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TIANTUO-3: A HETEROGENEOUS MICRO-NANO SATELLITES CLUSTER

Abstract

With the advantage of low cost, high function density, and short cycle in design and manufacture, micro-nano satellites have been a trend in recent years. However, their applications are greatly constrained due to the relatively limited functions of a single satellite. Constructing micro-nano satellites clusters through the cooperation of multiple satellites may provide a solution to this problem, which extends the application area of a single satellite as well as improves the overall flexibility and survivability.

In this paper, Tiantuo-3 (TT-3) heterogeneous micro-nano satellites cluster is introduced. Successfully launched on September 20, 2015 in the maiden flight of the Long March-6, TT-3 cluster consists of 1 nanosat, 1 picosat and 4 femosats. The main satellite called Lvliang-1 was developed with the mass of 19.54 kilograms and the size of 398 mm by 398 mm by 516 mm. And it can also be regarded as the extension from the single-board architecture of its predecessor TT-1 to a multi-board architecture. The picosat called Smart was designed as a standard 1U Cubesat and weighted 1.02 kilograms. Running the Android operating system and characterized by a reconfigurable software system, Smart is also the first PhoneSat in China. The femosats called Dust were developed with the mass 30 grams and the size of 56 mm by 66 mm by 6 mm, which are the smallest satellites in the world.

Until now, TT-3 cluster has continuously worked normally for over 12000 orbit circles and 800 days, and all the 6 satellites are working in good condition. Tasks successfully performed include construction of the 3-level heterogeneous satellites cluster, construction of 2-level self-organized network, recognition of sea-aero targets and global awareness through jointly worked ADS-B and AIS payloads, multiple satellites TTC within a cluster through a single ground station, etc. Fruitful scientific research data and application effects have been achieved, which greatly proves the efficacy and advantage of the heterogeneous micro-nano satellites cluster.