Paper ID: 44711
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21st IAA SYMPOSIUM ON HUMAN EXPLORATION OF THE SOLAR SYSTEM (A5)
Human Exploration of the Moon and Cislunar Space (1)

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UPDATED DESIGN CONCEPTS OF THE MOON AND MARS BASE ANALOG (MAMBA)

Abstract

Important milestones have been reached in the recent past in the launches of commercial, re-usable rockets and spacecraft and particularly heavy-lift launch vehicles. These could help pave the way to the realization of the Moon Village, a concept of an international presence on the Moon promoted by ESA's DG. Even though the Moon Village itself refers to the community behind the Moon activities, visual conceptions of it usually depict a collection of rovers, humans, and, perhaps the largest pieces of equipment, habitats.

Over the last decades, many habitats have been built and inhabited to provide an analog environment of the Moon or Mars. The main purpose of these habitats are usually terrestrial simulations. That is, today's habitats may provide an adequate laboratory environment for human factor studies, training purposes and subsystem technology testing, but they would not function on the surface of either Moon or Mars.

They typically share the following features that render them unusable for an actual mission off our home planet: They are not pressure tight, provide no adequate shielding against space radiation, many consist of a single space or have a single central module, which may render the habitat unusable after just one single catastrophic event, and they are not designed ergonomically. In addition, despite the fact that most habitats have a dedicated laboratory space, these labs often suffer from a rather arbitrary selection of lab instrumentation.

The habitat planned within project MaMBA is intended to provide a first prototype that could function on the Moon. This habitat is developed at the ZARM in Bremen, Germany, and comprises five to six connected, but independent modules. In its final state, the habitat is intended to serve for testing technologies such as life support, power systems, and remotely operated set-ups communication. For the described project phase, we focus on the development of the scientific module, which will contain a laboratory to be used by mainly geologists, biologists. In order to provide efficient and functional workstations for the laboratory, they will be designed ergonomically in collaboration with geologists and biologists.

We will present an update on the project MaMBA and the progress on its overall layout. To facilitate cooperation with industrial and institutional partners, in this paper we focus on the selection process of the scientific equipment, the design of the interior layout, our first-iteration of an effective radiation shield and the concept of the pressure vessel.