SPACE SYSTEMS SYMPOSIUM (D1)
Innovative and Visionary Space Systems Concepts (1)

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UNICUBESAT: A SATELLITE FOR AERONOMY MEASUREMENTS IN ORBIT

Abstract

The Group of Astrodynamics of University of Rome "La Sapienza" (GAUSS) established at Scuola di Ingegneria Aerospaziale the research and education program UNISAT, in which PhD and graduate students have the opportunity to gain hands on experience on small space missions. Four university satellites (UNISAT, UNISAT-2, UNISAT-3, UNISAT-4), weighting about 10 kg, have been designed, manufactured, tested and launched every other year since 2000 in the framework of this program. The satellite UNISAT -3, launched on June 29th 2004 is still operative after almost four years from launch and the data are received from the University of Rome Ground Station on a regularly basis. Unfortunately, the satellite UNISAT -4 did not reach the orbital phase, because of the failure of the launch vehicle in 2006. Scuola di Ingegneria Aerospaziale pioneered the field of university satellites, designing, building, testing and launching its own satellites back in the sixties, when the San Marco Program was established in cooperation with NASA. The aim of the San Marco program was the measurement of neutral atmospheric density at low altitudes, using an extremely accurate instrument, "the Broglio drag balance", ideated and proposed to NASA by Prof. Luigi Broglio, Dean of the School at that time. The last San Marco satellite has been launched in 1988. The technological developments in the last two decades, and in particular electronics devices miniaturization, allows now to install a revised scheme of the original Broglio drag balance on board a 1 kg nanospacecraft. A scaled version of UNISAT, UNICubeSAT, is being developed for hands-on education purposes, reducing the satellite weight from 10kg to 1kg, and this design includes a scaled version of the balance, to perform in situ atmospheric density measurements. A major requirement of this experiment is of course the orbit perigee height, which should be about 350 km or lower. A launch opportunity in these kinds of orbits could give the opportunity to continue our aeronomy studies tradition, installing a renewed version of the Broglio drag balance on a Cubesat. This experiment is very well suited for a university student-built satellite and recent advances in micro and nano instrumentation devices allow to scale down the original Broglio drag balance design to fit inside the small volume available in Cubesats. The paper deals with the cubesat satellite subsystems design, mission profile and key features of the experiment showing that meaningful measurements of the neutral atmospheric density can be obtained in orbit, within the accuracy limitations imposed by the cubesat power and volume constraints.