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Author: Mr. Christian Kropiunig
Joanneum Research, Austria

THE MILLER-UREY EXPERIMENT ON BOARD OF ISS

Abstract

More than 50 years ago, Prof. Stanley Miller and Prof. Harold C. Urey carried out their landmark experiment, demonstrating that amino acids, essential chemical building blocks of life can be created from simple gases, assumed to be present in the early atmosphere. The existence of such molecules outside the earth environment has been verified by astronomical observations and analysis of meteorites. A potential environment is the so-called accretionary disk. It is assumed that in the outer, colder layers of the accretionary disk dust particles were covered with ice. The gases in this environment shall resemble those of the original Miller-Urey experiment. Under ESA contract Joanneum Research and Graz University of Technology (Austria) together with their partners are currently finalizing Phase C/D of the Miller-Urey Experiment in microgravity. The science objectives of this experiment in microgravity are simulation of the accretionary disk environment with particle motion and formation of ice at low temperature when injecting water and feeding energy into the system. Two gas mixtures and the particles are contained in spherical vials. Each vial has electrodes and a small water reservoir. The vial's construction allows ultrasonic vibration and electrical cooling. The electrodes feed electrical energy into the system providing an arc. To avoid particle sticking the piezo will periodically be activated to give an impulse and to support a homogenous distribution of particles. The cooler construction keeps each vial at -5C during the experiment run to be able to form ice mantles around the particles when water is injected. The vials serve a leak rate of 10-10mbar*l/s to minimize intrusion of oxygen molecules. Two vials together with the thermal insulation are called Dual-Vial-Construction. Three DVCs are built and operated to investigate the influence of different operation times in microgravity. The Electronics-Box (EB), consisting of several PCBs, is a separate unit to control and monitor the DVC's. The EB is powered with 120VDC and has a serial communication interface to the spacecraft to send housekeeping data packets to ground for online tracking of proper autonomous operation. Before finalisation of the flight hardware the system undergoes a special cleaning procedure to ensure the inner vial volume is free of unwanted organic compounds before filling. The experiment will be operated in the MSG Glove Box on board of ISS. The gas mixtures and solid residues inside the vials will be analyzed on ground after return.