

Methods for LEO Testing of CubeSat Propulsion Systems

Low Earth Orbit is becoming an inexpensive and readily available technology demonstration environment. Many new CubeSat technologies are taking advantage of this as an economical mechanism to advance beyond TRL 5. A wave of CubeSat propulsion systems favoring both reaction control and primary thrust will approach TRL 5 over the coming years, with some already there. These propulsion systems cover a wide range of capabilities including taking CubeSats to interplanetary destinations. In order to determine the feasibility of using LEO to validate the propulsion system performance and in doing so raising the TRL, a variety of factors need to be addressed. These factors include: method of measurement, environmental disturbances, spacecraft control states, and spacecraft mass properties. Propulsion Pathfinder is a NASA Ames Research Center lead project focused on raising the TRL of multiple propulsion systems over a series of flights in the coming years. This paper will highlight a few of the methods of measurement considered by this project to validate the performance of a propulsion system. The measurement methods range from tracking acceleration and/or wheel spin-up to monitoring Two Line Elements between thrusting and non thrusting states. Focus will then be placed on the uncertainty of the measurement method and subsequently it's feasibility through an analysis of LEO disturbance environment models and common CubeSat mass properties. In addition, the primary spacecraft control states and their imposition from the propulsion system are assessed.