

SPACE SYSTEMS SYMPOSIUM (D1)  
Enabling Technologies for Space Systems (2)

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## CRUCIAL TECHNOLOGIES FOR DISTRIBUTED SYSTEMS OF PICO-SATELLITES

**Abstract**

Small satellite formations offer interesting potential to complement traditional satellites in application fields such as Earth observation, space weather and telecommunications. For pico-satellites (at a total mass of about 1 kg) the University of Wuerzburg established a roadmap for technology development to enable pico-satellite formation missions. So far two satellites have already been launched: UWE-1 (launched in 2005) to test parameter adaptations of Internet Protocols in space environment for future inter-satellite links in a distributed multi-satellite system and UWE-2 (launched in 2009) to realize attitude and position determination by MEMS components an extended Kalman filter for robust measurements. The technology advances of the current missions in preparation will be the topic of this contribution.

UWE-3 uses a modular design without any wiring to offer an extendable flexible basis for implementation of future UWE satellites. Its technology innovation addresses an attitude control system based on magnetic torquers and one reaction wheel, being able to point into any desired direction.

UWE-4 focusses on position control based on vacuum arc thrusters. This electrical propulsion system enables, at a minimum mass about 100 gramm, correction of the relative distance drift as well as topology changes in the future satellite formation. For the communication within the space segment delay tolerant network approaches (DTN) will be tested in orbit.

Details on the modularization concept, the attitude and orbit control system, as well as the communication concept for pico-satellites will be emphasized in this contribution. By integrating these technologies into a future multi-satellite formation, the low performance of each small satellite is balanced by integrating data from several satellites. The crucial innovative technology base will then be available to prepare in the next step a formation flying multi-satellite mission related to tracking of mobile objects on the Earth's surface.