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CONCEPT OF A LABORATORY FOR RESEARCHING PRODUCTION UNDER MARS-LIKE CONDITIONS

Abstract

With recent technological developments it has become realistic to put humans on Mars, the ISECG aims for this goal by mid-century. To establish a long-term human settlement on Mars it is not only important to focus on the way there, but also how humans can live, work and do research there. Since not all resources can be brought to Mars, it is in particular important to have the means for producing spare parts, or those parts whose need was not anticipated beforehand. This poses the challenge of producing parts on-site, with resources available.

Various studies have investigated how local resources can be utilized and how the martian atmosphere effects instrumentation used. However, there is yet no facility for investigating production processes under Mars-like conditions, especially with the possibility for humans to interact with these processes. Moreover, it is necessary to investigate how on-site available resources can be used for production and how such a facility can be integrated into a habitat complex.

This work proposes a concept for a laboratory that will enable researching production under Mars-like

conditions. The central element is a production hall with a base area of $90m^2$ which will allow long-term research of production processes. The laboratory will have a control room for implementing remote controlling of experiments conducted inside the production hall. Several airlocks will provide access to the production hall to interact with, maintain and modify conducted experiments.

Furthermore, it will be possible via a sample transfer lock to extract samples from the production hall. The atmosphere inside the production hall will consist of CO_2 at the same partial pressure as on Mars and Ar at a slight overpressure, necessitating the extensive use of robots for collecting samples and performing maintenance. The toxicity of the atmosphere in the production hall will impose operational limitations comparable to those on Mars. The existing MaMBA laboratory at ZARM will be integrated into the facility as a habitat component.

The presented laboratory is planned to be built and operated at ZARM, University of Bremen as part of the multidisciplinary "Humans on Mars"-initiative, which consists of eight faculties of the University of Bremen and four non-University research institutes. The facility is intended to be open to external collaborators, as well. Construction is anticipated to begin in 2025.