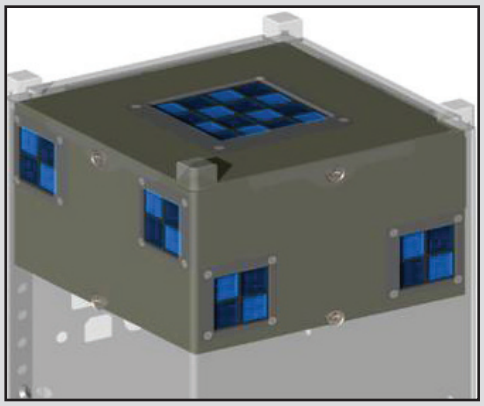
Advanced Propulsion Technology to Benefit Nanosatellites



Lab-sponsored University of Michigan Professor Alec D. Gallimore is developing the NanoFET [field extraction thruster], a novel electric rocket thruster that uses electrostatic acceleration of charged nanoparticles to propel spacecraft faster and with less propellant than previous technology allowed. (Credit: Michael Rayle, Electrodynamic Applications, Inc.)

Lab-sponsored University of Michigan Professor Alec D. Gallimore is developing the NanoFET, a novel electric rocket thruster that enables spacecraft to travel faster and with less propellant than previous technology allowed. The half-inch thruster uses nanoparticle electric propulsion, a technology that increases velocity by several hundred—or even thousand—miles per hour and thus promises a dramatic performance impact for nanosatellites, larger spacecraft, and possibly non-space-type vehicles as well.

As implied by its name, the NanoFET [field extraction thruster] employs electric fields to help create thrust as particles are charged, accelerated, and propelled into space. Initially 10 to 50 nm in size (i.e., approximately 1,000 times smaller than a human hair in diameter), these particles undergo scaling to increase their miniscule dimensions to 1-10 μ (i.e., 1/20 to 1/2 the size of a human hair). While such modifications render the particles visible and thus practical for advanced propulsion research, other challenges—such as designing materials capable of withstanding both high voltages and proximity to other materials, as well as ensuring the form and fit of all materials used on a satellite about the size of a baseball—remain. The researchers forecast that many such issues will see resolution in the next 3 to 4 years.

Meanwhile, Dr. Gallimore's team has tested NanoFET-based propulsion both in the air and in a vacuum chamber, using an aircraft that replicates conditions of limited gravity. Their results indicate that this revolutionary propulsion concept—specifically, the electrostatic acceleration of charged nanoparticles—has a number of potential applications for space propulsion and beyond, including possible uses in various manufacturing and biomedical technologies.