

The Development of Operating Software for an OPEN Small Spacecraft

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Abstract

The OpenOrbiter program aims to design and demonstrate the Open Prototype for Educational NanoSats (OPEN) framework. OPEN reduces small spacecraft development costs by making the design plans freely available to any institution that wishes to use them. OpenOrbiter will demonstrate the viability of this design via being launched into low-Earth orbit (LEO).

This poster presents the initial design work for the Operating Software for the OpenOrbiter spacecraft. Operating software efficiency is extremely important due to the limited level of communication with ground-based operators and limited onboard power production. The operating software performs task scheduling, constraint compliance management, and schedule optimization onboard the spacecraft. Constraint compliance management requires monitoring and consideration of numerous factors including the current battery level, onboard temperature, scheduled tasks, and GPS location. Research has been completed to determine how best to achieve these goals. This work considered the genetic algorithm-based approach, the exhaustive search-based approach and the heuristic-based approach. This heuristic-based approach has been selected due to its flexibility and robustness to facilitate different types of prioritization. From this research, a flow for operations was developed. Through collaboration with the Ground Control Software and Payload Software development teams, an efficient interface standard was created to consistently communicate with each of these systems. Continuing and future work include implementing this software on actual hardware, creating communication with all onboard hardware as well as ground-based controllers, as well as onboard monitoring and scheduling software. Once these goals are achieved, the spacecraft will be put through rigorous testing validate unit and integrated-system operation while verifying correct functionality through a variety of tests and conditions.