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GT-50 RF ION THRUSTER: DEVELOPMENT STATUS AND PRINCIPAL SOLUTIONS

Abstract

Nowadays, small satellites and smallsat constellations are becoming more and more popular. For building constellations, station-keeping, and maintaining longer mission lifetimes, as well as for deorbiting satellites as their lifetime has expired, it is essential that they are equipped with a propulsion system. Avant Space Systems works on a propulsion system for small satellites based on GT-50 RF ion thruster. The propulsion system includes a thruster with neutralizer, power processing unit, and propellant feed block. The development is conducted bearing in mind typical limitations in power allocated for a propulsion system, as well as volume and mass limitations. One of the key driving requirements is simplicity of integrating the system into a satellite. The total power consumption of the system does not exceed 300 W. Considerable attention is also paid to mathematical modelling of the thruster's operating process. To date, an RF discharge model has been developed, based on KARAT software. In addition, a general thermal model along with a model of RF power dissipation in the structure of the thruster is in work. In Avant Space Systems, an experimental prototype of the GT-50 thruster has been designed and manufactured. The model allows for fast replacement of discharge chamber and ion-optical system. During the research, the distribution of local plasma parameters, which made it possible to verify and expand mathematical models of the discharge. The electrodes of the ion-optical system made of various materials have been tested. The thruster's general performance has been measured with nominal power consumption. In addition, a compact RF generator has been designed and manufactured by Avant Space Systems, working on a resonant-mode switched power supply principle. It is now undergoing vacuum testing. Currently, a lot of information has been obtained on working processes of the thruster and the power supply system. The key elements of the thruster have been developed. The influence of magnetic field on RF power coupling to the discharge. The experience gained will allow creating a propulsion system that will have a number of structural and technological advantages compared to existing solutions.