PRECISION TOOLMAKING.
SIMPLIFIED.
**MANTLE’S GOAL**

**Accelerate** how manufacturers go from product idea to launch

by **simplifying** how steel mold tool components are made

with a 3D printing solution that delivers unmatched **accuracy**, **surface finish**, and **tool steel performance**.
MANTLE:
GAME-CHANGING SPEED, COST, AND EFFICIENCY

PROVEN RESULTS:

Less time to produce precision tooling

Less cost to produce precision tooling

More efficient molding
Medical Device Component

Application

Low Volume Injection Mold Core and Cavity

Key Metrics

- Lead time reduction from **weeks to days** and work required from **148 hours to 51.5 hours**
- **50% cost reduction**
- Accurate within 0.001" as printed without additional finishing
- Molding performance of printed inserts was equivalent to conventionally manufactured inserts

Full Case Study Link
HOW TOOLMAKING TIME WAS REDUCED

CONVENTIONAL TOOLMAKING PROCESS

TOTAL TIME
148 HOURS

TOOLMAKING OPERATIONS WITH MANTLE

TOTAL TIME
49.5 HOURS

* Reduced time
Part Name

**Torch Packaging Housing**

Application

**Injection Mold Component (Slide)**

Key Metrics

- 75% lead time reduction
- 75% cost reduction
- Printed tool was used with no post processing to part detail

Courtesy: Hypertherm
HOW TOOLMAKING TIME WAS REDUCED

CONVENTIONAL TOOLMAKING PROCESS

OUT OF HOUSE LEAD TIME

- Quoting
- Raw Materials
- CAM Program
- Rough Milling
- Electrode Milling
- Rough EDM
- Semi Rough EDM
- Finish EDM
- Wire EDM
- Final Finishing

8 WEEKS
$15,000

TOOLMAKING OPERATIONS WITH MANTLE

- Quoting
- Raw Materials
- CAM Program
- Rough Milling
- Electrode Milling
- Rough EDM
- Semi Rough EDM
- Finish EDM
- Wire EDM
- Final Finishing*

2 WEEKS
$3,750

* Reduced time
### Part Name

**Dental Guide**

### Application

**Low Volume Injection Mold Core and Cavity**

### Key Metrics

- 40% lead time reduction
- Total operations time reduced from 200 hours to 110 hours
- EDM operation time reduced from 100 hours to 27 hours

[Full Case Study Link](#)
HOW TOOLMAKING TIME WAS REDUCED

Conventional Toolmaking Operations

- Quoting
- Raw Materials
- CAM Program
- Rough Milling
- Heat Treatment
- Fixturing
- Hard Milling
- Electrode Milling
- Rough EDM
- Semi Rough EDM
- Finish EDM
- Final Finishing

TOTAL TIME: 200 HOURS

Toolmaking Operations with Mantle

- Quoting
- Raw Materials
- CAM Program
- Rough Milling
- Heat Treatment
- Fixturing
- Hard Milling
- Electrode Milling*
- Rough EDM
- Semi Rough EDM*
- Finish EDM*
- Final Finishing*

TOTAL TIME: 110 HOURS

* Reduced time
<table>
<thead>
<tr>
<th>Part Name</th>
<th>Deodorant Stick Thumbwheel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td>Production Injection Mold Core</td>
</tr>
<tr>
<td>Key Metrics</td>
<td></td>
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<tr>
<td>● Over 1.4 million cycles and counting with no signs of wear on the printed tool</td>
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<tr>
<td>● Printed inserts produced weeks faster than conventional machined inserts</td>
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<tr>
<td>● Mantle’s metal 3D printed H13 and P2X inserts have proven to be as accurate and durable as traditionally S7 steel machined inserts</td>
<td></td>
</tr>
</tbody>
</table>

**Full Case Study Link**
**Medical Tweezer Core and Cavity**

**Application**

Injection Mold Core and Cavity

**Key Metrics**

- From part design to molded parts within 3 weeks
- Successfully molded bio-based, recyclable 65% glass-filled PA11 polymer
- Incorporated conformal cooling to control insert temperature precisely

[Full Case Study Link](#)
**Fluid Barb Fitting**

**Application**

Injection Mold Core and Cavity

**Key Metrics**

- 50% lead time reduction
- $1,200 cost savings
Part Name

Medical Device Component

Application

Low Volume Injection Mold Core and Cavity

Key Metrics

- Lead time reduction from 12 weeks to 4 weeks
- Reduced tooling cost from $63k to $21k
- Accurate within 0.001" as printed without additional finishing

Full Case Study Link
**Part Name**

**CAM lock latch**

**Application**

Injection Mold Core and Cavity

**Key Metrics**

- 45% lead time reduction
- Tools required only 10 hours of final finishing and fitting
- Injected Nylon PA 6/6 35% glass filled
The accuracy of a CNC machine

The freedom of a 3D printer

Designed and priced for every shop
The solution includes:

**HARDWARE**

**SOFTWARE**

**TOOL STEELS**

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**PRINT**

Print & shape metal paste in custom printer

**SHAPE**

**SINTER**

Heat & sinter paste into a solid metal part in custom furnace
MANTLE SOFTWARE

Generate toolpaths in minutes (additive and subtractive)

No programming required

No CAM experience required

Train users in minutes
MANTLE SOFTWARE
4 easy steps

1. IMPORT PART FILES
2. ARRANGE PARTS ON BUILD PLATE
3. OPTION TO MODIFY BUILD STRATEGY
4. GENERATE TOOLPATHS, SEND TO PRINTER

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TWO MATERIALS OPTIMIZED FOR TOOLING

P2X: P20 Equivalent Tool Steel
32 HRC
Compatible with standard tooling operations: grinding, milling, machining, welding, EDM
Superior corrosion and abrasion resistance

H13 Tool Steel
HRC 42 As Sintered
HRC > 50 after Heat Treatment
Compatible with standard tooling operations: grinding, milling, machining, welding, EDM
TEXTURE AND POLISH LIKE STANDARD TOOL STEELS

TEXTURING
Chemical etch
Deep chemical etch
Laser etch

POLISHING
Achieved A2 finish

“This material took texturing just like P20 with the same settings. We could polish it to an A2 finish.”
- Mold-Tech
SOFTWARE TO ELIMINATE MANUAL OPERATIONS

From CAD to part - digitally

Automatic additive and subtractive toolpath generation – no programming required

Remote print monitoring and analytics
CONFORMAL COOLING

Without a time or cost penalty

REDUCE CYCLE TIME

- Faster cooling times
- Increase press capacity

LOWER PART COST

- More parts faster
- Reduce tool cavitation

INCREASE PART QUALITY

- More controlled shrinkage
- Reduce total part warpage
- Precisely address trouble areas with cooling
- Better shot-to-shot dimensional consistency
LET'S DO A PROJECT TOGETHER

WHERE MANTLE WINS:
Like all manufacturing processes, how well Mantle fits is application dependent. The following criteria help build an ideal application for Mantle.

- Complex tool designs that require multiple machining and EDM operations to build traditionally
- Molding of challenging plastics (high temp, filled, etc.)
- Quantity of molded parts needed is hundreds to millions
- Tool size < 4 x 4 x 2"
- The desire to learn processing parameters, so a steel tool is required
- The ability to use the printed inserts with a modular mold base
- Readily available finishing (grinding) and molding to take full advantage of Mantle lead time savings
- The ability to compare Mantle to a traditionally fabricated inserts using preexisting manufacturing data (lead times and costs) to help assess Mantle
- Optional: the desire to use conformal cooling