SPACE EDUCATION AND OUTREACH SYMPOSIUM (E1)
On Track - Undergraduate Space Education (3)

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HANDS-ON PRACTICES FOR SPACE SYSTEMS ENGINEERING EDUCATION USING PICO-SATELLITE TRAINING KIT HEPTA-SAT

Abstract

I developed new hands-on type course and tool for space systems engineering based on former CubeSat development experience at Nihon University, SEEDS and SPROUT. This is one of the courses at Aerospace Engineering, College of Science Technology, Nihon University. The goal of the course and kit are to provide the varied background students with space systems engineering experience by assembly, integration test (AI T) of "classroom pico-satellite kit HEPTA-Sat". In recent years, the development of ultra-small satellite has been actively carried out. This type of satellite project is possible to learn variety of elemental technologies. Such as mechanical engineering, electronic engineering and communication engineering and its system integration. To learn the space systems engineering, satellite based learning is a very effective training way. Although ultra-small satellite and as you well known CanSat project is simple educational project. However, it is sometimes hard to gain thorough knowledge or experience the whole development process because the roles are divided into team members. This is the not so good problem for preparation steps. On the other hands, the students can deeply learn function and physical architecture, subsystem design (e.g. electrical communication design between device to device, radio communication between satellite to ground station), system design and verification validation (VV) process over a short amount of time through AI T of HEPTA-Sat. The HEPTA-Sat is 7cm cubic configuration classroom pico-satellite. HEPTA-Sat composed of 6 function and 6 primary sub-systems, Structure, Electric Power Supply, Command Data handling, Communication, Ground station and Sensor. The main characteristics of HEPTA-Sat is as follows. 1) Almost all kit components of HEPTA-Sat can operate alone, and can be integrated step by step. 2) Almost all main device is removable for students to learn satellite system assembly, integration and test repeatedly. I report the effects of the course and details of HEPTA-Sat kit in this paper. There are two major contributions. The first is that we provide learning opportunity to students with varied background from departments of art, government officials and general public as student from aerospace engineering in a short amount of time (ex. 1 day to 1 trimester) and very low-cost rather than conventional space engineering educational kit. The second is that the course focuses on verification and validation through software and hardware AI T of satellite systems. These have not been realized in any of the previous engineering courses worldwide.