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ASSESSING POWER CAPABILITY AND DEGRADATION OF ON-ORBIT SATELLITES THROUGH AUTOMATED EXPERIMENTS

Abstract

Planet currently operates and maintains the world's largest Earth observation satellite constellation. In order to satisfy Planet's high demands for daily coverage, it is critical to maintain and optimize satellite operations to a high standard. Planet's SuperDoves utilize solar panels to charge onboard batteries. After three years of continuous operations, we designed an automated experiment to assess the power capabilities and degradation of the solar panels. Understanding how power generation deteriorates over time informs important programmatic decisions regarding future launches, expected satellite lifetime and satellite performance. For commercial companies, the power system capability of satellites is integral to determining the capacity of satellite operations. Current understanding of power generation and power capability is derived from recorded values and idealistic calculations, but include little to no consideration of the unique stressors from a space environment or nominal operations. Previous studies done in-house have demonstrated a correlation between depth of discharge and average power generation over an orbit, which was not predicted by our theoretical understanding of SuperDoves' power. In this experiment, we increase a satellites' operations incrementally, recording both depth of discharge and power generation and assessing overall satellite health at each stage. The experiment's goal is to determine the extent to which the relationship between depth of discharge and power capability has deteriorated over time. This paper covers the experimental design, including the implementation of automation for a relatively hands-off process for the operator, execution, as well as subsequent results and analysis. Continued implementation of this experiment in the future will help build a more robust model of power capability, and therefore fleet capacity, over time.