MANTLE

MEDICAL DEVICE CASE STUDY

First Prototype Lead Time Cut by 80% Using Tool-Steel Mold for High Temp Plastic Parts

- Molding performance equivalent to parts from conventionally manufactured tools
- Tolerance and surface finish requirements met without additional finishing

Case Study Summary

A global medical device manufacturer sought a solution to significantly reduce the time to prototype parts made with high-temperature plastic. Using Mantle's TrueShape™ technology and P2X material, cavity and core tool-steel mold inserts were 3D printed from a CAD file in just over 2.5 days and the tool was ready for molding after another 5.5 days of mold and insert preparation. Compared to a fabrication time of 7 weeks using traditional manufacturing, Mantle's process resulted in a time savings of more than 80%. The printed inserts demonstrated equivalent molding performance to conventionally manufactured components. Additionally, the molding surfaces had high tolerance and a smooth surface finish so no additional surface finishing was required prior to use.

Mantle printed insert with no surface finishing.

Several hundred parts were shot with both Acetal and Radel.

Industry & Customer Profile

A diversified global medical device manufacturer had significant experience 3D printing both metals and plastics for end-use parts. Up until this point, however, the company had to use traditional manufacturing processes to create metal tooling for prototyping or high volume molding applications. As one of the Mantle Frontier Partners, the company gained access to Mantle's TrueShape™ technology and application support to trial mold the performance of a printed insert in their manufacturing environment.

Product Challenge

The medical device industry has unique requirements that make new product introductions time-consuming and complicated. For many medical parts, the production materials must also be used during prototyping and testing to ensure safety and performance. This requirement means that 3D printed plastic parts are often not able to be used during the prototyping phase. Instead, durable injection mold tooling is needed both for initial prototyping and later-stage trials.

While 3D printed plastic mold inserts are sometimes used to mold prototype plastic parts, their insulating properties and surface finish limitations mean the prototype tooling process and parts deviate from the design and the production parts. Furthermore, these tools only survive a limited number of molding cycles and generally cannot withstand the difficult processing requirements of advanced plastics such as Radel® polyphenylsulfone (PPSU) and acetal. Radel is difficult due to high molding pressures (38,000) PSI, high melt temperature of 680° F, and high mold temperature of 320° F. Acetal is difficult because of its highly corrosive gas emissions and ease of flashing during molding.

The Solution

Inserts prepared for installation in mold base

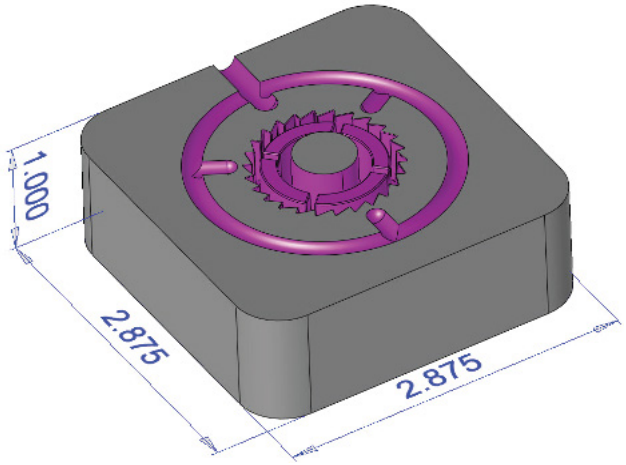
Using the supplied CAD file information, a set of cavity and core mold inserts were printed using Mantle's TrueShape™ technology and P2X material. The inserts were printed and shaped in 40 hours and sintered in 24 hours, with a total production time of 64 hours. The finished insert achieved tight dimensional tolerances and had a smooth matte surface finish similar to that found on parts after Electric Discharge Machining (EDM). Prior to being installed into the molding press, approximately

24 hours of operator/machine time was used to add ejector pin holes, tap mounting holes, and fit and install the inserts into a mold base. No surface finishing was needed on the molding surfaces prior to use.

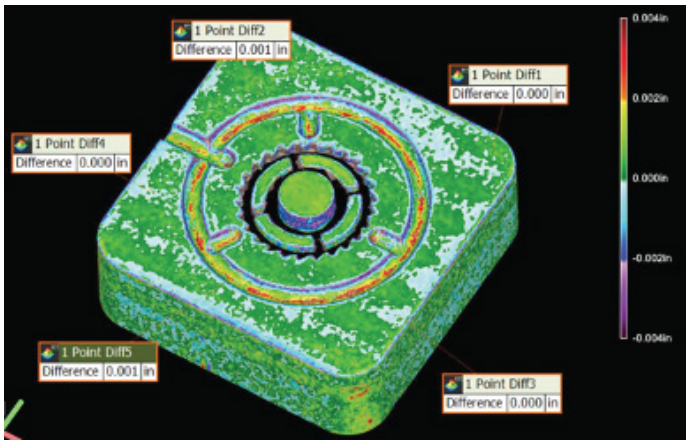
Once installed in the molding machine, parts were produced using Radel polyphenylsulfone (PPSU) at a mold temperature over 600° F and acetal at a mold temperature of over 390° F. Both materials require high molding pressures. The resulting parts passed all visual and dimensional requirements.

Evaluation Results

The trial results were favorable across all key evaluation criteria, including part quality, lead time, and cost. The printed inserts had tight tolerances within 0.001" to CAD and the resulting surface finish was 63 µin Ra (1.6 µm Ra), which produced high-quality matte prototypes with no surface finishing needed. Compared to traditional manufacturing, Mantle's process resulted in mold-ready production-grade tooling in 8 days compared to a normal 7 week lead time, a reduction of over 80 percent. The cost was reduced by over 50%. Given the positive result, the medical device manufacturer is planning future tooling builds to further qualify Mantle's TrueShape™ process and materials.



Mold cavity insert CAD



3D scan of printed mold insert showing tight tolerances after printing

Evaluation Results Comparison

Comparison Area	Conventional Approach	Mantle	Savings
Time	7 weeks	8 days	84% Faster
Cost	$4,442	$2,232 (includes printing and mold/insert preparation)	50% Less Cost

Mantle helps manufacturers bring new products to life faster, cheaper, and more easily than ever before with its patented TrueShape™ metal 3D printing technology. TrueShape™ delivers precision parts that dramatically cut the time and cost of making production-grade tools, molds, and dies. Mantle tools have produced hundreds of thousands of parts for customers - a number that grows each day. Mantle is headquartered in San Francisco, California. To learn more, visit mantle3D.com.

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