

SPACE EDUCATION AND OUTREACH SYMPOSIUM (E1)  
ON TRACK - UNDERGRADUATE AND POSTGRADUATE SPACE EDUCATION (2)

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TESTING AN INNOVATIVE BOOM FOR MICROSATELLITE ATTITUDE STABILIZATION: AN  
EDUCATIONAL EXPERIMENT ON SOUNDING ROCKET REXUS-7

**Abstract**

Students and researchers of the Space Robotics Laboratory (SRL) of the II Faculty of Engineering of the University of Bologna Alma Mater Studiorum and of the Group of Astrodynamics of the School of Aerospace Engineering of Sapienza, University of Roma, developed the BUGS experiment (Boom for University Gravity-gradient Stabilized Satellite). This experiment, proposed by the joint team of both Italian universities, was selected, in the early 2009, by a panel of experts of the ESA (European Space Agency), DLR (German Aerospace Agency), SNSB (Swedish National Space Board) and SSC (Swedish Space Corporation) to fly on board the sounding rocket REXUS-7 in the framework of the REXUS/BEXUS Programme (Rocket and Balloon Experiments for University Students). The BUGS experiment has two main goals: the hands-on education and the deployment test, in near microgravity conditions, of a boom for gravity gradient attitude stabilization of small satellites. The educational purpose consists on providing the university students with the opportunity of a practical experience in a real space project during their master and PhD courses, according to the educational philosophy of both laboratories of the universities of Bologna and Roma. The boom is based on an innovative design, exploiting rigidity properties of tape coiled springs. This new technology was never tested before in orbital conditions and REXUS-7/8 campaign provides the unique opportunity to analyse boom behaviour in microgravity conditions and to qualify it for space missions. This experiment aims to achieve data on boom vibration modal shapes during the deployment phase in order to improve the numerical simulations accuracy of the satellite attitude dynamics. Demonstrating the suitability of this kind of boom for low cost missions is very useful, mainly for educational satellites, whose production had a large impulse in the last twenty years. The boom provides these satellites with nadir pointing attitude by mean of simple passive stabilization, permitting them to carry on a number of different experiments for Earth Observation. The REXUS-7 launch is scheduled for the first week of March 2010 from the ESRANGE Space Center located near Kiruna, Sweden. This paper describes the whole experiment lifecycle, starting from the concept and design to the assembling, integration and test activity. The students activities are highlighted in the paper, including the participation in the vibration tests performed at the ESA Mechanical System laboratory, in the bench test campaign performed at the DLR laboratories and in the launch campaign.