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IAF HUMAN SPACEFLIGHT SYMPOSIUM (B3)
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OVERVIEW OF ACTIVITIES CONDUCTED DURING THE NIKE-I ANALOG MISSION IN THE LUNARES HABITAT

Abstract

Analog missions increasingly focus on investigating sustainable technologies and human factors critical for long-duration spaceflights. Established in 2017 in Piła, Poland, the LunAres Research Station is dedicated to simulating Lunar and Martian missions, accommodating six members for two weeks per mission. It focuses on advancing research in crewed space exploration, with a multidisciplinary approach from fields such as medicine, psychology, and engineering. As an illustrative example of this endeavour, this paper provides an overview of activities conducted during the NIKE-I mission, a 14-day lunar analog mission, conducted in LunAres in June 2023.

The crew performed a range of research and outreach activities. Given previous and ongoing investigations in the habitat, the majority of experiments were survey- and journal-based studies of crew psychology and dynamics - these experiments included topics such as team interactions and resilience in isolation, psychological indicators of adaptation to the analog missions with a focus on relationships between sociosexuality and psychological outcomes, identifying eating behaviour determinants, environmental perception, and team challenge resolution mechanisms. The multinational and professionally diverse crew also monitored their caloric intake during meals and its relation to caloric expenditure due to exercise. Exercise itself was a subject of study by investigating the effects of using the MaxForce exercise aid according to a prescribed workout schedule. In collaboration with the German Aerospace Centre (DLR), representative samples of the habitat microbiome were taken before and after the mission, while also performing the ISS experiment "Touching Surfaces" to assess the effects of materials on microbial growth. Another DLR test involved expanding the Extravehicular Activity operations to explore possible operational concepts for the LUNA analog facility in development by the European Space Agency (ESA) and DLR. In parallel, outreach activities were performed throughout the mission - a documentary filming for UK-based Institution of Engineering and Technology, and a series of outreach events with students, each of a different format for DLR School Lab Braunschweig in Germany. As a non-research activity, the crew developed, constructed, and tested a drill upgrade for a rover in the habitat.

Each activity is briefly introduced, providing an overview of the background and methodology, as well as the PIs responsible for the research. Outreach activities are briefly described in terms of their content, goals, target audience, and parties involved; non-research activities are also included and introduced for the sake of completeness and additional context.

Keywords: mission summary, analog research, human factors, lunar exploration