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Author: Prof.Dr. Kentaro Kitamura
Kyushu Institute of Technology, Japan

Dr. Hirokazu Masui
Kyushu Institute of Technology, Japan
Dr. Shuji Abe
Kyushu University, Japan
Dr. Teiji Uozumi
Kyushu University, Japan
Dr. Mariko Teramoto
Japan
Dr. Akiko Fujimoto
Kyushu Institute of Technology, Japan
Prof. Akimasa Yoshikawa
Kyushu University, Japan
Prof. MENGU CHO
Kyushu Institute of Technology, Japan

CULTIVATING SKILLS FOR REALIZING DIVERSE SATELLITE MISSIONS IN UNDERGRADUATE STUDENTS THROUGH COLLABORATIVE 2U CUBESAT DEVELOPMENT BETWEEN UNIVERSITIES

Abstract

Since the first launch of CubeSats in 2003, numerous CubeSats have been developed by universities as a highly practical means of education in space systems. These satellite programs typically require students in aeronautics departments to develop an understanding of systems engineering and project management. Through participation in such programs, students gain proficiency in satellite development, including requirements tracking, design review processes, system integration, and ground testing methods. However, while these programs effectively cultivate technical skills related to satellite development, they provide limited opportunities for students to propose and execute diverse missions in collaboration with experts from other fields. Additionally, as these programs primarily involve engineering students, CubeSat missions tend to focus on technology demonstrations rather than broader interdisciplinary applications. To address these limitations, we have implemented a complementary satellite development program for undergraduate students, fostering collaboration among individuals with diverse academic backgrounds. The Yotsuba-Kulover satellite is a 2U CubeSat project jointly developed by engineering students from Kyushu Institute of Technology (Kyutech) and science students from Kyushu University (Kyudai), with the primary objective of conducting scientific observations of space weather. The mission comprises two key objectives: (1) monitoring small perturbations in the geomagnetic field using a high-sensitivity magnetometer and (2) capturing images of auroral brightening with a Commercial-Off-The-Shelf (COTS) camera. In this program, engineering faculty members provide satellite development guidance to science students from different universities, while science faculty members equip engineering students with foundational knowledge of space weather science. Through this interdisciplinary collaboration, students from both fields enhance their understanding of disciplines beyond their own expertise while practicing systems

engineering to ensure mission success. The satellite development was successfully completed and handed over to JAXA in February 2025. This paper presents an overview of the Yotsuba-Kulover program, highlighting key insights and lessons learned from its educational approach to systems engineering and project management.