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Letter to the Editor

A JoSS Special Issue on Quetzal-1 - Guatemala's First Satellite

Dear Editor,

We are honored that the Journal of Small Satellites' (JoSS's) first themed issue features Quetzal-1, Guatemala's first satellite: a 1U CubeSat that operated in orbit from April to November 2020. Of special note, because there are no graduate level engineering programs in Guatemala, this project was undertaken and completed mainly by undergraduate students. Moreover, budget limitations on this pioneering space project required our team to develop several of the satellite's subsystems in-house. In this context, the project's leadership is proudest of the fact that Quetzal-1 was developed, tested, and operated by a group of around 100 people averaging 21 years of age, leading to the project's landmark successes and the laying the foundation for further satellite research and development in Guatemala.

Quetzal-1 won the KiboCUBE program of UNOOSA and JAXA in 2017, the AIAA's People's Choice Award in 2020, and the CubeSat Delivery Prize of Arizona State University in 2022. The project was also nominated for AIAA's Small Satellite Mission of the Year in 2020. The success of the Quetzal-1 project also led to the establishment of Guatemala's first Aerospace Research Laboratory at Universidad del Valle de Guatemala (UVG), where we developed Quetzal-1 and which now provides a platform for Guatemalan students to explore and develop aerospace engineering and foster innovation and collaboration in aerospace. The Laboratory currently has more than 25 active undergraduate students working on three primary research lines of investigation: nanosatellite subsystem design and implementation, low-cost and open-source environmental testing equipment design and implementation for nanosatellites, and the evolution of Quetzal-1 into the Quetzal-2 project.

This special issue includes the first two manuscripts on Quetzal-1. First is "Design and On-Orbit Performance of the Electrical Power System for the Quetzal-1 CubeSat," which presents the architecture and on-orbit operation results of the power system developed inhouse for the spacecraft. As presented in the manuscript, the EPS ensured a positive power margin throughout the satellite's mission, generating enough power to meet the satellite's demand and keeping the battery recharged regardless of the operating conditions. The second paper is "Design and On-Orbit Performance of the Attitude Determination and Passive Control System for the Quetzal-1 CubeSat," which included a Passive Magnetic Attitude Control (PMAC) system and an array of sensors to attain attitude. This manuscript describes how the on-orbit data validated the design. For example, the PMAC was able to detumble the satellite within a week and keep an adequate attitude throughout the mission, enabling photo-capture operations and permitting adequate solar energy harvesting. These manuscripts aim to thoroughly detail the design considerations taken and be a descriptive case study into the performance of an ADCS and an EPS in a limited system, wishing to provide valuable insight to other novice teams in this endeavor. This is supported by our inclusion of our engineering drawings, code, and other ancillary information so that other teams may replicate and build upon our work.

During the seven years it took to design, build, launch, and operate the satellite, we received unconditional support from many persons and organizations that made this project possible. JoSS is one of them, publishing our 2016 paper "A Methodology for CubeSat Mission Selection" when we were still struggling in the first phases of our project. At that time, we dreamed of our satellite in space but never imagined its level of operational success and that this satellite would receive such international recognition, greatly exemplified by this special edition in JoSS.

With great gratitude,

L. Zea[1], V. Ayerdi[2], J. Bagur[3], D. Álvarez[4], A. Aguilar-Nadalini[5]

[1]*Universidad del Valle de Guatemala, Guatemala lpzea@uvg.edu.gt*
[2]*Universidad del Valle de Guatemala, Guatemala vhayerdi@uvg.edu.gt*
[3]*Universidad del Valle de Guatemala, Guatemala jabagur@uvg.edu.gt*
[4]*Universidad del Valle de Guatemala, Guatemala alv14628@uvg.edu.gt*
[5]*Universidad del Valle de Guatemala, Guatemala agu15170@uvg.edu.gt*