

# Ghost Robotics

## Use Case: Spirit™ Series Robot

### Producing Lightweight, Durable Robot Parts on Stratasys Origin One

Ghost Robotics™ produces four-legged autonomous unmanned robots with all-terrain stability that can operate in almost any environment. These quadruped robots are size-scalable, ultra-agile, high-endurance and easy to program. Simple mechanical systems increase the robots' durability, agility and endurance. The robots' modular design supports the efficient field swapping of any sub-assembly.

#### Challenge

Ghost Robotics needed to produce lightweight, durable parts, with a cosmetic surface finish, for its Spirit™ Series robot.

- The team needed to stay agile, shipping units to customers while maintaining the ability to iterate on the designs based on customers' feedback.
- Injection molded parts and CNC machined parts were cost-prohibitive, had long lead times, and could not be easily iterated on.
- The company considered other 3D printing methods as a solution, but the parts weren't isotropic the mechanical properties weren't strong enough; and the surface quality was too rough for the parts to be given to customers.

#### Solution

Ghost Robotics searched for a suitable high-end 3D printing solution and found Origin One (acquired by Stratasys in 2021), leveraging the company's ecosystem material network to select the right material for the robot's parts. Henkel's high-impact material LOCTITE 3172 and ABS-like material LOCTITE 3843 had the optimal mechanical strength, durability, color, surface quality and price point.

Ghost Robotics ordered nine parts per robot, including 3D printed legs, soft toes and side panels. The team did not need to change the original design they had produced for CNC parts, which made swapping from a traditional manufacturing method to a 3D printed technology almost seamless. Fast time-to-part enabled Ghost Robotics to quickly come to a material and manufacturing solution for their parts.

"Now, we can comfortably ship the number of units we have on order, without worrying about immediately tooling something up," says Ghost Robotics mechanical engineer Gavin Kenneally. "The parts are rugged and robust and look great, like a finished product."

As Ghost Robotics continues to test the Spirit™ Series robot on different terrain, 3D printing allows them to retain flexibility with the geometry of the robot's parts. For example, they are considering enlarging the robot's foot treads, so the part geometry is not 100% set, which isn't an issue with 3D printing.

#### Impact

The Stratasys Origin One's build volume, high throughput, material availability, and low per-part cost make it an obvious choice for robotics components that would typically be machined. 3D printing robotics parts on a Stratasys Origin One eliminates the need for tooling, reduces cost by 80%, allows for fast design iterations that improve performance and accelerates time to market. As demonstrated on the parts and in the photos, the P3 technology enables exceptional surface quality that can be indistinguishable from an injection molded surface finish.

