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Author: Ms. Amanda Donner
Jet Propulsion Laboratory, United States, Amanda.Neufeld@jpl.nasa.gov

Mr. Peter Di Pasquale
Jet Propulsion Laboratory - California Institute of Technology, United States, Peter.Di.Pasquale@jpl.nasa.gov
Mr. Brian Campuzano
Jet Propulsion Laboratory - California Institute of Technology, United States, Brian.P.Campuzano@jpl.nasa.gov
Mr. Matthew W. Smith
Jet Propulsion Laboratory - California Institute of Technology, United States, Matthew.W.Smith@jpl.nasa.gov
Mr. Christopher Pong
Jet Propulsion Laboratory - California Institute of Technology, United States, Christopher.M.Pong@jpl.nasa.gov
Ms. Mary Knapp
Massachusetts Institute of Technology (MIT), United States, mknapp@mit.edu

ASTERIA OPERATIONS DEMONSTRATES THE VALUE OF COMBINING THE MISSION ASSURANCE AND FAULT PROTECTION ROLES ON CUBESATS

Abstract

On November 20, 2017, ASTERIA (Arcsecond Space Telescope Enabling Research in Astrophysics), a 6U CubeSat performing a technology demonstration of astrophysical measurements, deployed from the ISS. The specific technical goal is to achieve precision photometry via arcsecond-level line-of-sight pointing error and highly stable focal plane temperature control. Throughout development and operations, the roles of mission assurance and fault protection have proven critical to achieving this goal. Given the budget and schedule constraints typical of a CubeSat, innovative tailoring of processes has been critical to success throughout both development and operations of ASTERIA. Mission assurance and fault protection are both areas in which this tailoring is key. Mission assurance played an important role in identifying and evaluating risk and developing cost-effective mitigations. Flexibility in the fault protection design offers a variety of options for implementing risk mitigations as risks are uncovered both in integration and testing of the CubeSat, and in mission operations. This paper will discuss the approach taken on ASTERIA to implement mission assurance and fault protection and the resulting benefits to operational efficiency and success. It will briefly address the advantages of this approach during development, in which the combination of the roles provides mission assurance significant insight to system risks, which feeds back into testing methodologies and directly into fault protection design. In more detail, operations will be discussed, in which the roles merge to identify in-flight fault protection updates to efficiently respond to anomalies and improve the likelihood of successful technology demonstrations. The paper will also detail the tools that are used to analyze data, identify anomalies, and develop the updates to uplink to the spacecraft. Finally, the general operational approach will be discussed to highlight the usefulness of the ASTERIA processes and their applicability to future CubeSat missions.