

SMALL SATELLITE MISSIONS SYMPOSIUM (B4)
Design and Technology for Small Satellites (6A)

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DESIGN AND DEVELOPMENT OF ADVANCED TECHNOLOGY DEMONSTRATION SMALL
SATELLITE “TSUBAME”**Abstract**

The Laboratory for Space Systems (LSS), Matunaga Laboratory had developed and launched three small satellites: CUTE-I, Cute-1.7+APD and Cute-1.7+APDII. As a successor of these satellites, an Earth and Astronomical Observation Technology Demonstration Satellite “TSUBAME” is now under developing by cooperation of LSS (Matunaga Lab), Kawai Laboratory in Tokyo Institute of Technology, Kimura Laboratory in Tokyo University of Science, TAMAGAWA SEIKI Co., Ltd, Space Link Co., Ltd and NIPPI Corporation. The main missions of “TSUBAME” are as follows: 1) polarized gamma-ray observation with Hard X-Ray Compton Polarimeter (HXCP) by high-speed attitude maneuver with Micro CMGs; 2) Earth observation with a small high-resolution optical camera. This is a joint development of small satellite between different university and company. The motivation of this collaboration over these different heritages is to make a synergy effect on the design and development of TSUBAME. The Micro-CMG with small volume and low power consumption has been jointly-developed by LSS and TAMAGAWA SEIKI Co., Ltd. The torque amplification specialty of CMG provides the capability of agile maneuver. Avalanche Photo Diode (APD) developed by Kawai Laboratory is used as a direction monitor of gamma-ray burst, which has already demonstrated on “Cute-1.7 + APD II”. The Hard X-Ray Compton Polarimeter (HXCP) for polarized gamma-ray observation is also developed by Kawai Laboratory. A simple and low cost camera without deployment mechanism is developed by Kimura Laboratory, whose pixel resolution can achieve 10m at 600km LEO. The high reliable electric circuit design including Command and Data Handling circuit board, Electric Power System circuit board and GPS systems for small satellite are developed by Space Link Co., Ltd. The manufacturing of body structure and consulting of structural design is conducted by NIPPI Corporation. LSS is charge of system-level design, electric circuit integration, as well as the mechanism design. For example, LSS adapted four deployment solar cell paddles to supply enough electric energy, and a multi-master bus and distributed DCDC converters are adopted to accommodate many subsystems and to reduce the complexity of the total system. Ground

tests of the EM system are conducted to verify the performance of TSUBAME, including the electrical experiment and various environment tests such as gamma-ray radiation, proton radiation, thermal, vacuum and vibration. The modification design of TSUBAME is conducted based on the analyses of these experimental results.