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

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CHALLENGES AND OUTCOMES FOR A FULLY-AUTONOMOUS MICROGRAVITY PLATFORM TO PERFORM PARABOLIC FLIGHTS IN NORTHERN SWEDEN

Abstract

Flying Attitude STabilized ExpeRiment (FASTER) is a student project that aims to develop a platform to improve microgravity conditions in parabolic flights performed with small engine planes. By doing so, the project aims to make parabolic flight campaigns available at lower cost, easier to plan and applicable to any small airport. The platform has a cubic design with a fully autonomous Attitude Control System (ACS) consisting of three reaction wheels in an orthogonal configuration and has been developed to allow an easy integration and access to the payload bay, which will be located inside of the cube.

As the platform needs to react in a very short period of time, the team has developed a custom Real Time Operating System (RTOS) which ensures that the system can perform at the required reaction time with a low-cost computer. With the RTOS, the platform can operate completely autonomously during the full duration of the flight. A custom wireless communication system has also been developed to be able to retrieve real time telemetry and data during the flight as well as sending telecommands.

The Attitude Determination and Control System (ADCS) system consists of an Inertial Measurement Unit (IMU) with an accelerometer and a gyroscope that provide information about the attitude of the platform. A PID controller is used to control the reaction wheels to diminish the effects of external forces and stabilize the platform.

FASTER is currently manufacturing the platform structure and setting up the electronics system. The flight campaign will happen during summer 2022. In order to perform the flight campaign, a Cessna will be adapted to allocate a basket in which the platform will perform the stabilization maneuvers during the short microgravity time that this aircraft will provide. In addition to the basket, the team must ensure that both pilot and platform operator can perform a safe flight. For that reason, a technical safety plan is under development which will consist of the possible failures and issues that could be experienced during the flight and the solutions and procedures to ensure a safe flight.