IAF SPACE EDUCATION AND OUTREACH SYMPOSIUM (E1)
Interactive Presentations - IAF SPACE EDUCATION AND OUTREACH SYMPOSIUM (IP)

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THE EDUCATIONAL PLATFORM SOURCE - A CUBESAT MISSION ON DEMISE INVESTIGATION USING IN-SITU HEAT FLUX MEASUREMENTS

Abstract

The Institute of Space Systems (IRS) at the University of Stuttgart, which has successfully flown the small satellite Flying Laptop developed mainly by PhD students, and the Small Satellite Student Society (KSat e.V.) are developing a 3U+ CubeSat for innovative structure demonstration, atmospheric research and investigation of satellite demise. The Stuttgart Operated University Research CubeSat for Evaluation and Education (SOURCE) will be realised by master and bachelor students supported by PhD candidates and is currently in its detailed design definition phase. The project includes graded lectures and seminars for each subsystem, workshops organized by the student society and bachelor and master theses. It is expected to be launched NET 2020 using a piggy-back flight opportunity. Beside demonstrating innovative satellite sandwich structures and camera systems, SOURCE will perform atomic and molecular oxygen measurements during its 1-2 years of operation and heat flux density distribution analysis shortly before its demise. This enables students to take part in an innovative hands-on project with scientific relevance regarding the demise of nano and pico satellites at the end of their mission. The re-entry sensor setup is one of the student developments and is designed with the aid of the numerical simulation "PICLas", developed by IRS and the Institute of Gas Dynamics at the University of Stuttgart.

The results are used to identify parameters of interest and determine their value range. On this basis, commercial and self-developed heat flux density sensors are selected. To complete the sensor package, photodiodes are mounted on different sides of the CubeSat to analyse the tumbling frequency and detect traces of aluminium in plasma flows. The acquired data will then be used to validate the numerical models. This enables an innovative approach to illustrate the correlation of theory and practice in space related engineering processes. This paper will present the structure of the project with a focus on student work in all aspects of the mission but in particular in the payload subsystem. It will be discussed, how lectures and volunteer work is combined to achieve an ongoing educational process for participating students and will compare it with past IRS and KSat e.V. projects. Benchmarks on participation and learning success are given via assessment of external industrial partners in periodical reviews, which are based on the industrial space standard. Finally, an outlook is given on future educational missions, which are currently under development.