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3D Printer Enables Toolmaker to Produce Fixturing, End-Use Parts

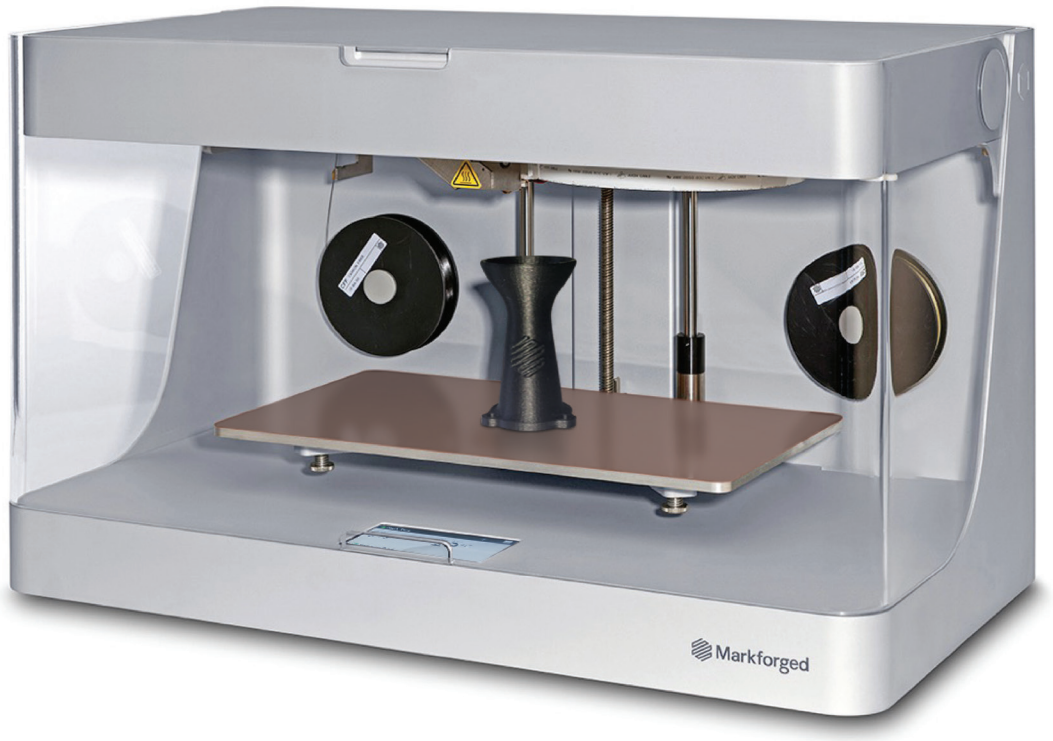
EDITED BY **JULIA HIDER** | ASSISTANT EDITOR

COMPANY
Elliott Tool Technologies

PROBLEM
Needed a more efficient way to create custom fixtures

SOLUTION
Markforged Mark Two 3D printer

RESULTS
Fixtures are made faster and more flexibly, with even some end-use parts possible



Elliott Tool Technologies thought that additive manufacturing could help address fixture-production bottlenecks, and after some research, chose the Mark Two from Markforged. This desktop system can print a range of industrial materials including carbon fiber, fiberglass and Kevlar.

Identifying and solving bottlenecks is an important part of keeping any business running. Elliott Tool Technologies identified a holdup in the process of producing its workholding fixtures, one that a 3D-printing system from Markforged (Cambridge, Massachusetts) has helped to solve.

Elliott Tool Technologies has been manufacturing tube tools and metal burnishing products for more than 125 years in Dayton, Ohio. The company's Tube Tools and Precision Metal Finishing divisions supply high-precision tooling for fine surface finishes and tight tolerances to a range of companies in the aerospace; heavy equipment; commercial and industrial heating, ventilation and air conditioning (HVAC); and oil and gas industries.

Over the years, time frames have contracted and business pressures have mounted. "There's an 'I need it yesterday' reality to the world in which we operate daily," says Manufacturing Engineer Ben Pruitt. "We have to be able to get templates and fixturing done quickly so we can produce any exotic or special tooling our customers need."

With just one toolmaker producing most of the templates and fixtures needed for machining as well as various jigs and templates for part modification, the company began brainstorming how to avoid bottlenecks and come up with faster solutions. "We thought rapid prototyping with 3D printing would help us fill the void," Mr. Pruitt says. "Rather than pulling our toolmaker off of a fixture that might take several weeks, we thought we could use 3D printing to help take care of some of our other requirements."

The goals were to speed part prototyping to evaluate compatibility with fixture designs and to lower costs compared to conventional processes. The company just needed to find a cost-efficient machine that could produce parts of the quality it needed.

Mr. Pruitt had used Markforged 3D printers for tooling at a previous shop, and he thought one of them might fit the shop's needs. "I didn't want us to spend a decent amount of capital on something that wasn't going to produce a quality product," he says. "I knew Markforged had good software, a good user interface and would be reliable." He reached out to equipment provider Adaptive Corp., and metrology and additive manufacturing specialist Frank Thomas took the call.

The shop started using the 3D printer to make end-use parts, including these cam plates for a World War II-era milling machine. This part proved to Mr. Pruitt that 3D-printed parts could have the quality and strength of aluminum ones.

The shop wanted to 3D print the strongest, lightest parts possible without having to invest in metal additive technology. Mr. Thomas recommended the Mark Two, part of Markforged's series of desktop systems. The machine prints industrial materials including carbon fiber, fiberglass and Kevlar, as well as a chopped-carbon-fiber filament that can be reinforced with continuous fiber called Onyx. Parts made with Onyx are said to have twice the strength of other 3D-printed plastics, as well as a high-quality surface finish and high heat tolerances.

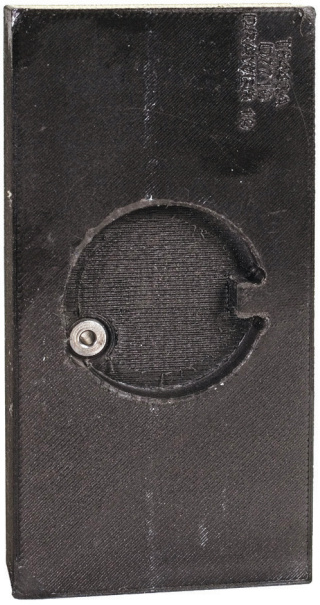
Mr. Thomas did a benchmarking exercise with the Mark Two for the shop. He printed some parts, tracking the cost and print times. The shop then compared this information with the cost of conventionally manufacturing parts in house and outsourcing them, as well the material cost and time delays involved with bid specifications and vendor negotiations. "When you 3D print something you avoid a lot of steps," Mr. Thomas says. "You never have to create a 2D drawing, you just go straight from CAD to the additive manufacturing (AM) machine and print the part in hours."

Adaptive Corp. quickly set up a Mark Two at Elliott Tool. Training on the Mark Two included almost everyone in the company, including engineers and managers. "The more people who are involved, particularly those in day-to-day traditional manufacturing, the more we can upgrade their overall skill set and elevate our ability as a company to make parts in a greater variety of ways," Mr. Pruitt says.

With the Mark Two operational, the shop began seeing a variety of positive results. Mr. Pruitt says a drill-fixture issue opened his eyes to the potential of AM to improve in-house processes. It was an oddly shaped part that the shop had tried to fixture with steel that conformed to the basic shape. However, this solution didn't envelop the part enough to hold it steady for machining, so Mr. Pruitt turned to 3D printing. "We realized we could just take a basic, solid model of the casting for the part, then sweep that shape across another fixture and essentially 'mold' the casting to the fixture. We could just print that instead of fabricate it."

AM also enabled the team to make revisions and add "nice-to-have" changes to the drill fixture that would have cost a lot to manufacture traditionally. "With AM, all you need to do is make minor adjustments in your Autodesk Inventor part files and then recreate the STL that drives the 3D-printing process," he says. "You can watch the revision changes on screen, and if you see you've made a design error, you can just go back a revision or two before you print." This enables the shop to adapt quickly to urgent engineering changes and provide a faster turnaround for customers.

Elliott Tool previously tried to make this drill fixture with steel that conformed to the part's basic shape. When that didn't work, the shop virtually "molded" the shape of the casting into another fixture and 3D printed it.



Beyond making fixturing, the shop even began using the system for end-use parts. The company was tasked with replacing the cam plates on a World War II-era horizontal milling machine. The plates support a table that rides on the angles of the plates and cuts the opposite form of the angles into the parts being milled. The cam plates had threaded holes that the shop was able to design and print directly into the part. The 3D-printed holes had the same perpendicularity as the holes that were reamed in postproduction, and the 3D-printed threads functioned equally as well as the ones that were hand-tapped. The fact that these cam plates could support the forces of more than 300 pounds going back and forth over the plates' sharp angles was proof to Mr. Pruitt that the 3D-printed parts have the strength the shop needs.

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