

IAF SPACE EDUCATION AND OUTREACH SYMPOSIUM (E1)
In Orbit - Postgraduate Space Education (4)

Author: Prof. Klaus Schilling
Zentrum für Telematik, Germany

HANDS-ON EDUCATION WITH CUBESATS MOTIVATING INNOVATIVE NEW SPACE
PROJECTS: SMART, SMALL, SELF-ORGANIZING SPACECRAFT SYSTEMS (S5)**Abstract**

Education in space technology needs to reflect not only related important theory, but should also include practical implementation classes to practice problem solution capabilities. In this context in the curriculum “Satellite Technology” at University Würzburg already in the first semester so called “CanSat” labs were introduced since 2005, where teams of students implement a measurement device to characterize atmospheric properties, like density or temperature. The CanSat device will be deployed from an aircraft in about 3 km altitude, is implemented in an empty can as structural subsystem, and will descent by using a parachute.

In more advanced semesters, small CubeSat satellites serve as example to practice system engineering skills. In a “FlatSat” a baseplate with access to space simulation environments, measurement and test equipment allows to access different subsystem hardware components. This way challenges at different complexity levels are offered to the students and solved in hands-on approaches in close interaction with supervisors. A set of essential satellite building blocks (such as on-board data handling system, power control system, attitude control system) is provided, such that the students can solve given specific tasks, like integration of sensor payloads or autonomous control software, and test them in hardware-in-the-loop experiments.

At the stage of MSc- or PhD-level, students are integrated in related project teams to ongoing research projects, based on CubeSat approaches. In particular, satellite formations are a core research topic in Würzburg, allowing parallel teams to contribute. Here innovative topics in Earth observation, like characterization of cloud composition by use of computed tomography approaches to derive from measurement of backscattered Sun light from different perspectives enabled by the multi-satellite system. This way, slice by slice an image of the cloud’s interior is generated. It is motivating for the students to work here in cooperation with scientists in interdisciplinary and international teams.

Hands-on experiments guide students in the “Satellite Technology” program at University Würzburg in tasks of increasing complexity to apply system engineering skills for finding solutions. At advanced stage of studies, they acquired the appropriate experience to contribute to ongoing CubeSat research projects as a precursor to contribute to future complex space technology implementation projects at agencies and in industry.