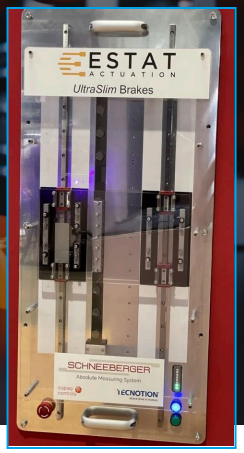
Clutch Performance: Compact Motion Control Powered by ESTAT



ESTAT Actuation is rewriting the rules of motion control with brakes, clutches, locks, and latches powered by electroadhesion instead of heavy, bulky, and heat-prone electromagnets. Spun out of Carnegie Mellon University (CMU) in 2019, the company's first breakthrough was a featherlight rotary clutch. ESTAT continues to broaden their product line with solutions like the linear electroadhesive brake, capable of transmitting up to 25lbs (11kg) of force while consuming only milliwatts of power. Based on the principle of electroadhesion—similar to the static cling that makes a balloon stick to a wall—ESTAT's components are significantly smaller, lighter, and more energy-efficient than conventional hardware. This breakthrough enables new possibilities in mobile robots, exoskeletons, wearables, and beyond.

The company's trajectory owes much to CCO **Kirby Witte**, whose career has centered around testing the limits of legacy actuator technology. While pursuing a PhD at CMU, Witte focused on the design and testing of exoskeletons for athletic augmentation, a field constrained greatly by existing actuator technology. At CMU, she met future ESTAT founder and CEO **Stuart Diller**, who was perfecting "electric glue," electroadhesion between surfaces. They found an opportunity to work together to create a lightweight ankle exoskeleton. After a stint in surgical robotics, where she ran into the same bulky, inefficient actuation systems, Witte joined Diller at ESTAT. Over the past four years, she's helped transform his research into usable and practical products like ultra-slim brakes and the linear clutch.

With componentry as thin as paper—three times lighter and ten times smaller than conventional systems, with minimal power draw—ESTAT delivers a new class of actuation hardware that makes robots safer, more agile, and far more cost-effective to construct and operate. And by building an off-the-shelf catalog of electroadhesive products (with bespoke designs in as little as 8 weeks), ESTAT is lowering barriers for customer entry across industries, from consumer electronics to aerospace.

Challenge

While showcasing at a major trade show, ESTAT's tech attracted the attention of SCHNEEBERGER, a leader in linear motion products. The meetup quickly grew into a major opportunity, as SCHNEEBERGER invited ESTAT to demonstrate its ultra-slim linear brakes in their booth at the 2024 IMTS trade show, one of the industry's top stages. There was just one problem: ESTAT didn't yet have a working demo. With only eight weeks on the clock, the team launched into an all-out sprint to design, build, and deliver a flawless system that could spotlight their breakthrough tech on stage and in real time.

Project Details

Company:
ESTAT Actuation

Year Founded:
2019

Founder:
Stuart Diller, Ph.D.

Programs Participated In (Year):
Innovation Works Manufacturing Assistance (2024)
Robotics Factory Scale Program (2024)

We discovered Butler Technologies, Inc. and ToolCo through the Scalable Grant program and have kept our manufacturing local ever since. We are proud to be 'made in PA' thanks to Innovation Works."

--Kirby Witte
CCO, ESTAT Actuation

Solution

To meet the deadline, ESTAT leaned on the Robotics Factory for critical support. Robotics Factory staff provided design reviews for the demo unit and hands-on troubleshooting during final assembly, helping ESTAT navigate several last-minute hurdles. One of the biggest challenges came when their first prototype failed due to vibration issues—the polycarbonate plate they had installed experienced resonance with the motor control frequency. With crucial guidance from Robotic Factory's **Andrew Katon**, the team quickly pivoted, machining a new plate in the Robotics Factory lab and reassembling the system. Thanks to this collaborative effort, ESTAT delivered a successful showcase at IMTS 2024 and launched its first co-branded product with SCHNEEBERGER on one of the industry's biggest stages.

The Robotics Factory has been instrumental in ESTAT's scale-up, delivering technical expertise, financial support, and much-needed *human* guidance. Through the Scale Program, **Matt Verlinich** helped refine manufacturing, while Innovation Works' vetted vendor database gave the team a critical edge in building reliable supply chains. A Scalable Grant pushed things further, enabling ESTAT to vet local suppliers, bring on a contractor for vendor development, and confidently source the vast majority of components and services in-state. The Robotics Factory filled vital gaps for a lean team, offering design reviews, 3D scanners for rapid quality checks, and a sounding board during high-stakes decisions. The result has been faster product development, stronger quality control, and the momentum to move from its academic roots to a customer-focused, market-ready company.

ESTAT Actuation is firmly rooted in Pittsburgh's robotics ecosystem, shaped by mentors at CMU, Innovation Works, and the Pittsburgh Robotics Network. For Witte, returning to Pittsburgh after a stint in Silicon Valley meant gaining access to the same world-class accelerators and manufacturing resources on par with the Bay Area, combined with the city's uniquely collaborative spirit. That support has fueled steady growth—eight full-time employees (with more on the way), key contractors, access to talented student interns, and close ties to local toolmakers, engineers, and manufacturers. ESTAT has been recognized as one of the University of Pittsburgh's "2023 Outstanding Employer of the Year". Backed by partners like the Robotics Factory and Innovation Works, the company is proving that electroadhesion isn't science fiction but a new foundation for motion control. By replacing the heavy, power-hungry devices of the past with paper-thin electrostatic films, ESTAT is unlocking faster, more efficient, and more intelligent machines. For robotics and beyond, the message is clear: the future of motion starts and stops with ESTAT.

Innovation Works and the Robotics Factory

Innovation Works is one of the most active early-stage investors in the country and the most active in Pennsylvania. Since its inception of the seed fund in 1999, Innovation Works has invested in over 780 companies that have gone on to raise $3.4 billion in follow-on funding. Innovation Works is part of the Ben Franklin Technology Partners network, which has catalyzed economic growth over the last 30 years by providing access to capital and networks that help foster innovation and technology-based economic development in Pennsylvania. The Robotics Factory is an array of robotics programs led by Innovation Works and the Pittsburgh Robotics Network. Learn more at **innovationworks.org** and **robotics factory.org.**