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THE STATUS OF CUBESAT ELECTRIC PROPULSION TECHNOLOGY

Abstract

In recent years, CubeSats and related technologies have become popular. Until now, there are over 700 CubeSats have been launched to the orbit. Compared with the traditional satellites, the CubeSats have unique characteristics, which are small volume, light mass, power limited and low cost. As a result, some traditional satellite subsystems are not suitable for the applications of CubeSat. There are still some related technologies needed to develop to fulfill the constraints. Among them, the CubeSat propulsion system is one of the key subsystems in many future missions. The propulsion system could be used for independent orbit raising, deep space mission, constellation deployment, de-orbit, etc. However, by the end of 2017, there are only 22 CubeSats that have the propulsion system. The need for the CubeSat propulsion system is high demand, and many new innovative missions will use them in the future. Now, the propulsion system could be classified into two main categories, the chemical propulsion system and Electric Propulsion(EP) system. The chemical propulsion systems that dominate the current missions have high Technology Readiness Level (TRL). But it has the low specific impulse and total impulse, which limited the use of them. On the contrary, the EP has the higher specific impulse and total impulse with low TRL. It could prolong the life of the spacecraft, improve the payload ratio greatly. The EP is promising and especially competence in some innovative missions such as formation networking, lunar mission, asteroid exploration and other deep space missions. This paper presents the state-of-the-art CubeSat EP system. The principles of traditional EP and emerging EP technologies that will be used in the upcoming missions are given. Throughout the paper, not only the review of flight heritage and in-orbit performance of EP are included, some innovative EP systems are also discussed in detail. Finally, a systematic and objective evaluation of different CubeSat EP technology is prospected for the CubeSat designer to choose the right candidates for their mission.