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Euglena and Eu:CROPIS: Biology meets technology

Eu:CROPIS (**Eu**glena:**C**ombined **R**egenerative **O**rganic-food **P**roduction **I**n **S**pace) is a DLR Compact Satellite, no return mission scheduled to launch in spring 2017. The whole satellite spins around its long axis and by this means applies different accelerations to the payload. The payload consists of two identical compartments of which one is active at any time of the mission. Each compartment contains two coupled life support systems. One is a combination of a greenhouse to grow tomatoes coupled to a microbial trickle filter, which converts synthetic urine to nitrate which in turn fertilizes the growing plants. In a second system, which is coupled via an exchange unit to the first system, two algae containers with *Euglena gracilis* culture supply the required oxygen. Furthermore, ammonia, a breakdown product of urea which is poisonous to plants in higher concentrations, is removed by *Euglena*.
As foreseen, one compartment will be active at Moon acceleration and the other at Mars acceleration. During the activity of the first compartment, seeds as well as algae are kept in a dormant mode in the second compartment. Each acceleration level will be applied for six month preceded by a three weeks algae growth and spin-up period. Numerous cameras will record the growth of tomato plants. The breakdown of urea will be analyzed by the use of an automatic ion chromatography system. The positioning of the algae tanks along the radius of the payload gives the unique possibility to analyze algae movement in respect to the acceleration vector and light in an acceleration gradient. A newly developed densitometer allows to determine the position as well as movement of the cells over the whole acceleration gradient. Furthermore, an automatic qPCR system will allow to monitor the expression level of 500 to 1000 genes. Monitored genes include functions for gravi- and phototaxis, photosynthesis, stress responses and metabolism.
The LED panels used for illumination of plants and algae include PAM sensors to address questions in regard of long-term reaction photosynthesis to enhanced radiation levels and reduced gravity. Furthermore, pH, oxygen, temperature, pressure and acceleration precision are monitored. All data sets are transmitted to ground. In addition, a radiation sensor system (DLR, Cologne) monitors radiation in and outside the payload.
The mission will demonstrate the use of the life support systems as recycling units and will supply invaluable data sets for the long-term stability of such systems in space on organismic, cellular, physiological as well as molecular level.