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CONSIDERATIONS FOR DEVELOPING CRITICAL SPACE WEATHER CUBESAT MISSIONS

Abstract

Responding to the needs of sponsors for smaller spacecraft to more effectively utilize access to space, JHU/APL has created a flexible and modular, Multi-Mission Nanosatellite (MMN) spacecraft architecture for low-cost execution of critical missions. Under a pathfinder effort, two initial triple (three unit or 3U) CubeSat hardware prototypes are being built with Pre-Ship Review scheduled for mid-2011.

This pathfinder program shows us how to create a constellation of small satellites that is well suited to making measurements of the near-Earth space environment given the spatial and temporal variability that preclude solely independent, localized measurements. In this paper we discuss some of the factors that must be considered when designing a system for space weather monitoring and the scientific investigation of the near-Earth environment. Some important parameters include: 1) the number flux and energy of energetic particles in the auroral region and/or the radiation belts, 2) the number density temperature and composition of neutrals and ions in the upper atmosphere, 3) the wind speed in the upper atmosphere, 4) the ion drift velocity and/or DC component of the electric field, and 5) small scale fluctuations in the ionosphere that lead to radio scintillation. An integrated solution will be addressed that spans the range of potential science objectives, enabling sensor technologies, triple-cubesats (¡5kg) and nanosatellite (¡50kg) system design, secondary launch options, and the associated data processing and distribution plan.