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A CONJUNCTION RISK ASSESSMENT OF THE CUBESAT SWARMS IN THE
SUN-SYNCHRONOUS ORBIT

Abstract

In a Nature Comment article in 2018, Professor Levchenko and Keidar encouraged global scientific institutions to conduct scientific research using smaller satellites, with a strong recommendation that cubesat swarms would play an important role. This fully demonstrates the cubesat phenomenal effect in recent years. Since 2013, the number of cubesat has increased exponentially. The number of launches exceeded 300 for the first time last year, which is in line with Gompertz's logistic prediction model. It is expected to reach 700 or more annual stable growth after 2030. However, high growth also brings high risks. Firstly, the cubesats are difficult to track and identify. Secondly, as the Dnepr event in 2013, the launch of the cubesat has not yet reached a unified consensus and standards, bringing too many unknown risks. Also, each launch of the cubesat is also a swarm-type launch, with more than 90% concentrated in the Sun-synchronous Orbit regim. We have cataloged all the launches of cubesat so far, cataloging their orbits and features. Based on our semi-analytical semi-numerical evolution software, more than 70% of cubesats in this region will not meet the mitigation guideline of falling within 25 years. Moreover, during the evolution process, it is found that dangerous accidents that may be caused by cubesat in the future will account for more than 30% of the entire 600-1000km orbital range. Finally, in response to this situation, we strongly recommend that it needs to strengthen the management and information disclosure of pre-launchand post-launch of cubesats swarm, and suggest that cubesats can have a standard propulsion module with a total impulse of several 10m/s, or have a drag-sail.