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THE TREND IN SFL NANOSATELLITE PERFORMANCE

Abstract

The Space Flight Laboratory (SFL) at the University of Toronto develops advanced nanosatellites for various applications. SFL has three different spacecraft platforms to suit various mission needs: the 3.5 kg, 10 cm by 10 cm by 34 cm CanX-2 platform, the 7.5 kg, 20 cm by 20 cm by 20 cm Generic Nanosatellite Bus (GNB) platform, and the 15 kg, 20 cm by 20 cm by 40 cm Nanosatellite for Earth Monitoring and Observation (NEMO) platform. Each platform can be configured to meet different mission requirements. Both the GNB and NEMO platforms may be equipped with fixed appendages. The CanX-2 platform is named after the CanX-2 spacecraft, which has been operational since April 2008. The three-axis stabilized, one-axis controlled CanX-2 continues to perform as a technology demonstrator and an atmospheric science platform. The passively stabilized NTS, operational since April 2008, continues to perform ship tracking. NTS implements CanX-2 avionics in the GNB form factor and includes a 46 cm fixed payload antenna. NTS was developed within seven months, from contract start to launch, demonstrating responsive space. The GNB platform has been operational since July 2010 with the launch of AISSat-1. The three-axis controlled AISSat-1 performs regional ship tracking and includes a 46 cm fixed payload antenna. Eleven additional nanosatellites are currently at various stages of development at SFL. These include the BRIght Target Explorer (BRITE) space astronomy constellation, comprising six 6.5 kg spacecraft each carrying a 3-cm aperture telescope. Each BRITE spacecraft utilizes a star tracker to achieve 1 arcminute pointing control, a two-order of magnitude improvement to the attitude control ofAISSat-1. The six BRITEs will be deployed in pairs into multiple sun-synchronous orbits (SSO) - the first two are scheduled to launch towards the end of 2011 into a dawn-dusk SSO. Two 6.5 kilogram spacecraft, CanX-4 and CanX-5, intend to demonstrate precision formation-flying using differential GPS and a nanosatellite propulsion system. CanX-7 will demonstrate new de-orbiting technology. AISSat-2 is under construction and will follow the footsteps of AISSat-1. The first satellite based on the NEMO bus is NEMO-AM (Aerosol Monitoring), which will be used to study regional aerosol distribution using a multi-band, dual-polarization optical instrument. NEMO-AM further pushes the performance envelope of a nanosatellite by implementing an 80 W, 160 Wh power system and a computer capable of handling a data rate in excess of 400 Mbps. This paper outlines the continuing trend of performance advances on SFL nanosatellites.