Paper ID: 34624
student

MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Facilities and Operations of Microgravity Experiments (5)

Author: Mr. Marcello Valdatta
University of Bologna / Polaris, Italy

Dr. Domantas Brucas
Space Science and Technology Institute, Lithuania
Mr. Ugnius Ragauskas
Space Science and Technology Institute / Vilnius Gediminas Technical University, Lithuania
Mr. Matas Razgunas
Lithuania
Mr. Tautvydas Skipitis
Space Science and Technology Institute / Vilnius Gediminas Technical University, Lithuania

UNMANNED PARABOLIC FLIGHT PLATFORM FOR REDUCED GRAVITY EXPERIMENTS

Abstract

The capability to simulate near-space conditions (reduced gravity and vacuum) gives the possibility to achieve important results in order to test or qualify a component for an actual spaceflight. Moreover, an other important application of the near-space condition is the biological and physiological research. There exist different platforms capable to reach the near space condition, or part of them (the reduced gravity is one of the most difficult to have access). Otherwise these platforms are either very expensive (like sounding rocket, parabolic zero-g planes flight or ISS experiments) or of a very short duration (like the dropping tower). Another important issue is the repeatability of the experiment for some platforms. A platform such as sounding rocket, for example, even if it can guarantee a good time and a good quality for microgravity conditions, does not ensure quick repeatability of experiment. Each flight requires at least two year of preparation. Fast repeatability platform (ensuring fast turnaround time), like dropping tower, can guarantee only few seconds of microgravity time, which often is not enough for some experiments. A platform for microgravity experiments, that will cover the needs of all the experiments that cannot fit into required time, cost and repeatability of any other experiment methodology, is needed. Thanks to the progress in the field of unmanned systems and thanks to the born of rules for this kind of planes it was possible to develop a new family of unmanned planes to perform scientific parabolic flight. All the unmanned platforms have similar payload-capsule. This capsule will allow experimenting at different level of pressurization and provided with a service module. The first plane is a parabolic flight plane that achieve few seconds of microgravity conditions but with the possibility of experiment at practically any area; the second plane equipped with different propulsion unit that allow increasing the time for the experiments and to reduce the vibrations. The last platform is an unmanned plane-shuttle, which is released from a stratospheric balloon. During the free falling phase, the payload inside the plane experiences a microgravity condition. When, due to the augmentation of the air density the plane will decrease the acceleration, the capsule will manoeuvre and start to perform a series of parabolas to achieve microgravity conditions several times. A long repeated microgravity phase and small vibrations are expected. The paper presents the mission plan and the first tests on the systems.