IAF SPACE EXPLORATION SYMPOSIUM (A3)
Virtual Presentations - IAF SPACE EXPLORATION SYMPOSIUM (VP)

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SAMPLE - SEMI-AUTONOMOUS MODULAR PLANT AND OTHER LIFE-SUSTAINING EXPERIMENT

Abstract

In order to enable long-duration missions to celestial bodies, a sustainable human habitat system must be constructed. Non-human life, such as edible plants and other biological samples, will also need to be sustained. Yet the space in the human habitat is likely be scarce, high-cost and insufficient for the cultivation of significant amount of plants. SAMPLE (Semi-Autonomous Modular Plant and other Life-sustaining Experiment) proposes creating separate environments for non-human life. The key objective of the project is demonstrating that cultivation of plants in a closed cycle of matter is possible in extreme conditions outside of a human habitat. In particular, it can have an application in cultivation of edible plants during a space exploration mission, for example to the Moon. SAMPLE is able to control the environmental conditions inside the module by means of appropriate insulation and temperature adjustment. This can enable the survival and growth of the organisms inside. During plant cultivation, a universal daily cycle is created, so that the module can function anywhere. All the chemical compounds are introduced into the module at the beginning of the experiment, along with the plant seeds and soil substrate. After the module is closed, the experiment can run autonomously - the water and all the nutrients circle inside the module, participating in the ongoing biological processes. The conditions inside the module are checked by sensors, which send information to the control station in the main habitat. Internal variables such as light intensity and heater power are automatically adjusted by the designed software but can also be remotely controlled from the habitat. The energy is provided by photovoltaic panels and excess energy

is stored in batteries, so that the module can operate continuously, even during lunar night. Thanks to the autonomy of the module, only rare maintenance on a basic level is required. The project involves the design and manufacturing of a functional module prototype, tested during the IGLUNA Field Campaign on Mount Pilatus (2132 m) in July 2020. SAMPLE is participating in the ESALabCH IGLUNA project, led by the Swiss Space Center and supported by the European Space Agency. The oral presentation at IAC will explain the motivation behind the SAMPLE project and its technical details. Results of the experiment conducted at the IGLUNA Field Campaign will also be presented and discussed. Conclusions, including useful insights for similar undertakings in the future, will be drawn at the end.