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Next Generation Propulsion: The ALFA Mark VI

My project improves on an existing thruster called the PIT, which uses fast rising electromagnetic fields to ionize a fuel and propel it away creating thrust. My design ionizes the gas prior to firing in order to create a current sheet much sooner than the PIT. In previous years I proved that my concept was correct. This year I designed and built a full size propulsion system to test my concept on the same level as other thrusters currently in development. I designed a novel power-train to transfer the energy stored in the capacitors to the drive coil. I also designed a fuel injection valve that achieves much better gas distribution across the face of the thruster's drive coil than previous NASA designs. I designed and built a very efficient charging system to store energy from normal 120 V AC source in a 1200 V capacitor. I used high voltage DC to ionize the fuel. An electrode covers the entire face of the drive coil and acts as the anode. A cathode then emits electrons into the thruster's plume to neutralize the plasma. The entire system is controlled by a PIC microcontroller. I tested the set-up in a vacuum chamber that I designed to replicate the environment of space. To measure thrust, the thruster, ALFA (Assisted Lorenz Force Accelerator), was suspended on a spring system with the drive coil pointing up. An accelerometer was used to analyze the motion of the ALFA mark VI and determine acceleration and thus, thrust.