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Planetary Science in Analogs in Lunares habitat.

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Introduction

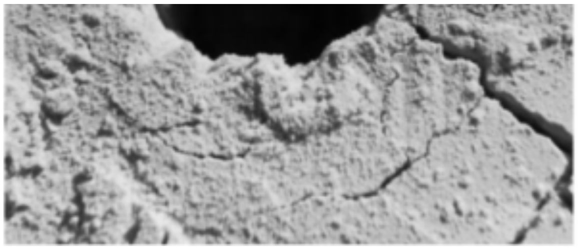
Lunares base was established in 2017 by Space Garden (www.lunares.space) (**Fig. 1**). It was created by space enthusiasts, who sponsored the design, materials, equipment and building of the facility as well as organization of scientific and exploratory missions. Lunares name derives from LUNA (Moon), and ARES (Mars), to highlight ability to run two types of environmental analogs: lunar and martian ones. EVA terrain connected by airlock (**Fig. 2**), together with laboratories inside the habitat were designed to perform planetary science experiments during analog missions. Actually, we study: (1) growing plants on regolith simulants; (2) water and magnetic particles extraction; (3) robotic operations in simulated lava tubes.

Fig. 1. The habitat has 8 functional modules around social area called Atrium (108 square meters): Dormitory with 6 private chambers, Biolab with hydroponics and bioreactors, Analytic lab, Kitchen, Operations room, Storage, Sanitary Modules, Airlock module connected to isolated EVA terrain inside the hangar (photos: Space Garden).

Fig. 2. Airlock module connecting the habitat with EVA terrain. Sterilization area with UV light is activated every time whenever doors are opened. Green and red signaling for "stop" and "go" commands are both located inside the habitat and in the airlock (photos: Space Garden).

1.Regolith simulants

150 square meters of Moon surface was made using small basalt rocks and powder. Another 150 square meters of red rocky surface simulated martian terrain. Both surfaces were shaped with volcanoes and craters. This unique terrain is used for extravehicular activities in isolated from external environment hangar, with various types of lighting modes, communication, navigation and environmental conditions such temperature and humidity. On this rocky surface analog astronauts search for original meteorite samples and regolith simulants. Several regolith simulants were used (**Fig. 3**), for example Lunar analogue AGK-2010 [1]. We cordially invite planetary scientist to test Lunares platform as well as multiple regolith simulants.



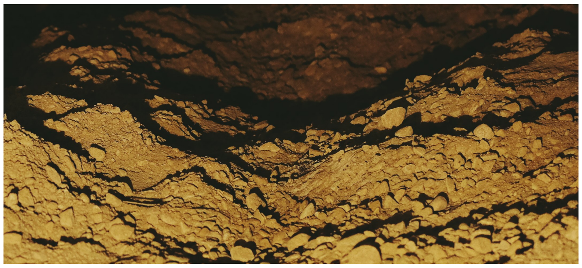
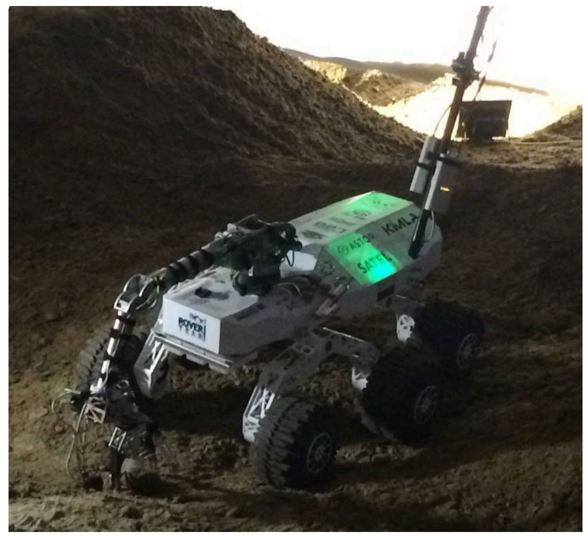


Fig. 3. Lunar analogue AGK-2010 [1] and martian soil (up). Martian and lunar EVA terrain in Lunares hangar (down).

2. Operations

We developed two different habitat manuals and procedure types, specified for lunar and martian conditions. Schedules and communication modes are running on two different timing systems: Lunar Standard Time (LST) for lunar missions [2], and Mars24 Sunclock [3] for martian analogs. Every time two analog astronauts go for 2 hour EVA walks. During this time 3rd astronaut controls EVA from the habitat. Analog astronauts communicate via radio and wifi connection. EVAs can be fully autonomous using rovers and landers (**Fig. 4**), controlled by astronauts crew, or controlled fully remotely from the Mission Control Centers.

Fig. 4. ExoGeoLab lander from ILEWG equipped with VIS/IR spectrometer and telescope ready for use during EVA operations (**up**). Telerobotic operations using Modernity Rover (**down**).



Acknowledgements

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