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STRUCTURAL DESIGN, MODELLING AND TESTING OF A 2U CUBESAT THERMAL/VISUAL IMAGING PAYLOAD.

Abstract

Few detailed reports of AIT campaigns for CubeSats exist in the literature. The aim of this paper is to offer some insights into the test campaign of a student CubeSat payload together with some recommendations. PROVE Pathfinder is the University of Bristol's volcano imaging CubeSat payload. This 2U payload consists of a visual and a thermal infrared camera, and their power and control electronics. In April 2023, the team conducted an environmental testing campaign at the ESA CubeSat Support Facility in Belgium, under ESA's Fly Your Satellite Testing Opportunities scheme. This test campaign aimed to structurally qualify the payload to survive a nominal worst-case launch in accordance with relevant space standards.

This paper presents the structural modelling and test design employed for the payload. Through rigorous finite element modelling, the study calculates the anticipated structural response under a varying launch environment, thereby informing the test strategy.

The results of the testing campaign are presented. Challenges in mode identification within the response dynamics are acknowledged, stemming from proximity of frequency peaks meaning they are excited simultaneously. In addition to this, where possible, evidence-based reasons for frequency/amplitude shifts in modes are provided.

Furthermore, the paper offers recommendations for future vibration testing campaigns of CubeSat payloads, drawing upon lessons learned from this campaign. By describing the methodology and challenges encountered, it is hoped that this study helps other student teams who are contemplating qualification of CubeSat payloads.