The Groundstation

The entire structure of UWE-1 The ground-station maintains the communication with the satellite. The control program for the ground-station has been designed by our students. Settings such as selection of frequencies, antenna pointing etc. can be adjusted, to facilitate an optimal data flow between satellite and ground-station. Received data are fed to an internet connected server, offering the data to the worldwide user community.

The Start

In May 2005 UWE-1 was shipped to Russia to be launched from Plesetsk Cosmodrome on a Kosmos 3M rocket on October 27. 8:52 (CEST). 64 minutes after the launch, UWE-1 was set out to space. At 12:08 (CEST) our ground-station received for the first time telemetry data sent by UWE-1 from the orbit.

Results

The test plan with UWE-1 has been carried out in orbit. Sensor and communication data had been collected and evaluated. Meanwhile UWE-I has successfully terminated his operational phase.
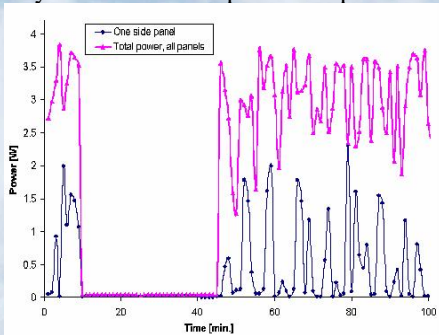
For results achieved please visit our web-site:
www7.Informatik.uni-wuerzburg.de/cubesat

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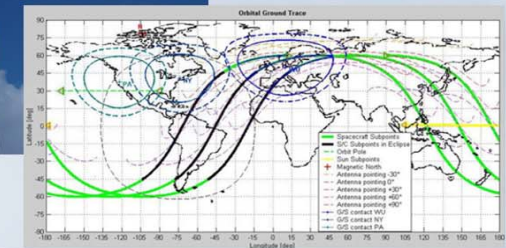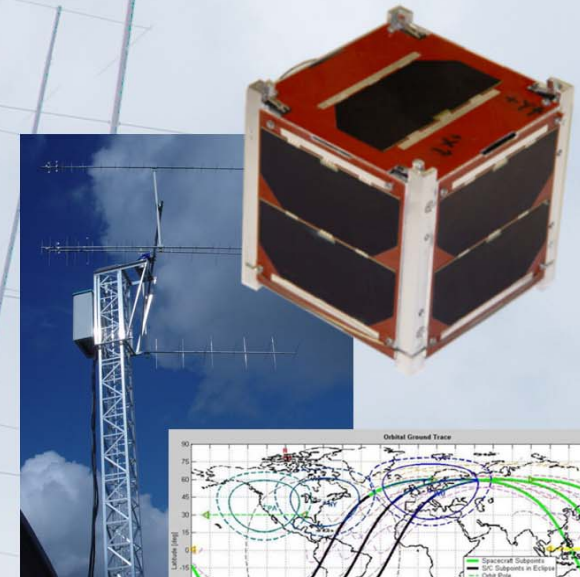e-mail : schi@informatik.uni-wuerzburg.de

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Julius-Maximilians Universität Würzburg

# Pico Satellites - Interesting Opportunities for Space Exploration

UWE-1

University **W**ürzburg's **E**xperimental satellite - **1**

## Pico Satellites – cost efficient test platforms in space

Pico satellites offer interesting potential in the area of in-orbit testing for small components:

- Low launch costs due to limited mass (< 1 kg)
- Standardized frame to accommodate components to be tested
- Short time frame for realization   (< 1 year)
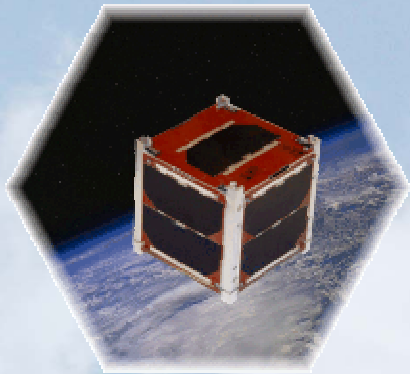
A broad spectrum of experiments can be realized with a pico satellite:

- Testing of electronics
- Usage of novel sensors
- Telecommunication experiments
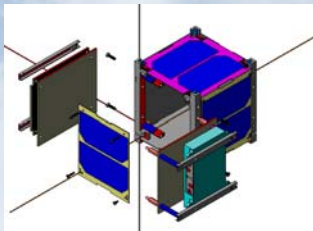
A successful example of this innovative and efficient pico-satellite approach has been tested with UWE-1 in orbit.

UWE-1, a technology demonstrator

University of Würzburg Experimental-satellite 1 (UWE-1) is in orbit since October 2005. The mission objectives of UWE-1 comprised:

- Adaptation of telecommunication link to space environment using internet protocols
- Technology development tests
  - Use of micro-Linux as on-board operating system
  - Test of triple-junction GaAs solar cells,
  - -Demonstration of miniaturization   techniques
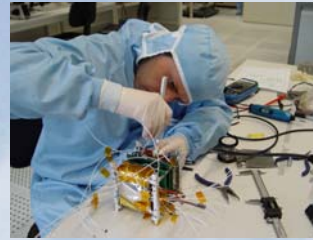
The research is focused on adapting mobile internet technologies to typical aerospace characteristics like delays, disruptions and disturbances. The internet linked ground stations parameters must be fitted and optimized to ensure reliable data transmission.

TCP/IP und SCTP (Stream Control Transmission Protocol) are some of the protocols tested.

Conventional internet-communication-protocols must be adapted, to ensure reliable data transmission between satellite and ground station, despite of the enormous distances and typical disturbances.

The Satellite

To attain this goal, the entire hardware composed of electronic control boards and engineering mechanics was developed at our institute and has been manufactured together with industrial partners.

Structure

The structure of the satellite consists of aluminium alloy, The solar cells are attached to the side panels. The frame also bears the circuit board and the batteries. To ensure that it is compatible with the outer space environment, simulations were successfully run on FEM- und thermal analyses followed by various vibration, thermal and vacuum tests. UWE-1 is displayed during the vibration test on a Shaker.

UWE-1 is displayed during the vibration test on a Shaker. This is to measure the transferred acceleration in all three axes during a simulated launch
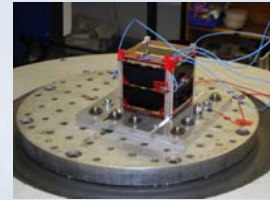
Electronics

The onboard electronic consists of the power supply, the computer board and the trans-ceiver board. A high-capacity H8-processor with 4 MB flash memory has been integrated to allow sophisticated experiments.

Novel triple - junction GeAs solar cells with extreme power conversion efficiency charge two lithium polymer batteries. The power supply system is protected by safety switching (under voltage und overload protection etc.) and is constantly controlled by the processor, to ensure undisturbed on board power supply.

Software

The software team adapted the Micro-Linux operating system to the H8-processor and customized it to the mission requirements. It supports the communication protocol (IP over AX25) and the house keeping software, which supervises not only the power supply, but also temperature and other crucial data to be transmitted to the ground station