AeroHive: A Novel Honeycomb Electrohydrodynamic Thruster Array With Vectorized Propulsion

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Electrohydrodynamic (EHD) propulsion, also known as ionic wind, is capable of producing thrust with no moving components. Using emitter and collector electrodes, EHD thrusters ionize and accelerate air molecules through a corona discharge. EHD propulsion provides many benefits, including low noise output, minimal maintenance, and zero carbon emissions. Currently, EHD's largest challenge is the low thrust produced, hindering its widespread use. This project aimed to address this challenge of low thrust by designing, building, and testing a novel EHD thruster: AeroHive. By using a honeycomb shaped collector with needle emitters, AeroHive's design minimized wasted space while demonstrating structural integrity. AeroHive's components were designed and 3D printed, and a conventional thruster was created using the same process to serve as a comparison. After electroplating collectors, the thrusters were then tested, and the input current, thrust, wind speed, operational voltage, and operational current were recorded. AeroHive produced roughly twice the thrust density as the conventional thruster despite having half the electrode volume. By modifying AeroHive's electrode connections, thrust vectorization was achieved. Additionally, numerical simulations via Finite Element Method confirmed the results of the honeycomb and conventional thrusters and optimized airflow and thrust. Overall, AeroHive offers enhanced performance, optimized geometry, and novel features with potential applications for silent, electrically driven propulsion systems and electric component cooling.

Awards Won:
Third Award of $1,200
Midjourney: Eight awards of $2,500