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NANOSATS AND CUBESATS: THE NEXT FIVE YEARS

Abstract

Over the past 10 years, approximately 300 microsatellites, each weighing less than 200 kilograms, have been launched into orbit by 20 different vehicles. One hundred of these satellites were nanosatellites, weighing less than 10 kilograms. Over seventy percent of these satellites were built by governments and universities. The number of nanosatellites launched, especially the smaller standardized CubeSats, is expected to triple in the next few years. These small, low-cost satellites may change the landscape of the space industry in the coming years. Distributed innovation is driving down the cost and increasing the potential uses of nanosatellites. The cost of building a microsatellite is decreasing as parts are standardized and often shipped as complete kits, and additive manufacturing (for example, 3D printing) appears poised to become a contributing factor.

Several missions have already been conducted, with hundreds more planned during the next five years alone. Among the mission types are Earth observation, communications testing, targeted scientific investigation, and education. Nanosats also serve as test beds for new technologies and formation flying. With the advent of Arduino controllers and CubeSat kits, along with the rise of a Maker or DIY spacecraft community, even individuals are able to build satellites. This groundswell of activity has led to the formation of new commercial businesses building CubeSat kits, component parts, or microsatellites. Examples of these companies are Pumpkin, Nanosatify, Tyvak Nano-Satellite Systems, Planet Labs, among others. Larger companies like Boeing and government organizations like NASA and the DoD are also investigating the potential in nanosatellites. In recent years, small satellite companies have raised over $100 million$ in venture capital and angel investment.

This paper will provide a summary of nanosatellites expected to launch during the next five years. The summary will be based on publicly available information. Examples of missions will be described, emphasizing the different types of operators and builders. Finally, a brief description of potential issues will provided, including the likely increase in orbital debris, space traffic management, launch costs, and disaggregated satellites versus conventional satellites.