

23rd IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)
Generic Technologies for Nano/Pico Platforms (6B)

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FAILURE FRIENDLY CUBESATS: DEVELOPING GUIDELINES TO FACILITATE ON-ORBIT
FAILURE ANALYSIS**Abstract**

In recent years, the CubeSat community has established a new approach to the development of space systems. Key characteristics of this new approach include an increased risk tolerance, the utilization of the latest commercial electronics components, and the availability of frequent launch opportunities. The resulting spacecraft can achieve remarkable performance to cost ratios while remaining small enough to meet the CubeSat specification. Frequently launch opportunities allow CubeSat developers to perform many of their qualification experiments in orbit, learn from the results and quickly fly an improved version of the system. We can call this the fly-learn-refly development approach (FLRDA). This development approach has proven quite successful with over 300 CubeSats in orbit and many more in development. However, it is inevitable that CubeSats will encounter on orbit failures during the development of new components or techniques. In order to take full advantage of these in orbit experiments, the failure points and any root causes must be identifiable. This ability to identify failures from telemetry data is critical to the success of FLRDA. It is therefore critical to identify key spacecraft parameters that can support spacecraft health diagnostics. Cal Poly's PolySat team has been developing CubeSats for over a decade and has had the opportunity to analyze the in orbit performance of a number of internally developed systems, including a number of failures. This paper describes the processes and results for failure analysis performed by the PolySat team and the steps that were taken to improve the team's designs and processes. The results of these investigations are then used to provide general rules of thumb to provide satellite developers with improved diagnostics capabilities from in orbit data.