

**SCIENTIFIC OUTREACH OF THE LUNAR EXPEDITION I.0 IN THE LUNARES HABITAT IN POLAND.** A. Kołodziejczyk<sup>1,2,7</sup>, A. Rudolf<sup>7</sup>, M. Gocyla<sup>7</sup>, M. Młyńczak<sup>5,7</sup>, I. Schlacht<sup>2</sup>, E. Wierzejska<sup>6,7</sup>, A. Waśniowski<sup>6,7</sup>, L. Davidova<sup>7</sup>, P. Konorski<sup>7</sup>, M. Słonina<sup>7</sup>, D. Budzyń<sup>7</sup>, J. Kuźma<sup>7</sup>, G. Ambroszkiewicz<sup>7</sup>, M. Harsymczuk<sup>1,2,7</sup>, B.H. Foing<sup>1,2,3</sup> (<sup>1</sup>ESA/ESTEC & <sup>2</sup>ILEWG PB 299, 2200 AG Noordwijk, NL, [Bernard.Foing@esa.int](mailto:Bernard.Foing@esa.int), <sup>3</sup>VU Amsterdam, <sup>4</sup>Institute INAF-IAPS, <sup>5</sup>Warsaw University of Technology, <sup>6</sup>Medical University in Poznań, <sup>7</sup>Lunares)

**Introduction:** Habitat Lunares is a simulated space base and chronobiological laboratory to perform advanced studies on humans in controlled conditions [1]. With common effort of Medical University in Poznań, Lunares became the first in Poland laboratory of extreme medicine. People living in this base are constantly monitored by telemedical devices. Additionally, the base is monitored regarding O<sub>2</sub> levels, temperature, humidity, radiation and light intensity. The habitat is equipped with automated lighting system controlled by Mission Control Center, where specific ranges of solar spectrum can be administrated selectively (Fig.1). It's the only facility of its kind in Europe, where conditions of the future base both on the Moon and Mars can be simulated. The habitat is located at the former military airport in Piła, north of Poland. Four analog missions were planned for 2017, among them the Lunar Expedition I.0. During two weeks of isolation from external world, analog astronauts were completely cut off from UTC time, sunlight and urban noise. They could leave the hab only to an airplane hangar where the surface of the Moon was simulated.



Fig. 1. The Lunares habitat is equipped with 3 types of automated lighting systems: circadian lighting, hydroponic lighting, EVA terrain lighting.

**Scientific objectives of the Lunar Expedition I.0 studies:** The main objective of this analog mission was to perform chronobiological studies and subjective time perception experiment. It is well known, that astronauts are isolated from natural sunlight during stay in space, what implies desynchronization of metabolic circadian cycles, decreases immunity, sleep quality and concentration. In this experiment we tested the influence of developed lighting systems on circadian rhythms in analog astronauts, also during EVAs (Fig.2). Moreover, specific non-intrusive experiment detected the effect on stress.



Fig. 2. During EVAs analog astronauts were monitored with prototypes of non-invasive telemedical devices to measure respiratory signal, ECG and motion.

The second objective of the mission was to investigate biological life support systems. Multispecies ecological relations were implemented in the bioloab and hydroponic system (Fig.3) to generate oxygen, recycle wastes and water.



Fig. 3. Hydroponic system with multispecies bioreactors including algae, cyanobacteria, Kombucha, Hermetia, Drosophila and cockroaches.

This work presents the main results from the simulation and opens future perspectives for external partners invited to collaborate with Lunares Team.

#### References:

Kołodziejczyk A. M., Lakk H., Orzechowski L., (2016). Acta Futura 10, ISSN 2309-1940.

**Additional Information:** [www.lunares.space](http://www.lunares.space)