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PRELIMINARY FLIGHT RESULT AND ARCHITECTURE OF SDS-4 ATTITUDE CONTROL
SUBSYSTEM**Abstract**

This paper reports on the first flight results of the attitude control operation of micro satellite: SDS-4. JAXA conducts Small Demonstration Satellite Program: SDS. This program provides small satellite platforms to demonstrate newly developed technology and components. SDS-4 is the first 3-axis stabilized micro satellite from SDS program, which has been developed since late 2009. SDS-4 is planned to be launched as a piggyback payload of H-IIA launch vehicle in May 2012, operated on Sun-synchronous orbit with an altitude of 677km, and controlled in inertially-fixed sun oriented attitude. Adding to the four main demonstration missions, one of the most important destinations of SDS-4 is to achieve 50 kg class accurate 3-axis stabilized bus system for coming advanced missions like earth and planetary observations. For this purpose, Attitude Control Subsystem (ACS) of SDS-4 adopts zero momentum control with 3 reaction wheels, and uses Micro Star Tracker (STT) for precise attitude determination. What makes the ACS architecture difficult is the size and mass limitation. SDS-4, which dimensions are about 50x50x50 mm³ and total body mass is about 50kg, has little room for allocation of ACS components, and it is even difficult to arrange hardware redundancy. To obtain both accuracy and reliability, ACS is designed with intelligent software algorithm including on-board FDIR system. In cases where a certain bus component is at fault, software FDIR system works and ACS automatically selects the alternative control algorithm, which implements utmost performance with the rest components. For attitude estimation, STT measurement data is normally used together with MEMS Gyro data in an Extended Kalman Filter (EKF). Meanwhile, static attitude estimation using combination of Sun Sensor and Magnetometer is also implemented and ready to be used as an alternative for STT measurement. This paper describes the details of SDS-4 ACS design, and evaluates it with the obtained flight results.