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DEVELOPMENT OF A PSEUDO-CUBESAT AND DEPLOYER FOR TECHNOLOGY DEMONSTRATION IN MILLIGRAVITY ENVIRONMENT

Abstract

Most modern-day CubeSats require precise attitude actuation, which is typically provided by reaction wheel systems. At Technische Universität Berlin (TU Berlin) an alternative means of angular momentum exchange is being researched. Pico-satellite fluid-dynamic actuators (pFDAs) induce torque by changing the motion of a liquid metal inside a closed-loop channel. To further advance the technology of pFDAs, their capabilities will be demonstrated in milligravity.

Technische Universität Berlin Pico satellite Experiment-6 (TUPEX-6) is a student-driven mission that provides with the opportunity to conduct an experiment in milligravity environment. To achieve the necessary experimental environment, TUPEX-6 is participating in the Rocket and Balloon Experiment for University Students (REXUS/BEXUS) program. In March 2019, TUPEX-6 will be launched on-board REXUS 26. A free falling unit, resembling a 1U CubeSat is being developed, concurrently with rocket-borne equipment and ground station. The pseudo-CubeSat hosts an 3-axis redundant attitude control system, consisting of four pFDAs, to perform the experiment. The rocket-borne equipment is being developed to enable the ejection of the free falling unit from the rocket. Utilizing the ground station, any data that will be transmitted by the pseudo-CubeSat is received.

Besides the pFDA attitude control system, the free falling unit contains all subsystems necessary for a CubeSat. In addition, it holds a recovery system, including a parachute, which is ensuring the survival of the pseudo-CubeSat. The ejector on-board the rocket is being developed to comply with the CubeSat design specifications. Furthermore it features an electrical interface to the deployed unit. After ejection of the free falling unit, data will be gathered and transmitted to ground. The TUPEX-6 ground station that is being developed will be set up in the launch area, to allow reception of transmitted data. Each system provides the developing students with a comprehensive hands-on experience, by allowing them to drive a mission through all phases of a space project.

Currently in mission Phase C, the TUPEX-6 team is working towards the critical design review and design completion in June 2018. By October 2018, the system will be undergoing assembly, integration and test with closure of mission Phase D in December 2018. This paper describes the finalized system architecture and the achieved test results to date.