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BUTCUBE – ROAD FOR CUBESAT IN-ORBIT SOLAR ECLIPSE OBSERVATION MISSION UTILIZING 1U DEMONSTRATOR

Abstract

An In-orbit Solar Eclipse Observation mission was pre-selected for the potential future scientific flight mission of the Brno University of Technology (BUT, Czech Republic) CubeSat. The mission would be a valuable addition to existing top-level research of Sun Corona at BUT, performed in cooperation with University of Hawaii. The goal is to perform space-based Corona observation during Sun eclipse by Moon. This mission significantly expands the concurrent options by increasing number of possible observations of total Solar eclipses and providing the unique data from region close to the Suns surface.

The flight mission is to be simulated on 1U BUTCube platform, that is currently under development. BUTCube is the very first student CubeSat project at BUT. Composed of 5 Ph.D. candidates, pioneering in space technology, the team was supported within an internal Ph.D. grant competition. This paper presents the demonstration mission development and lessons learned.

The flight mission requirements, including potential observation orbits were studied. An algorithm capable of searching the observation orbits and their parameters was proposed. This allows the further electric power, link and thermal budget scaling and creates a benchmark for the demonstration or flight mission. The 2025 observation orbit was further analysed. All the 1U BUTCube systems are custom made, adopting ESAs Fly Your Satellite design specification. The EPS and communication systems were designed with respect to planned mission. BUTCube frame will be 3D printed from PEEK material and subjected to experimental eigen frequency testing. The experiment should support modal analysis results, creating inputs for the future structural considerations. The frame will also house 2 Mpx camera simulating main flight mission payload. The demonstration goal is to test the CubeSat systems functionality including image processing in the same way as they would be handled on board flight mission. With no previous CubeSat knowledge, the team plans to embrace the CubeSat development experience during the flight mission preparation and upcoming BUT CubeSat projects.