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EuroMoonMars Workshop 2018: a pilot study on a semi-autonomous laboratory module for analogue simulations

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Introduction: On the 19th and 20th of April 2018, the International Lunar Exploration Working Group (ILEWG) and ESA-ESTEC held its annual EuroMoonMars Workshop. The 19th of April focused on technical demonstrations to prepare interested participants for the simulations, held on the 20th of April.

Terrestrial analogues can offer great insight into what it takes for the human species to inhabit Space. *EuroMoonMars* is a pilot research programme that functions as one of the small building blocks towards human or robotic habitation of the Moon, Mars, Phobos, or asteroids. Its annual program is concerned with the development of its Robotic Test Bench (ExoGeoLab), Habitation module (Exohab) and Laboratory module (Exolab) at the European Space Research and Technology Centre of the European Space Agency, Noordwijk, NL (ESA-ESTEC).

EuroMoonMars2018 Laboratory module: The laboratory module functioned as a sub-system in a bigger-picture with the ExoGeoLab, the Exohabitat, and the Ground Control Center. The laboratory crew consisted of a crew commander, scientific officer, biomedical engineer, food designer and visual artist. The laboratory is a prototype for functional experimentation. There were internal functions and scientific experiments. In addition, there was also an ExtraVehicular Activity (EVA) to demonstrate guided biomedical advice during emergency situations and to collect astro-biological samples - later to be analyzed with the Visual Near Infra-Red spectrometer.

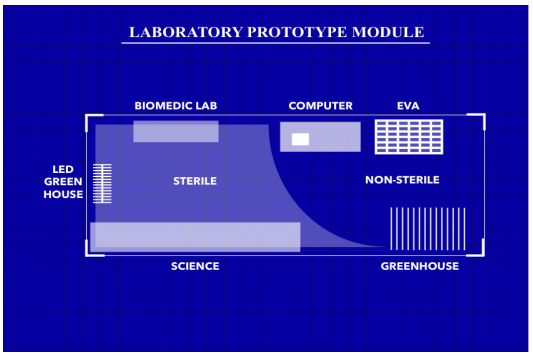

Figure 1: The layout of the laboratory module at ESA ESTEC, Noordwijk, NL.

Plant Laboratory: Long-duration human spaceflight into deep space will increasingly rely on the production of carbon-based biomass. Thorough on-going research into plant growth in space will enable the food provision of edible-fresh products. Within the Plant Laboratory a small-scale pilot study on plant growth in Martian simulant soil with the help of a generic chemical fertilizer in cultivation pots was executed. We had a number of seeds that were carefully selected based on plant research in space e.g. romaine lettuce and red curly lettuce.

In the non-sterile area of the lab there was a greenhouse compartment that could function as a fresh food source, oxygen supply and extraction of pollutants from the atmosphere. The food designer was taking care of the plant health of the greenhouse and the processing of food, in particular hot sauce. This product in particular was chosen because of the known alteration in tastes when humans live for a prolonged time in space.

Figure 2: A photo taken during the first simulation in the laboratory.

Medical Emergency during EVA: During the ExtraVehicular activity one astronaut suffered a physical breakdown. Telecommunication contact with the biomedical engineer enabled guided CPR. One of the EVA astronauts practiced CPR on the other astronaut, based on the instructions from the biomedical expert. **Public Affairs and Outreach:** The Visual Journalist was in close contact with the Public Affairs Officer in Ground Control Center. This allowed direct output from simulation to public. **Lessons learned:** The main issues during the simulation occurred within the communication. During the first simulation there was a communication problem with Ground Control Center that could have been solved by splitting up the communication device. The second simulation suffered from inadequate information on the WebEx code to enter the meeting, therefore they were out of communication for 50% of the simulation. In order to execute the functions well enough during the simulation it is of requisite that the crewmembers are well informed on their tasks before the simulation starts.

References:

[1] The MoonVillage Concept and Initiative, J. Woerner and B.H. Foing, [2] B. Foing et al , Highlights from Moon Village Workshop, held at ESTEC in December 2015 , http://www.hou.usra.edu/meetings/lpsc2016/pdf/2719.pdf, http://www.hou.usra.edu/meetings/lpsc2016/pdf/2798.pdf [3] Space Architecture: Education for Engineers and Architects, S. Hauplik-Meusberger, O. Bannova. [4] Studying plant growth in space, NASA, https://www.nasa.gov/centers/ames/pdf/423451main_Tropi-2_FactSheet3.pdf,

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