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BIM LAU-PE: CULTIVATING SEEDLINGS IN MICROGRAVITY

Abstract

The effect of gravity on plant roots is an intensive subject of research. Sounding rockets represent a cost effective and valuable platform to study this effect under micro-gravity conditions. As part of the upcoming MASER 13 sounding rocket campaign scheduled for autumn 2015, two experiments on Arabidopsis thaliana seedlings have been devised and financed by ESA: GRAMAT (GRavity Analysis on Maser rocket of A. Thaliana) and SPARC (a Specialized Phospholipase A, and Relocalization in auxin-transporting Cells in g). These experiments are aimed at studying (1) the genes that are specifically switched on or off during microgravity and (2) the position of auxin transporting proteins during microgravity. To perform these experiments, RUAG Space Switzerland site of Nyon, in collaboration with the Swedish Space Corporation (SSC) and University of Freiburg, has developed the BIM-LAU-PE (Biolology In Microgravity Late Access Unit Plant Experiment). This late access module which will be charged onto the rocket just hours before the launch includes 36 independent cassettes for cultivation of the seedlings. 12 of these cassettes are mounted on a centrifuge, providing 1g in-flight reference samples. At the start of the microgravity phase, the centrifuge is switched on and the cassettes are tilted by 90, thereby aligning the roots tips direction with the artificial gravity vector. The module itself is temperature controlled to provide optimal cultivation conditions for the seedlings. Each cassette can harbor several tens of seedlings which are chemically fixed (PFA or RNAlater) upon completion of the MASER microgravity phase by means of a dedicated injection system. The injection system is designed such that seedling cultivation compartment is filled devoid of any bubbles which could hinder fixation. The custom design was done by considering the injection dynamics in microgravity such as absence of gravity induced stratification. The injection system was tested during a dedicated parabolic flight in March 2014 (60th ESA Parabolic flight campaign, VP 110), validating its suitability for the BIM-LAU-PE cassettes. An overview of the BIM-LAU-PE module design is presented, highlighting specific module design features and verifications performed. A particular emphasis is placed on the parabolic flight experiments, including detailed results of the micro-g injection mechanism validation.