

IAF SPACE EDUCATION AND OUTREACH SYMPOSIUM (E1)
Lift Off - Secondary Space Education (2)

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THE WOLVERINE CUBESAT DEVELOPMENT TEAM FLIPSAT PROPOSAL: ANALYSIS OF
SINGLE BIT FLIPS AS A FUNCTION OF RADIATION HARDENING**Abstract**

The Wolverine CubeSat Development Team of Palm Beach Garden, Florida became the first middle school to launch a 1U CubeSat through NASA's Educational Launch of Nanosatellites (ELaNa) Program and the CubeSat Launch Initiative (CSLI) on December 3rd, 2018. Launched aboard a Falcon-9 from Vandenberg Air Force Base and deployed from the SpaceFlight Industries FreeFlyer into a sun synchronous orbit, this novel picosat is designed to evaluate the viability of extremophile bacteria in low Earth Orbit, which could provide insight into the theory of panspermia. Upon arriving at The Weiss School in the fall of 2015, Aerospace instructor Kevin Simmons formed the satellite development team with the intention to design, build, test, and fly the 1U CubeSat within three years. The students later determined they intended to build a biotechnology payload, and partnered with two aerospace contractors: Near Space Launch for the spacecraft bus, and NYRAD for the spacecraft payload.

Based on the high quality of student experiences and knowledge gained during the WeissSat-1 development, Simmons divided his students into six teams, each determining their own missions and spacecraft bus configurations. Students drafted proposals per NASA's CSLI guidelines and conducted a Preliminary Design Review (PDR) with six aerospace engineers in November 2018. The six student proposals consisted of five 1U or 2U CubeSats and a 1U lunar rover. One of these proposals is FlipSat, a 2U CubeSat which will consider multiple parallel microprocessors with varying levels of radiation hardening which will operate concurrently with a ground unit. Optimization of the radiation hardening is critical to insuring the consistent operation of microprocessors in space.

FlipSat can provide direct benefits to future space missions. FlipSat will help determine the optimal amount of radiation hardening for missions to be safe from bit-flipping in the presence of ultra high energy cosmic rays. While the Bitflip's technical mission is as a technology demonstration, its primary mission is that of education. Bitflip will allow a new generation of middle school students to develop, build, test, and fly a CubeSat before they enter high school.