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# FLIGHT RESULTS OF THE MISSION OF TNS-0 #2 NANOSATELLITE CONNECTED VIA GLOBAL COMMUNICATION SYSTEM

**Abstract**

Technological NanoSatellite TNS-0 #2 developed by JSC Russian Space Systems was successfully launched on August 17, 2017 from the International Space Station during the spacewalk of the Russian cosmonauts. The mass of the satellite is 4.8 kg and the form-factor is hexagonal prism. The main feature of the TNS-0 nanosatellite series is the use of the GlobalStar communication system. The TNS-0 satellites upload and download the telemetry and other information via GlobalStar antennas installed onboard. For successful communication session it is necessary the TNS-0 and GlobalStar satellites are to be in the line of sight, and at the same time the GlobalStar satellite and the ground receiving station are also to be in the line of sight. Such a situation for the TNS-0 #2 occurs about 15 times in a day and the communication intervals vary from one up to three minutes. The details on the sessions are given in the paper.

The main purpose of the nanosatellite TNS-0 #2 is to obtain the flight qualification of the instruments and sensors installed onboard. It is equipped with the passive magnetic attitude system developed by the Keldysh Institute of Applied Mathematics RAS. The system consists of a set of hysteresis rods for initial angular velocity damping and a permanent magnet located along the axis of symmetry to stabilize the axis along the local geomagnetic field induction vector. Three-axis magnetometer, a set of photodiode sun sensors, a single ultraviolet one and an infrared horizon sensor are installed onboard. The results of the attitude motion determination using these sensors data during the mission are presented in the paper. The satellite is also equipped with GPS/GLONASS receiver. Using its measurements the TNS-0 #2 orbit degradation in the dense layers of the atmosphere is tracked, the density of the lower atmosphere is estimated and also the atmosphere effect on the attitude is studied. Flight result completely confirmed results of preliminary simulation of the TNS-0 #2 motion.

The next satellite of the TNS-0 series is planned to be equipped with the active attitude control system

and propulsion system for orbital maneuvering. The flight qualification of the star-tracker developed for the nanosatellite is within a purpose of the scheduled mission together with attitude and orbital control algorithms testing.