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New Missions Enabled by New Propulsion Technology and Systems (6)

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# PROSPECTS FOR THE USE OF HELICON THRUSTERS FOR SPACE EXPLORATION

**Abstract**

The helicon wave phenomenon was first experimentally discovered in the 1960s. However, the theoretical description of plasma processes was given by F. Chen only in 1985. The main advantage of space propulsion based on this phenomenon is the absence of electrodes directly in contact with the plasma, which lengthens the propulsion system's lifetime and decreases production costs. The aim of the studies described in the paper was to assess the prospects for using helicon thruster in various space missions. A set of helicon thrusters with powers of 200 W, 1 kW and 10 kW was considered. Expected thrust performance and geometry of the thruster were estimated. Operation modes of the engine and plasma parameters were calculated using KARAT software, which implements the "particle-in-cell" method featuring the direct Monte-Carlo method to account for particle collisions. In addition, the obtained data was compared to the results of calculations in the HELIC software, created by D. Arnush and F. Chen. As a result of the analysis of the obtained data, the areas of possible use were identified and the main disadvantages and principal engineering challenges of this type of thrusters were outlined. In the course of the research, a comparison was made with other types of electric propulsion in the context of the requirements of missions featuring constellation maneuvering, LEO to GEO orbit-raising, as well as deep space missions. If the problem of low efficiency is solved, helicon propulsion systems can be very promising in both near-earth missions and deep space exploration.