveness of the habitat which is dependent on the efficiency of the crew. While these human issues are to be effectively overcome, they must not be integrated into design after the fact.

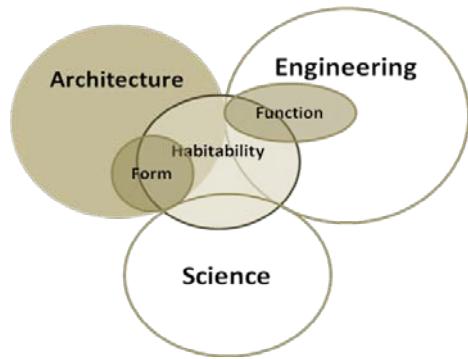


Figure 2: *Scheme of habitability for lunar habitat*

3. Summary and Conclusions

The human being is a complex system in itself. Providing life support and radiation protection is not sufficient to assure optimal habitability conditions for lunar long duration habitat. A human being has to live and work in the habitat (Fig 2). Space Architect must assure the ability of carrying out the scientific experiments and the maintenance of the operational condition of the module. In reality, these two large groups of activities are not separated, but linked together in an environment with limited volume, and so these activities must be carried out in the same place or at the same time.

A combination effort between architectural demands through the engineering and scientific solutions may be the best way to solve habitability problems to make the future lunar habitat usable and liveable environment. Architects must be working with engineers and scientists from the first step of defining scenario. It may reduce cost and risk of the projects. The significance of this paper is to provide comprehensive role for space architects in the future lunar long duration stay.

References

- [1] Ian O'Neill, Building a moon base, Feb 2008.
- [2] F.A. Slane, Engineering implications of levitating lunar dust, SPACE 94 engineering, construction, and operations in space, ASCE, New York, 1994, pp. 1097–1105

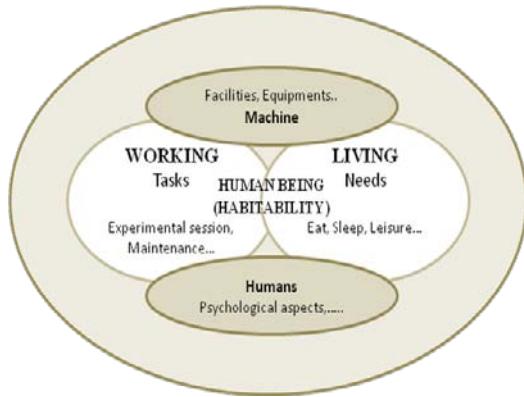


Figure 2: *Scheme of human being, Courtesy of SICSA*