



News Release

Defense Advanced Research Projects Agency

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IMMEDIATE RELEASE

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DARPA DEMONSTRATES MICRO-THRUSTER BREAKTHROUGH

The Defense Advanced Research Projects Agency (DARPA) has demonstrated micro-thrusters that are 50 to 100 times more efficient than those previously demonstrated. The micro-thrusters have a thrust chamber approximately four millimeters (0.16 inches) on a side and are now approaching the performance of macroscopic thrusters in terms of impulse generated per unit of propellant, or specific impulse.

"We are very excited about these new results," said Dr. John D. Evans, program manager in DARPA's Microsystems Technology Office. "Providing compact, low-power maneuverability is one of the key challenges in developing fully autonomous, integrated micro-systems on land, in air, and in space. These results demonstrate that high-efficiency propulsion can be achieved at the micro-scale, and provide a roadmap for further micro-thruster advances."

With DARPA Phase II Small Business Innovation Research funding, researcher Dr. Amish Desai of Tanner Research, Pasadena, Calif., has demonstrated micro-thrusters that generate 40 milli-Newton seconds of impulse by combusting 35 milligrams of propellant, primarily composed of black powder. This yields a specific impulse of 116 seconds, and represents the highest known level of specific impulse achieved to date for micro-thrusters. Specific impulse is the amount of impulse (force multiplied by time) generated per unit mass of propellant. It measures how efficiently a thruster uses propellant to change the speed or direction of a spacecraft.

The researchers originally built the micro-thrusters using various plastics, epoxy and silicon. As they increased the combustion pressure, the structural integrity failed repeatedly, and specific impulse values did not increase significantly. When researchers devised a more substantial structure made of aluminum, able to support a higher internal pressure, specific impulse levels of 100 seconds and beyond became possible.

Micro-thrusters are miniature actuators created using small cavities, rocket propellant, and low energy igniters. They provide thrust in the same way that the Space Shuttle solid rocket boosters provide thrust, while being thousands of times smaller. The ultimate goal of DARPA's research is to permit the eventual integration of micro-thrusters into guided munitions, small

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satellites, and micro air vehicles, thereby providing enhanced maneuverability in a small, low-cost form-factor. The next step for researchers is to develop the technology to mass-produce these thrusters using standard lithographic techniques such as those used to manufacture semiconductor chips.

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