

IAF SPACE SYSTEMS SYMPOSIUM (D1)  
Interactive Presentations - IAF SPACE SYSTEMS SYMPOSIUM (IP)

Author: Mr. Theodore Ouyang  
BLUECUBE Aerospace, United States

Mr. William E. Mayville  
BLUECUBE Aerospace, United States

Mr. Kevin Simmons  
BLUECUBE Aerospace, United States

## PREVENTING SINGLE EVENT UPSETS IN MICROBIT CHIPS IN A HOSTED LEO PAYLOAD

**Abstract**

The FlipSat-1 is an optimization mission that seeks to optimize methods of radiation hardening. FlipSat-1 will test three different methods of radiation protection, however recent design changes have allowed for the possibility of more. Results from FlipSat-1 can then be taken into further application for large satellites and high radiation sites on Earth. The primary mission of the FlipSat-1 is educational. The FlipSat-1 team is composed of high school and middle school students of South Florida. Throughout the process of building the FlipSat-1, students will practice and learn relative aerospace and networking skills. The FlipSat-1 will launch as a hosted payload due to the financial means of the team and the simplicity that it offers. The FlipSat-1 will use the micro:Bit hardware for radiation testing due to the pre-existing platform that it provides for education and the compatibility that it would have with preexisting student skills. Additionally, using the micro:Bit system in space would provide a proof of concept for its usage in space as it is not space designed hardware. The three methods of radiation hardening that the FlipSat-1 will be utilizing are error-correcting code, watchdog timers, and physical radiation protection. All tests will be running on small heat hardened printed circuit boards (PCB.) Error-correcting code will be tested on 5 different printed circuit boards. Watchdog timers will have 3 PCBs for physical watchdog timers, with a period kick, and 3 PCBs for electronic watchdog timers with a function-based kick. Physical protection will use a thickness of physical protection ranging from 1 to 5 millimeters of material, each material having 3 PCBs. Error-correcting code (ECC) is a database focused system. ECC is a common method of error prevention, commonly used in data transmission in circumstances where data packets may be prone to loss. The system works by automatically changing data by checking that with pre-existing notions. Watchdog timers are another type of software radiation protection that will be tested on the FlipSat-1. If the proper usage of a function is not detected, the watchdog timer will manually reset the system (a kick,) which, should there be a code failure, would result in that being wiped. Additionally, simply time driven automatic resets can be used which will reset the system over intervals automatically, regardless of function error.