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Quality and safety, a challenge for traditional and new space (1)

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SPACECRAFT SAFETY IN VERY LOW EARTH ORBITS

Abstract

The quality of traditional tasks of space activities depends on the orbit altitude of spacecraft. In the last time, many global projects assume to replace heavy satellites in geostationary orbits by small-satellite constellations in low Earth orbits (for example, SpaceX, OneWeb, etc.). Since the required power of the communication equipment is inversely proportional to the square of the distance from the spacecraft to user on the Earth, placing the satellite in Very Low Earth Orbits (VLEO) at altitude about 200km allows reducing its mass by orders of magnitude with the same signal quality.

The long-term maintenance of spacecraft in VLEO is possible with the air-breathing electric propulsion (ABEP) using outer atmospheric gases as a propellant.

The system analysis of safety of the spacecraft with ABEP is considered in conditions of strong variations of density and composition of the atmosphere and orbit parameters. The areas of safety of spacecraft in space of generalized parameters combining such characteristics as the specific cell power, the specific impulse, orbit parameters, etc., are presented.