



 Markforged

Centerline Engineered Solutions

Making Quality a Priority in a
Contract Manufacturing Shop

CASE STUDY





Keeping Costs Down with Custom 3D Printed Fixtures

Centerline Engineered Solutions is a contract engineering and fabrication business in Greenwood, South Carolina. The company realized that time spent machining tooling and fixtures was time that could be better spent on end parts, so Phil Vickery — CEO of Centerline — looked into alternative options. After purchasing a Mark Two to print custom tooling, the company cut its costs on printed parts with Markforged technology by **86%**, and its lead times by **88%**.

APPLICATION	CUSTOMER	PARTS	PRINTER	MATERIAL
Tooling and Fixtures	Centerline Engineered Solutions	Press Brake Punch & Die	Mark Two	Onyx

Centerline had to turn down projects simply because the customer’s budget could not cover the tools and fixturing costs required to make the parts. On low-volume parts particularly, it struggled to find affordable tooling solutions for its products. This resulted in money lost for Centerline, and customers looking elsewhere for a supplier.

86%
LOWER COST

88%
FASTER

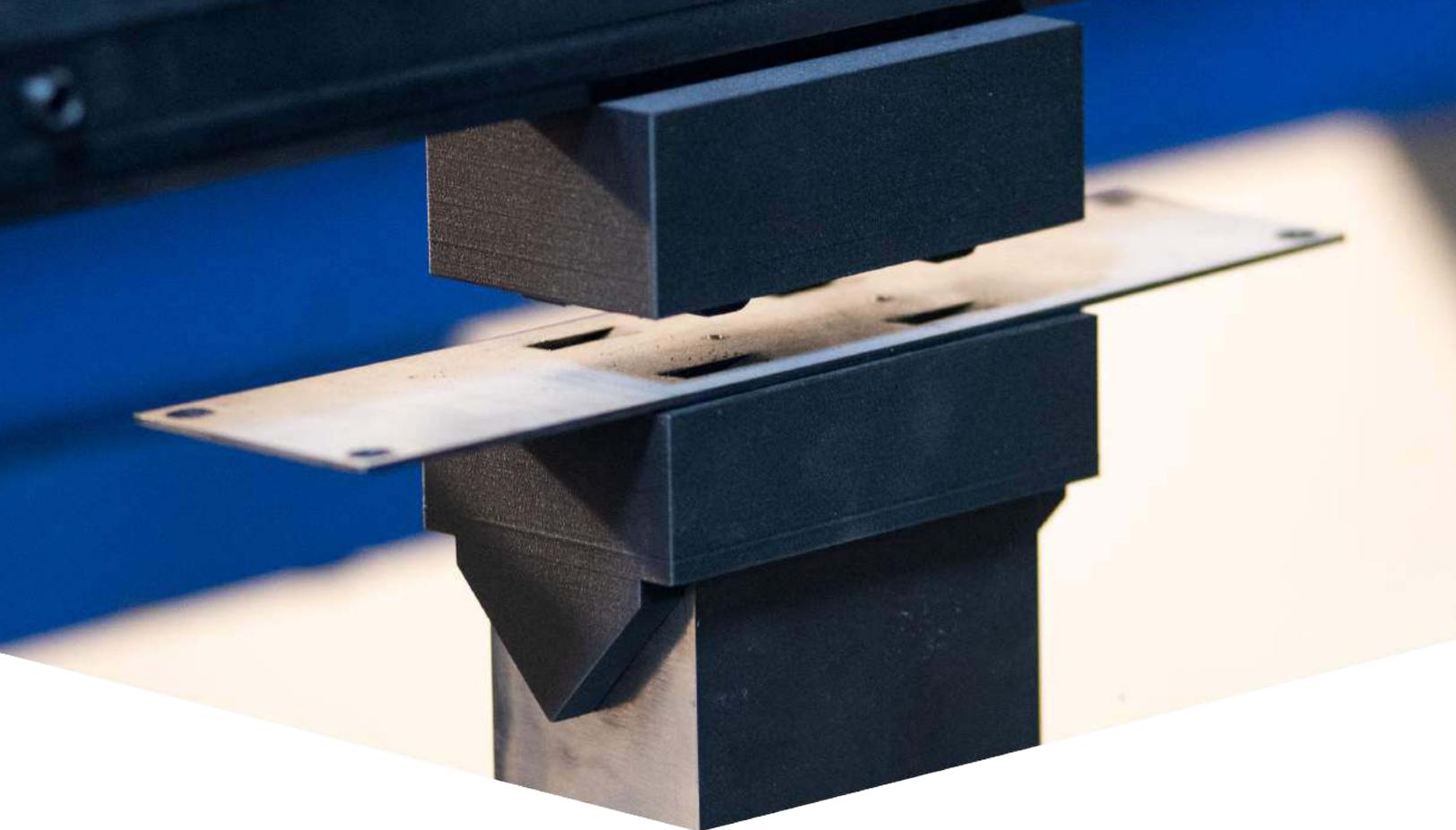
“It gets more costly each and every time a part touches another person and another operation.”

Costs escalate rapidly on parts that require multiple machining operations. If a part is 3D printed, fewer people need to work on it, reducing costs for the business and customer.

“To make a special die for a press brake is very expensive — we’re talking \$1000 to \$2000”

A machined, custom-made press brake die is expensive. If the forming requirements suit the application, 3D printing can provide a drastically cheaper solution.

Affordable Options with Markforged Technology



THE SHEET METAL PART

Centerline's customer asked engineers to bend and form a custom sheet steel part. Because the customer only needed two parts made, Phil and his team knew the tooling costs exceeded what the customer was willing to pay. Centerline would have to make a custom fixture to fabricate just these two parts, meaning that the cost per part was astronomical. Phil and his team suggested a 3D printed fixture, which the customer believed would not form their part.

THE PRINTED FIXTURE

Phil paused the print midway through, reinforced critical points with steel inserts, and continued the print. The result is a strong part with steel-reinforced forming features that easily shaped their laser cut sheet steel blank. The customer was stunned that a low-cost, 3D printed fixture could form the steel in the way they wanted. The tooling cost less than \$200 to print, which resulted in an 86% drop in costs for the customer.

"We're getting close to the strength of aluminum in the pieces we make now. The material is much stronger than I ever expected, and it actually holds up over time."

Phil Vickery, Centerline Engineered Solutions

PARTS

Press Brake Punch & Die

MATERIAL

Onyx

PRINTER

Mark Two

CUSTOMER

Centerline Engineered Solutions

“Within the first two hours of the Markforged Mark Two arriving, I was printing things. It was a very easy startup from my standpoint, and it's been well accepted by my employees as well.”

Phil Vickery, Centerline Engineered Solutions



86%

LOWER COST

88%

FASTER

Moving Forward with Markforged

Phil has used his Mark Two to effect change throughout his company. He and his team have printed everything from inspection, welding, and assembly fixtures for in-house manufacturing to custom tooling and end-use parts that are shipped out to larger clients. While Phil initially thought that a 3D printer would only be good for prototyping, he has since altered his workflow to include considering 3D printed fixtures on many of his manufacturing projects.

“We're looking for tools and fixtures that help us to be more precise and efficient,” says Phil. “I can now take a CAD drawing and print it out and say, ‘Here's the fixture’ within half the time it took to make it in the previous methods.”

Centerline engineers and machinists were skeptical at first about how a 3D printer could make their day-to-day work easier. Once Phil proved to them that he could make strong parts for a fraction of the cost, his team quickly got on board with the idea. Since then, Phil's employees have been approaching him with ideas of parts they can print instead of machine. Phil has saved his company time and money, while changing perceptions of how 3D printers fit into a machine shop's process.