

Terrarium Controller to Imitate Lunar Conditions for Live Organisms

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Understanding the ability of organisms to survive in space is essential for our plans to return to the Moon and eventually travel to Mars. Food and nutrition are among the many other requirements that astronauts must meet to survive in space. Testing which plants can survive in various extraterrestrial conditions is necessary to ensure the survival of manned missions. A 12U CubeSat terrarium controller that will simulate lunar conditions is proposed to perform these tests. The CubeSat will also possess a 2U terrarium payload containing organic material that will need to be kept alive for the mission. Thus the controller will have two separate regions of interest: the simulated lunar conditions, and the conditions inside the terrarium. Thus the controller will possess two primary computer systems that will have limited communication with each other. The controller will be comprised of several computer sensors that will all capture information regarding both regions and make decisions both automatically and manually to ensure the homeostasis of the organism inside. This information includes but is not limited to temperature, pressure, humidity, and gas concentration. The sensors capture quantitative data, meaning that if falls out of a certain range, a signal will be triggered to ensure that the temperature falls back into the range. Any errors can be manually changed by entering a desired condition into the computer's communication link. A Seebeck and Peltier device, otherwise known as a thermoelectric generator (TEG), will accomplish this by heating and cooling the system as necessary. To recreate lunar conditions, the controller will be connected to a centrifuge to recreate the Moon's gravity as well as external TEG that will be set to the temperature extremes on the Moon (-150 to 120 °C). The controller will report the information from both regions using a two-way radio transmitter that will send the data, as well as capture any signals that are sent to change the conditions of the CubeSat at will. Lighting is also a key factor in the growth of any plant, and an LED lighting system will be connected to the controller to imitate the presence of the Sun. This controller will ultimately demonstrate the ability of CubeSats to recreate lunar environments that can host future experiments.