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ESTIMATION OF THE POSSIBILITY OF USING ELECTRIC PROPULSION SYSTEMS FOR
SPACECRAFT'S POSTMISSION DISPOSAL FROM OPERATING ORBITS

Abstract

The environment state of near-earth space is characterized by a huge number of non-operational space objects. One of the ways to reduce the dynamics of growth in the number of such space objects is a postmission disposal with atmospheric reentry.

At present, various methods are being considered for the postmission disposal of space objects from working orbits. These can be: active deorbiting with using jet propulsion systems, electrodynamic tethered systems, magnetodynamic systems, sail systems and etc.

One of the most promising methods is the use of a jet propulsion system. The main advantage of this approach is to ensure the removal of a space object at a given time and to a given point in near-earth space. However, this approach has a significant drawback associated with the need for propellant components on board the space object. This leads to a significant increase in the mass-size characteristics of the disposal object.

One of the most promising types of propulsion systems is the electric propulsion system (EPS), which has a number of significant advantages over other types:

1. The value of the specific impulse (1500 ... 1600 sec.), which significantly exceeding the value of the specific impulse of other types of propulsion systems.
2. Use in the process of operating electrical energy, which can be obtained directly in space using solar panels.
3. Possibility of long operation life (thousands of hours).
4. Possibility of multiple re-ignition (thousands of cycles).

Along with the indicated advantages, EPSs have some of specific features that must be taken into consideration when using them:

1. The need for sufficient electrical power on board (after the degradation of solar panels at the end of the spacecraft's functional life).
2. Small amount of thrust (ones ... tens of mN).
3. The complexity of the electric propulsion system structure.

The paper presents the results of evaluating the use of EPSs for solving the problem of postmission disposal a spacecraft from a working orbit on the basis of existing Hall thrusters. A scheme of a postmission disposal has been developed. The requirements for the parameters of the propulsion system and their dependence of the spacecraft's mass, the value of the ballistic coefficient and the power consumption are determined. The calculations took into account the main parameters of the electric propulsion systems

(SPS-25 and SPS-40) developed by Space Electric Thruster Systems (Ukraine, Dnipro).