IAF SPACE EDUCATION AND OUTREACH SYMPOSIUM (E1)
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Author: Dr. Kathryn Graham
KISPE Space Systems Limited, United Kingdom

Mr. Ben Hudson
KISPE Space Systems Limited, United Kingdom
Mrs. Vicky Anderson
KISPE Space Systems Limited, United Kingdom
Dr. John Paffett
KISPE Space Systems Limited, United Kingdom
Mrs. Angela Brown
KISPE Space Systems Limited, United Kingdom

THE SATELLITE LEARNING LABORATORY: A HANDS ON TRAINING SATELLITE

Abstract

With the growing space industry, the need for a skilled space work force is becoming of greater importance. In the UK, the space skills survey in 2023 identified gaps in a wide range of technical areas including software, systems engineering and project roles, particularly at the mid career level. In order to address these skills shortages, upskilling training is needed. There are courses available and in development that address these needs, however, lecture/book training can only take you so far. Practical hands on experience with as representative a system as possible enables deeper understanding of the material.

The Satellite Learning Laboratory (SatLL) has been developed to provide a unique hands on learning experience to be utilised as part of a space systems engineering curriculum, catering for levels from basic, with no background space experience, to intermediate and advanced. The flight representative kit featuring satellite subsystems can be integrated, tested and operated in a classroom environment, employing a representative ground support system. SatLL enables training across all the typical spacecraft subsystems, including power systems, command and data handling, attitude determination and control, communications and payloads.

For software skills training the onboard computer has been developed to enable progression from programming with the familiar Arduino IDE environment to writing software in C code to run on a more representative real-time operating system. The onboard computer employs a flight representative STM32 microprocessor chip, enabling skills learning and code development to be performed. SatLL is provided with a connection board to allow the system to be first built in a 'flatsat' configuration before assembling into the 'flight' configuration, and can be used for training in systems engineering, verification and validation. There is a payload bay to provide the ability to integrate different example payloads, including a camera, communication system and internet of things, to provide students with the opportunity to learn some of the various trade-offs required for differing satellite applications.

SatLL is a small (approximately 3U CubeSat form factor), low cost system to enable use in a class room setting. With the use of tailored training materials it can be utilised for upskilling and for STEM, primary/secondary, college and undergraduate training, making it a versatile teaching aid.