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PRODUCT ASSURANCE FOR SMALL SATELLITES IN RESPONSIVE SPACE WITH MODULAR PAYLOAD AND COTS-PLATFORM

Abstract

Product assurance (PA) is a crucial but resource- & time-consuming part of large space missions. In contrast, PA on CubeSat missions is very lightweight, with low resource and time investments. With the growing demand for day-and-night communications and the push for easier and affordable access to space, more and more small satellite constellations and missions are emerging. This demand for uninterrupted availability makes space systems and constellations vulnerable to failures or malfunctions of individual space elements. Given the typically long development and build times for specially designed platforms to meet payload requirements, the need for responsive space systems arises. The concept used in this paper for responsive space is a commercial off-the-shelf (COTS) platform with a costumer provided modular payload. Thereby time can be reduced and a faster replacement of a faulty element in a space constellation can be achieved. Same method can be applied to accelerate the dispatch of important science, observation or military missions. Such a response is feasible in accordance with small satellites within a medium budget and sole focus on the modular payload. These changing environmental conditions necessitate a more streamlined and viable PA for small satellites with a focus on payload, reduced time, and medium budget & resources.

This study presents an initial analysis for payload PA in combination with small satellites based on responsive space. A brief opening of established and possible future responsive space concepts is included. Moreover, an examination of the most time- and work-intensive activities in traditional PA with respect to their risk-mitigation effect forms the basis for further analysis on payload PA in responsive space. Additionally, a analysis of the most common failures with low product assurance CubeSats and low budgets against high product assurance missions with high budgets is concluded. This analysis derives into a preliminary search for predictive failure characteristics in correlation to the applied product assurance, since failure statistics are missing for medium budget small satellites.