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# NEA SCOUT PROPULSION SYSTEM TESTING

**Abstract**

As CubeSat capabilities improve to meet the needs of users, the demand for propulsion systems is increasing as a way of extending the operational envelope of the spacecraft. To support this emerging capability NASA is working with vendors on various missions to advance the use of propulsion systems. The Near Earth Asteroid Scout (NEA Scout) spacecraft will launch as a secondary payload on EM-1, the first flight test of NASA's Space Launch System. NEA Scout is a 6U CubeSat designed to conduct reconnaissance of near Earth asteroids using a deployable solar sail as the primary propulsion system. The focus of this paper is on the secondary propulsion system, a high performance refrigerant (R-236fa) cold gas system responsible for the initial trajectory correction maneuvers and transitions to attitude control following sail deployment. The propellant is stored as a two-phase fluid in the tank and expelled through thrusters as a cold gas. A smaller plenum is used to ensure vaporization of the propellant prior to thruster firing. This approach reduces heater power and provides greater control over the fluid properties when compared to flowing directly from the tank to the thrusters. A ground test article was designed to be similar to the NEA Scout flight system with the goal of replicating the operating conditions of the flight system critical functions. The ground test article employed a similar layout to the flight propulsion system with an emphasis on accessibility and configurability. Analysis and testing were completed at MSFC to better understand fill/drain procedures, long term storage conditions, and flight system fluid properties during simulated flight conditions. The data collected helped to define the heater power required to avoid liquid propellant from reaching the thrusters. Testing also showed that the presence of liquid in the plenum can be detected using a only pressure transducer. A performance test of the RCS is planned for May 2017 to measure the differences in nominal thrust between the six flight thrusters. Thrust variability is expected to be primarily a function of nozzle manufacturing tolerance and could be corrected for in software. The test will primarily measure thrust magnitude but will also give some insight into thrust misalignments. The results and experience gained from these tests serve to provide insight for similar future work as NASA hopes to support and accelerate the development of CubeSat propulsion systems.