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THE CANX-4&5 MISSION: ACHIEVING PRECISE FORMATION FLIGHT AT THE NANOSATELLITE SCALE

Abstract

Future missions involving multiple nano- and microsatellites will require highly precise absolute and relative position knowledge and control; intersatellite communications; high-performance attitude determination and control systems; and advanced, compact propulsion systems for orbit maintenance. The dual spacecraft CanX-4&5 mission—slated to launch in 2013 on India's Polar Satellite Launch Vehicle (PSLV)—will demonstrate all of these capabilities at the nanosatellite scale: both as standalone subsystems, and in concert, to accomplish autonomous formation flight with sub-meter relative position control and centimeter-level relative position determination. CanX-4 and CanX-5 are individual spacecraft based on the Space Flight Laboratory (SFL) Generic Nanosatellite Bus (GNB). Each spacecraft is identical, and formation flight is enabled by each satellite having a GPS receiver, on-board propulsion system, S-Band inter-satellite link, and fine guidance, navigation and control (GNC) computer. The two spacecraft will share on-board position, velocity, and attitude data wirelessly over their intersatellite link, and one of the two spacecraft will perform propulsive maneuvers to achieve and maintain a series of autonomous formations. The technologies and algorithms used on CanX-4&5 are extensible to a broad range of missions and satellites at the nano- and microsatellite scale; thus, this ambitious technology demonstration will serve as a pathfinder for several formation flight and constellation applications.