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DESIGN AND DEVELOPMENT OF A SUN SIMULATION DEVICE FOR TESTING
NANO-SATELLITES

Abstract

F-1 was one of five pico-satellites (CubeSats) deployed into orbit from the ISS on Oct 4th 2012. The satellite development started late 2008 and during the testing phase, the project team implemented a long-duration test campaign where the satellite was kept operational under simulated Sun light for a long period. The test lasted for more than 150 hours (equivalent to 10 orbits) to verify that the satellite can operate on its own autonomously, evaluating system reliability. In order to perform the test, the team had designed and built a Sun simulation device consists of halogen and xenon lamps mounted on a detachable steel frame. The lamps were controlled by a micro-controller and the user can set the “light” and “dark” durations to simulate the sunlight and eclipse conditions of different orbits. The satellite itself was placed on a 2 degrees-of-freedom rotating device to simulate the satellite’s spin while in space. The device contains a micro-controller allowing each axis’s rotation speed to be adjusted independently, effectively simulating different satellite spin scenarios in space. These devices were built from readily available and low-cost materials, and they can be quickly built in less than a month by a typical CubeSat team. This paper will describe the design, manufacture and operation of the Sun simulator and the 2-DOF rotating machine. Some lessons learned in F-1 CubeSat project will also be provided.