Effects of Geometry and Voltage on Ion Engine Design

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The purpose of this project is to find out how the geometry and spacing of the anode and cathode and the voltage input can affect the thrust output of a small scale ion engine. If I increase the input voltage, then the output thrust will increase because more ions can be produced. If the distance between the anode and cathode is increased, then the output thrust will decrease because the ions won't be able to transfer as easy. If the grid pattern is a circle, then the output thrust will increase because there are more ions being transferred. I built three different ion engines with different geometric grid patterns for the anodes and cathodes: triangular, square, and circular. I then tested the three different engines at voltages ranging from 5kV to 10kV and at different spacings between the anode and cathode ranging from 5mm to 15mm to measure wind speed and record current. From the data collected, I was able to calculate the resistance, input power, output thrust, output power, and power efficiency of the different ion engine designs. The triangular grid pattern had the highest maximum output thrust at 1.346mN. The square grid pattern was the most efficient at 5.28%. The circular grid pattern had the lowest resistance value of 75MOhms. My hypothesis was partially correct because the output thrust was higher when there was a higher voltage and lower spacing. My hypothesis was incorrect about the circular grid pattern because it had the lowest output thrust.

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