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SMALL SATELLITE MISSIONS SYMPOSIUM (B4)
Small Satellites Potential for Future Integrated Applications and Services (4)

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LOW-COST SMALL SATELLITE SYSTEM FOR ELECTRO-DYNAMIC TETHER DEMONSTRATION MISSION

Abstract

The space debris problem is unavoidable for the future space age. As a recent example, the collision of IRIDIUM33 and COSMOS2251 on 10th February 2009 had a significant impact on the orbital debris environment. One method of avoiding such satellite collisions is the de-orbiting of non-functional satellites by using Active Debris Removal (ADR) techniques. The Electro-Dynamic Tether (EDT) system is being developed by JAXA (Japan Aerospace eXploration Agency) as one of the ADR applications. The EDT system can produce thrust for de-orbiting by using the Lorentz force induced by the conductive tether as it crosses the geomagnetic field. This system requires a small amount of electric power and propellant compared to other methods, thus, it provides a useful de-orbiting function as an embedded unit for future satellites. An autonomous rendezvous and docking spacecraft to attach a standalone EDT system to existing debris may be a future application. However, on-orbit validation of the tether deployment system and the electron emitting device is required. In this context, Kyushu University has started the design of a small satellite for an EDT demonstration mission. So far, we have designed two small satellites from 2003, QTEX (Kyushu University Tether Satellite Experiments) and QSAT (Kyushu Satellite) for a polar plasma observation mission. Through these two projects, we have studied the low-cost 50-kg class small satellite system and established a general-purpose satellite based on the original unit concept and the distributed processing concept by using the CAN (Controller Area Network) bus. We called this general-purpose satellite system USAT (Universal SATellite). The USAT system satisfies the piggy-back conditions of the Japanese H-IIA launcher, essentially all of the subsystem components consist of COTS (Commercial-Off-The-Shelf) units. These key features allow the low-cost development and the on-orbit demonstration. In this paper, we introduce the system characteristics of USAT for the EDT demonstration mission and explain the benefits of overall system design.