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# RETRACTION OF THE TETHER ON LAST STAG OF THE DEPLOYMENT PROCEDURE FOR TETHER-ASSISTED RE-ENTRY

**Abstract**

In recent decades tethered satellite systems have been flown successfully in space on a number of occasions. It is possible that in the future the tethered satellite systems will be potential alternative for conventional rocket propulsion technology. Such tethered satellite missions have been successful and unsuccessful over the past years. One such successful mission has been the Young Engineers' Satellite 2 (YES2) mission in 2007. YES2 demonstrated a tether-assisted re-entry concept, whereby payload will be returned to Earth using momentum provided from a swinging tether. The system was placed onboard Russian Foton-M3, which was in the elliptical orbit (minimum orbital altitude 262 km and maximum orbital altitude 304 km) and full length of the tether was 30 km. Deployment of the YES2 mission consisted of three phases: there was a slow deployment of 3.5 km of the tether to the local vertical in the first phase; the objective of the second phase was to deploy a tether length of 30 km and bent at an angle of about 40 degrees from the local vertical; and an end-mass started to swing to the local vertical at a constant length of the tether and the third phase completes when followed a capsule separated from the tether in the vicinity of the vertical.

The aim of this paper is to find an alternative deployment tether principle which will give the opportunity to reduce the total length of the tether required for a successful landing capsule on the surface of the Earth. So, the tether will retract on the carrier spacecraft in the third phase and the vertical velocity of the capsule will cause the Coriolis force, which additionally increase the velocity of motion of the capsule to the local vertical. As a result, the absolute velocity of the capsule at break point of the tether will be less compared with the velocity in the YES2 mission. In order to determine the smallest time of the deorbit of the capsule was carried out a series of calculations for different velocity retracting of the tether and for different moments of separation of the capsule from the tether. It is shown that the proposed the control law requires the deployment of a significantly lower total length of the tether. It is shown that the proposed the principle of the deployment requires a significantly lower the tether length compared with the mission YES2.