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DEVELOPING A DISTRIBUTED AND FRACTIONATED SYSTEM OF 10 GRAMS SATELLITES FOR PLANETARY OBSERVATION

Abstract

The miniaturization of electronic components enables major reduction of spacecraft size and mass, as is the case of CubeSats, PocketQubes, and FemtoSats, which offer shorter development time and costs, in comparison with traditionally larger satellites. However, these miniaturized satellites still require a considerable effort in terms of time and investment (several years of development, and costs around 105106 for CubeSats). More recently, an even smaller class of spacecraft, the ChipSats has been introduced. ChipSats are microchip-shaped spacecraft with masses ranging from a few grams to 10s of grams. At the lower end of the mass range (1-10 grams), they belong to the class of AttoSats. Due to their small size, AttoSats enable unprecedented low costs and agile development and potential for swarm missions of distributed and fractioned systems for applications such as planetary observation. However, despite their benefits there have not been many initiatives to develop AttoSat systems. In this article, the development of a satellite system of three 10-grams satellites is presented. The three satellites work together to achieve the common goal of studying Earth's atmospheric environment, conforming a distributed system. Moreover, different satellites are designed to perform different functions, making them part of a fractionated system: one satellite acts as a communication node transmitting data to ground stations, while the two other satellites have environment sampling capabilities. Visual intersatellite communication capabilities ensure data transmission among the satellites. The presented system is meant as a technology demonstration project for future distributed and fragmented satellite swarm systems for planetary exploration. The AttoSats are scheduled for launch on 2022/23 on board of a LuxSpace satellite.