

Technology Roadmaps for Space Exploration (09)  
Poster Session (P)

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## TESTING OF APPROACHES OF MITIGATION OF RADIATION INFLUENCES

**Abstract**

The short-term mission electronics for the Low Earth Orbits (LEO) spacecrafts can be based on the Commercial Off-The-Shelf (COTS) components reducing significantly the total budget. The COTS parts are not usually radiation tolerant, but with proposed approaches it can survive higher radiation doses enough to meet the mission requirements.

Proposed paper describes testing of approaches used to raise the radiation tolerance of low cost electronic components. Digital three-axis fluxgate magnetometer and switch-mode power supply both based on discrete semiconductors intended to CubeSat mission were irradiated to prove the radiation mitigation techniques on COTS electronics.

Method of fully autonomous cold-redundancy switching mechanism was developed. It was determined that two identical COTS systems powered by such power switching mechanism can withstand and work properly up to four times longer than one stand-alone. The non-operating (unbiased) unit usually degrades even slower than the biased one. The switching mechanism is based on radiation tolerant or radiation hardened discrete transistors, making sure that there will not be any failure from this part.

Methods can be easily modified and rated precisely for systems with up to 500 W of input power. Proposed approaches can be used in future missions to save money and resources while keeping high operational lifetime and scientific benefit as with very expensive electronic components.

The COTS components can be changed to radiation tolerant/hardened in the same functional way.

CzechTechSat is a student scientific mission planned by the Czech Technical University in Prague. Its purpose is to build a CubeSat to demonstrate mentioned approaches. In the experiment we propose using of a three monitored identical electronic systems (e.g. COTS GPS receiver, AMR magnetometer, etc.). One fully stand-alone, and two cold-redundant equipped by the switching mechanism. Total time of operation will be measured and compared each other and with identical devices tested in the laboratory.