Paper ID: 43064
oral
student

51st IAA SYMPOSIUM ON SAFETY, QUALITY AND KNOWLEDGE MANAGEMENT IN SPACE ACTIVITIES (D5)
Quality and safety, a challenge for traditional and new space (1)

Author: Mr. Michael Weisgerber
Technical University of Munich, Germany, michael.weisgerber@tum.de

Mr. Martin Langer
Technische Universität München, Germany, martin.langer@tum.de
Mr. Stephan Neumann
TU Muenchen, Germany, Stephan.Neumann@berns-engineers.com
Mr. Florian Schummer
Technical University of Munich, Germany, f.schummer@tum.de

RELIABILITY PREDICTION OF STUDENT-BUILT CUBESATS

Abstract

Since their introduction in 1999, CubeSats emerged from a simple idea of standardizing small satellites to an accepted design baseline. More than 700 CubeSats have been launched so far, and many of them enabled students to work on real space hard- and software. Nowadays CubeSats are used not only for science and education purposes, but also in commercial missions, and many of them are demonstrating novel technology for the first time in orbit. Analyses of past missions revealed a large amount of catastrophic failures in the first few days. Almost twenty percent of all CubeSats failed immediately after the launch and another ten percent failed within the first few weeks of their mission. These numbers are too high even if considering the role of CubeSats missions as cheap technology demonstrators with an inevitable amount of risk. Engineering flaws and the use of new technologies were identified as the main contributors to this high infant mortality rate. In the past, we researched new approaches to reduce these failures and minimize the high number of infant mortality and dead-on-arrival cases. Since these approaches focus on reliability improvement during system level testing, the comparability between projects is low and the methods cannot be used for early design tradeoffs. To predict CubeSat reliability also in early design stages, we now matched approaches from the automotive and aerospace sector with the typical requirements of low cost CubeSat projects. In this paper, we will present this prediction method. The biggest advantage is that this method does not require a lot of input data, a bill of materials is sufficient. This allows to predict the lifetime of the system very early when assuming zero functional failures. We will also report on the implementation of the method on our CubeSat MOVE-II and the lessons learned of this process. We expect that the proposed method is able to predict the reliability of CubeSats in early design stages with a sufficient level of confidence while being no too much of a burden to the limited resources of universities. The proposed method is also capable of predicting the reliability of bigger satellites when built of automotive qualified or commercial off-the-shelf components.