Plasma Actuator, "Not A Drag," Year II

Kollman, Robert

Since 1998, dielectric barrier discharge plasma actuators or vortex generators have been steadily rising in popularity. This interest is due to complex physics unraveling itself into the form of everyday applications. Plasma actuators ionize the air around them, forming a nonthermal plasma layer over exposed electrodes, which then repels neutrally charged air. The repelling of that air leads to the actual actuation, or change in fluid flow, around the device itself. The goal was to build an affordable, scaled down plasma actuator that would be able to fit on a mid-size car. By adding a direct current voltage generator, that multiplies input voltage 1,000:1 using a Flyback transformer, the plasma actuator uses higher voltage while maintaining minimalist, versatile design. While the actuator was constructed similarly to those described in a number of scientific resources, the device was powered in a completely innovative fashion. Additionally, the project fully tested and realized the feasibility of the every day use of plasma actuators. After testing, the actuator is more effective in terms of thrust generated and dielectric field strength. This result is hypothesized to be a result of the increase in applied voltage, rather than the change from alternating current to direct current power source. The results of this experiment manifest themselves in two ways. The first is physical data gathered; thrust, mass flow rate, and dielectric field strength were analyzed and yielded a maximum thrust of 750.319998 micro-Newtons/Watt at the 12 kV setting. The second result is common application. The plasma actuator is projected to increase gas mileage from 10-15% for the average vehicle as well as result in an estimated reduction of 25% overall aerodynamic drag.

Awards Won: