Ground-Based Preparatory Activities (11)
Ground-Based Preparatory Activities (3) (3)

Author: Dr. IOANA-ROXANA PERRIER
Institute of Polytechnic Science and Aeronautics (IPSA), France

Prof. Bernard Foing
ILEWG "EuroMoonMars", The Netherlands
Dr. Agata Kolodziejczyk
Analog Astronaut Training Center, Poland
Mr. Kristian Komenda
Analog Astronaut Training Center, Poland
Mrs. Emma FORGUES–MAYET
France
Mr. Hugo CASTAING
France
Mr. Mikael Clain
France
Mr. Théo Podolsky
France
Mr. Quentin Gouault
France
Mr. Julien Bardin-Codine
France

PREPARING FUTURE MOON EXPLORATION MISSIONS THROUGH ENGINEERING AND SCIENTIFIC EXPERIMENTS

Abstract

As part of the project - based learning, students at IPSA aerospace engineering school, started working on the habitability conditions on our natural satellite. We joined the ILEWG Euro Moon Mars program to be closer to the future of the space exploration and particularly the one of the Moon. We shall describe the preliminary results from EMMPOL1 crew campaign inside a lunar simulation habitat, and lessons learned for mission control and science support. We will go from hydroponics to life support and a sample return system. A greenhouse concept was developed and the design, automatic systems, energy budget and other parameters were studied. This is meant to allow humans to have an autonomy in growing plants and vegetables, to have fresh food and a good nutrient supply. The hydroponic system we propose has an improved biofilter with an increased nesting surface, meaning an increased surface for nitrifying bacteria. Water is a key element for our survival. Hydration is important for humans but necessary for plants too. A 9.4 pH commercialized water was tested during our isolation campaign. It was compared with neutral pH water impact on the growth of plants but also on the human body. Analog astronauts followed a special diet to clearly identify the action of the alkaline water. Algae are resistant to environmental changes, easy to breed and they effectively reduce CO2, it is also the most widespread oxygen producers in the world. Arthrospira plantita, Chlorella, Spirulina, Synechocystis spp. were the most dominant algae species selected for an efficient CO2 reduction investigation as a function of time by placing algae consortia in chambers of various volumes in a sealed container. The algae were saturated with the external habitat

air rich in CO_2. The risks were characterized, and costs related with implementation of this biological method. Our daily production of wastes increased and the types of materials we were using evolved, we then tested compost done with recyclable plastic like laboratory items, plastic gloves, and plastic bags, using the Berkley method. We then created a 3D plastic printed micro launcher composed of three parts: the thruster, the tank, and the payload. Being able to 3D print a launcher directly on a Moon base with inexpensive materials as plastics, would allow to decrease the complexity and the price of returning samples to Earth.