

These Aren't Your Kids' LEGOs: USU Team Develops Rocket Propellant Using Familiar Plastic | College of Engineering

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News Release — June 10, 2021 — A Utah State University engineering team won first place at the 2021 Wasatch Aerospace and Systems Engineering Mini-Conference. Their award-winning tech was a 3D-printed, plastic-based rocket propellant.



Dr. Whitmore with master's student Kurt Olsen (left) and sophomore Parker Forster testing the thrust for a small satellite propulsion system using ABS-based propellant.

The team included Stephen Whitmore, professor of mechanical and aerospace engineering, and Tyson Smith, '07, '10, '22, electrical engineering doctoral student and aerospace engineer at [Space Dynamics Lab](#). Together, they 3D-printed rocket propellant using acrylonitrile butadiene styrene, or ABS, the same plastic used to manufacture LEGOs.

"It turns out that with just some slight modification, many of the plastics that have been developed for other things made very good rocket fuels," said Whitmore. "ABS is a very stable material and takes a lot to get it to burn. In the 3D-printing process, even though it looks like a solid piece, it is actually made up of tiny layers of microfibers. In between those tiny fibers, there is a lot of open space and a path for electrical arcs to occur."

"Basically, if you smell hydrazine, it's about the last thing you're going to smell. It's a very reliable propellant because it's so volatile, but you can't throw it away, you

can't recycle it. It's become prohibitively expensive to work with."

Operating costs of the ABS-based propellants are considerably lower than those of hydrazine, and the fact that they're manufactured using 3D printers makes them easy to adopt. 3D printing provides (1) flexibility to produce a wide variety of shapes and sizes for tailored requirements and (2) a scalable system to meet diverse performance needs.

Speaking about innovations in engineering, Whitmore said, "It used to be you could think something up, but you couldn't build it with the old-fashioned manufacturing techniques. But the ability to print stuff nowadays means that you can make structures that weren't possible just 10 years ago."

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Organized by the American Institute of Aeronautics and Astronautics and the International Council on Systems Engineers, the two-day virtual conference brought together engineers and academia and industry for the purpose of "celebrating the creativity of engineers." The conference attracted more than 150 participants along the Wasatch Front.

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