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NANOSATELLITES TRIANGLE FORMATION FLYING FOR TERRESTRIAL GAMMA-RAY
FLASHES AND TRANSIENT LUMINOUS EVENTS STUDY

Abstract

Terrestrial gamma-ray flashes (TGF) and transient luminous events (TLE) are the energetic phenomena at the Earth atmosphere. TGFs are supposedly caused by high-energy electrons accelerated by intense electric fields produced during thunderstorms. TLEs, such as sprites, jets, elves, etc. are commonly occur above thunderstorm clouds. To study these transients we propose to use a group of small satellites at LEO equipped with gamma- and UV-radiation detectors. To better locate TLEs and the source of TGF, we propose to use three satellites that will ideally form the unilateral triangle in projection onto Earth surface. The length of the triangle side at the mission begin have to be equal to 1000 km, but due to the mission requirement there must be a possibility to reduce it up to 100 km. In addition, there are requirements imposed to the attitude control system: UV-sensor sensitive axis must be pointed to the nadir with the accuracy better than 10 degrees, and the accuracy of attitude determination must be better than 1 degree.

The mission could be implemented by using TNS-0 micro-satellite platform, with the satellite mass of 5 kg for a prism form-factor. The micro-satellite will be equipped with magnetotorque for the attitude control, while magnetometer and sun sensors are used for the attitude determination. Down link to the

ground stations provided by using GlobalStar communication system. The initial orbital configuration is provided by Progress cargo vehicle.

In order to decrease the effect of J_2 perturbation, all three satellites move along the orbit with the same height and inclination. The triangle configuration is formed due to the differences in micro-satellites longitudes of the ascending node and phase shift along the orbit. Active relative motion control is provided by changing the satellites' attitude, which leads to a difference in atmospheric drag that affects the satellites. In this paper the study on controlled relative motion of the three satellites will be presented.