From Small Satellites to Planetary Rovers and Rockets – A University Approach

Prof. Dr. Ing. Klaus Briess
TU Berlin

Thursday, 31st May 2018, 5 p.m.
ETH Hönggerberg, HIL D 53

Abstract:

Twelve small satellites for Earth observation or technology demonstration have already been developed by scientists and students of TU Berlin and were launched into orbit successfully from 1989 till the end of 2017. After seven satellites of the TUBSAT family, the CubeSats of TU Berlin with the names BEESAT-1, -2, -3 and -4 were designed, built and brought into orbit. BEESAT-5 to -8 are now under construction for a launch end of 2018. Beside the CubeSat missions, several nanosatellite missions are currently in development or in operations. The three-axis stabilized TUBIX-20 nanosatellite bus was launched in 2017 to demonstrate new technologies for small satellites. The results are used in the follow-on Earth remote sensing mission TUBIN that is equipped with an infrared imaging payload. Four 10 kg nanosatellites are waiting for their launch from Vostochny Cosmodrome in the beginning of 2018. These satellites will fly in a formation to demonstrate inter-satellite communication in S-band on a sophisticated level for distributed spacecraft systems. The so called S-Net mission will establish the first inter-satellite network in S-band in space. Beside these satellite missions for technology demonstration in space other research activities are related to electromagnetic spectrum analysis in space and to develop a building block satellite ready for servicing.

The transfer of the newly developed small satellite technologies to the use for low-cost interplanetary missions and the investigation of the options and the limitations are part of the research and education activities at TU Berlin. There are two other special points of focus in the student educational area: planetary rovers and rockets. The works on planetary rovers include design studies of micro rover missions for exploration of Moon and Mars and gaining practical experience and validation of new system concepts in an analogue lab environment. One example is the development of a micro rover [1] with a mass of 20 kg to explore the Moon along the rim and the Shackleton crater. Another example is the development of the fully autonomous Mars exploration rover SEAR [2] that is being tested on a planetary surface test-bed. Additionally the students have the opportunity to develop their theoretical...
knowledge in space propulsion systems by practical work on real sounding rocket projects and their operation from dedicated launch pads in Germany and Sweden.

The paper gives an overview to the activities and cross-links between the CubeSat and nanosatellite technology research activities of TU Berlin and practical educational activities in the fields of planetary rover and sounding rockets.

References


Curriculum Vitae:

Since 2003, the Chair of Space Technology at TU Berlin is led by Professor Dr. Klaus Brieß.

With joining the Technische Universität Berlin as professor for space technologies, he has dealt extensively with small satellites and their various uses for communication and remote sensing of the Earth, Moon and other celestial bodies. Professor Brieß has special expertise in the area of satellite engineering with a focus on the miniaturization of space technologies for use in micro-, nano- and pico-satellites as well as in the development of space sensors.

Professor Brieß previously has worked in the aerospace sector on different instrumentations and missions for remote sensing. Since 1994 small satellites are at the focus of his research activities. As a project manager at the German Aerospace Centre (DLR) from 1996 to 2003, Professor Brieß has led the satellite mission “BIRD” to success. Now he is managing his large research group at TU Berlin that is one of the leading institutions worldwide in the area of small satellites, with more than ten satellites in orbit and several missions in development.