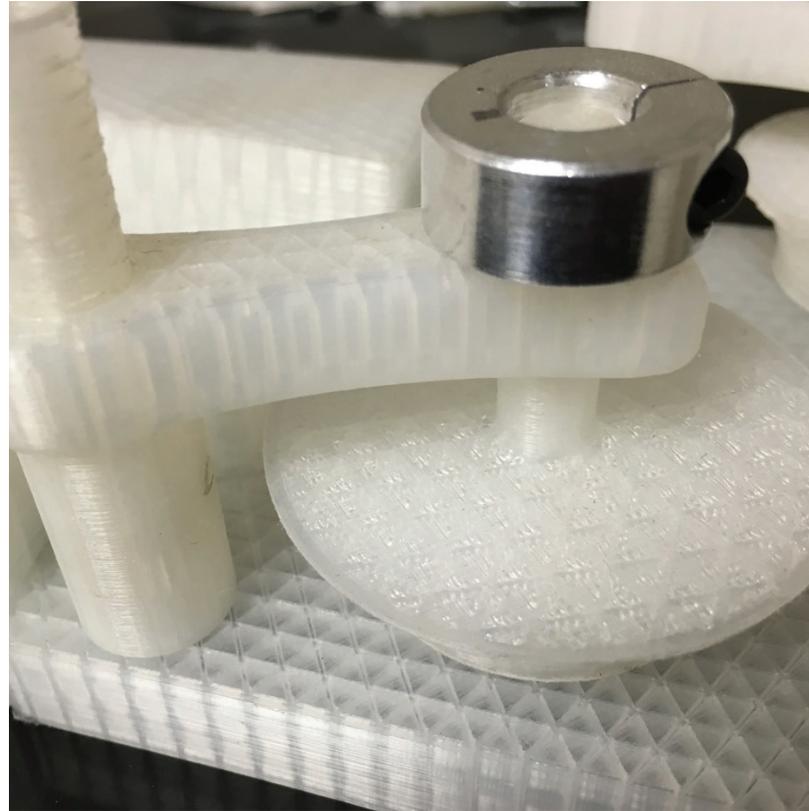


Markforged Nylon: A Resistant Solution



Comparing the Numbers

	Cost	Time
Markforged Parts (5)	\$82.00	117 hours
Machine Shop – Aluminum	\$1,795.00	264 hours + shipping time

The printer paid for itself in less than 4 prototypes.

Searching for Solutions

When it comes to 3D printing, one often doesn't think too hard about the chemical properties the materials contain. While the Markforged printer is most well known for the material strength of its parts, two engineers at Whitford Corporation discovered that the unique chemical properties of Markforged's high quality nylon filament provides reliability in the face of harsh chemical solvents.

The Whitford Companies manufacture a wide variety of specialty coatings and sealants. Jon Fetzner and Bobby Colmery work as process engineers to identify process, safety, and ergonomic improvements around the company's manufacturing floor.

Company

Two process engineers at Whitford Corporation, look for money and time saving solutions throughout the company's specialty coating and sealant manufacturing methods

Problem

Prototype an inexpensive part for a critical process step that would cost \$2000 to machine

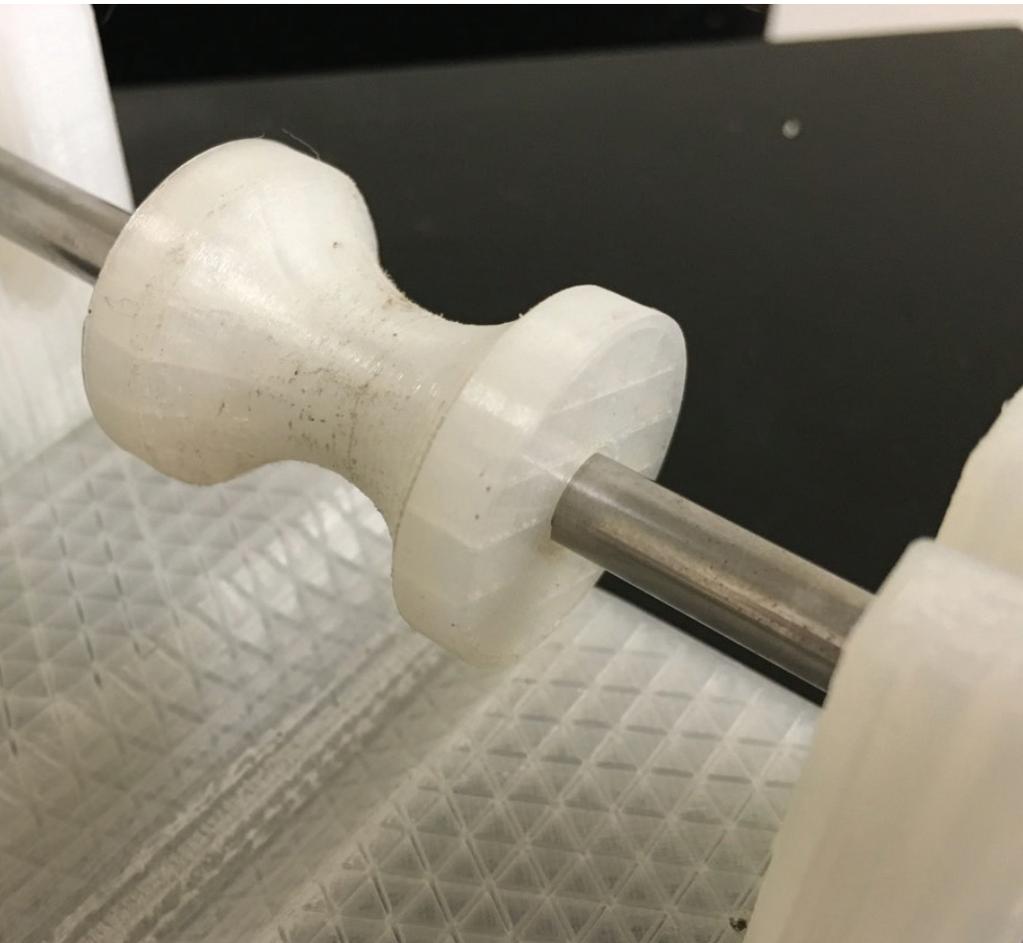
Result

Using the Mark One, the team iterated on the design many times for the price of one machined part

Reward

The printer more than paid for itself within the first few weeks

Many of the components handled in manufacturing need to be robust and resistant to the solvents used in the manufacturing process. Few polymers are sufficiently resistant in a harsh chemical environment. As a result, prototype and custom parts have been historically outsourced to a shop to be custom machined out of metal, with complicated parts sometimes costing thousands of dollars. It is up to Fetzner and Colmery to find better and more cost effective approaches.

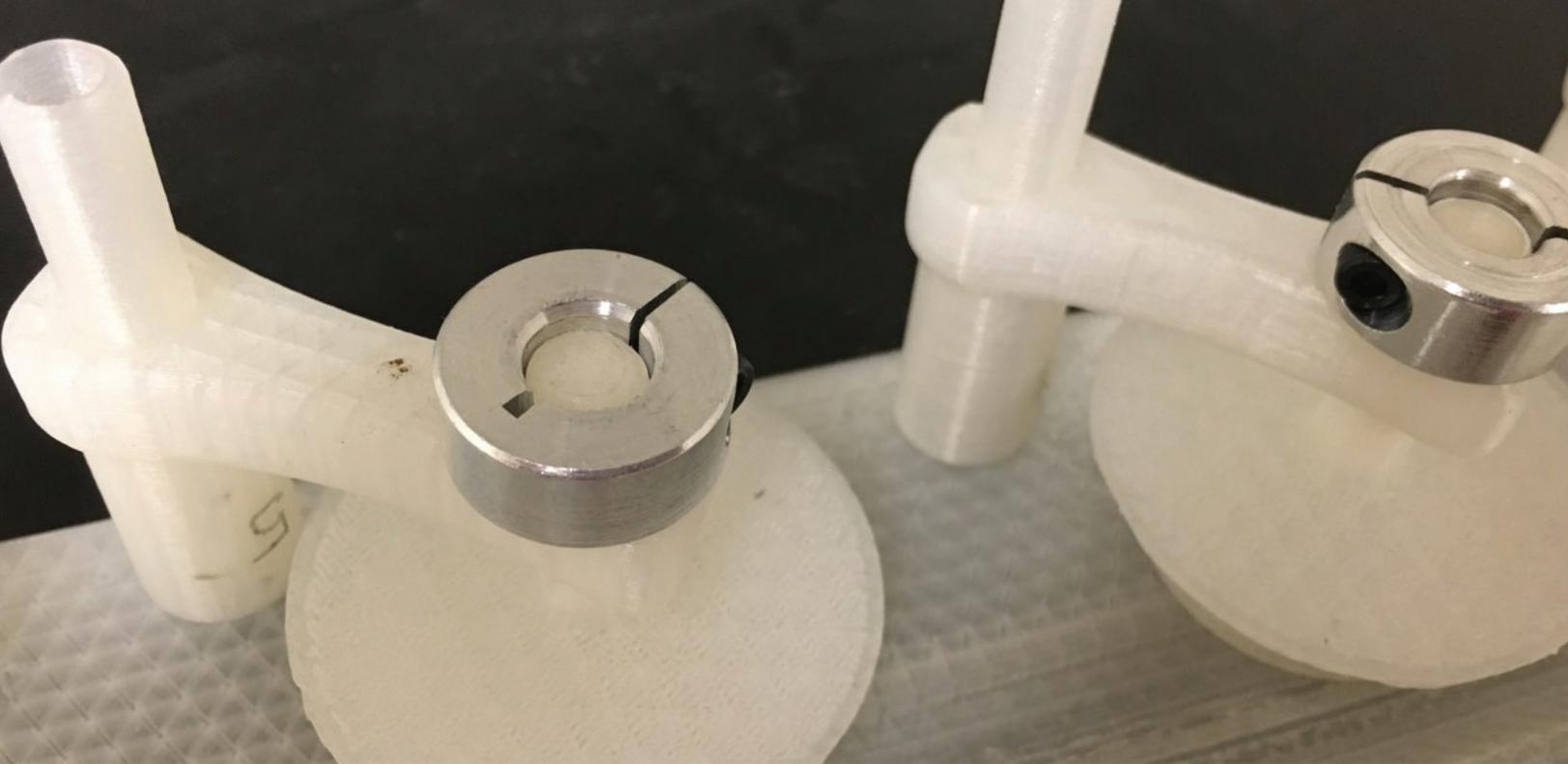


Finding a Method that Sticks

Among the processes Fetzner and Colmery have been working on are improved techniques for packaging a particular sealant, whose methods that “have always been a big problem, and take a little bit of black magic.” The team explained that they went down several avenues to solve one of their latest challenges, and ended up with an idea for a simple 3D printed packaging apparatus. However, due to a design change, they had to scrap that idea and start over. “We tried several iterations of that design and couldn’t figure out how to get it to work reliably,” Fetzner explained, “We went to a new design, switched gears, and thought 3D printing was out.” The team then arrived at a concept for an elegant apparatus to more reliably package the sealant product. Due to its complexity, they sent the design to be machined by a third party machining resource and received a quote of around \$2000. They knew they would have to go through

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-Jonathan Fetzner
Process Engineer
Whitford Corporation



multiple iterations to perfect the design, so they had to pursue a different manufacturing option: "After receiving a quote for \$2000 from a machine shop to fabricate the apparatus, we determined that price was too steep for another design that will no doubt need more changing after field testing. We really loved the concept of 3D printing and thought 'man, wouldn't it be awesome if we had one of our own? We could do all this testing and tweaking in house.'"

The two process engineers laid out four essential criteria that needed to be met to justify the purchase a 3D printer: The printer needed to be cost effective, user friendly, print functional parts, and its material needed to be solvent resistant. "We looked into all types of printers; from \$800 desktop printers to \$140,000 industrial strength printers," says Fetzer. After selecting a few potential printers with the necessary capabilities, they started looking at materials. They received



material samples from a few different vendors, including Markforged, and placed them in some of their harshest chemical solvents. "We went through the process of elimination of materials", Fetzer explains, "Some of them completely dissolved... we tested the [Markforged] nylon and that eliminated all the other printers, really. It was the only one that held up to all the criteria that we had... the nylon went through a 26-hour bath in our most harsh solvent and it still looked beautiful".

"When they saw the cost of that and the cost of the Markforged printer, we found other items we could invest in, and that pretty much sold it right there..."

-Bobby Colmery
Process Engineer
Whitford Corporation

Sealing the Deal

Once Fetzter and Colmery had narrowed their options down to the Markforged printer, the next challenge was convincing management that the purchase would be worth it. Many of the machines at the company are decades old and get the job done. Aside from some very sophisticated laboratory instruments, a 3D printer would be the most modern piece of equipment at the company, but very few people were familiar with its benefits. "The whole 3D printing concept was foreign to us until we started looking into it," Fetzter described, "we had to sell the concept first before buying it." Everyone in management agreed that the new assembly was helpful to the sealant manufacturing process, and that they needed to make it somehow. That was the first step in getting everyone on board with going in this direction.

With the Markforged 3D printer priced at about \$5,500, and a single machined packaging apparatus at \$2,000, it was an easy sell. "When they saw the cost of the apparatus versus the cost of the Markforged printer, we found other items we could print in-house to reduce cost, and that pretty much sold it right there...", Colmery explained, "it was the cost itself, and that we no longer needed to rely on suppliers for some of our other parts." With the Markforged printer, the Whitford Companies could manufacture and prototype many chemically resistant parts at a fraction of the price it would take to get them made elsewhere. The team explained that cost of machined prototypes created for the sealant packager would have definitely exceeded the cost of the printer: "The Mark One has pretty much paid for itself...the amount of iterations we made, I don't even know how much that would have cost. We definitely saved a lot of money."

Upon receiving their Mark One, the pair immediately set it up. "We were printing something within the hour...it all went together perfectly and it just worked". Amazed with its capabilities and with its applications, the two now incorporate 3D printed parts into other fixes, "a lot of things we see around here, we say 'hey...maybe we can print that.' It's a great experience."

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Markforged's mission is to bring high strength 3D printing to everyday engineering. Offering the world's only 3D printing systems capable of automatically reinforcing engineering plastics to aluminum levels of performance and beyond, Markforged enables every business to easily manufacture parts with structural strength right on the desktop. The Mark Two Industrial Strength 3D Printer empowers professional users to affordably create workhorse 3D parts that solve real problems, as well as realize reinforced structures never before possible. Markforged technologies are delivered with thoughtful, powerful software designed for collaboration, sharing, and scaling.

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