



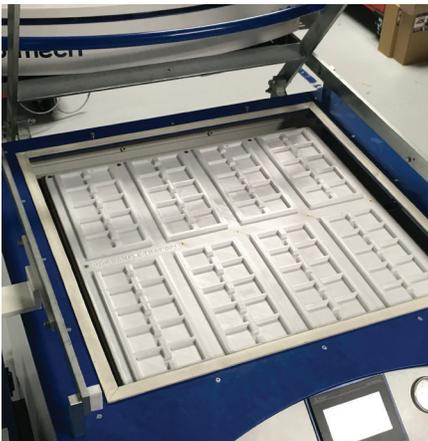
Beyond BIG Thermoform Case Study

Speed Time to Market by 3D Printing Large Thermoform Dies

3D printing is a fast and effective method to create high quality patterns and master tooling for vacuum and thermoforming molds to be used for large and small batch production.

Why BIG

Utilizing a small desktop printer can be ineffective and difficult for printing thermoforming patterns as multiple parts would be required. Aligning these parts and dealing with seams requires sophisticated jigs or fixturing. With a large format 3D printer, these patterns can be printed as one piece making setup of the thermoformer a simple process.



A large 3D printed pattern or master was created for shaping 8 customized trays in each of the thin gauge sheets pressed.



3D Platform is a leading manufacturer of large-scale, industrial-class 3D printers. Based in Roscoe, Illinois, 3D Platform is a company of skilled mechatronics engineers who embrace advancements in technology to innovate, design, and build next generation equipment for rapid prototyping. 3D Platform is committed to building on industrial strength linear motion components, actuators, and motors while maintaining affordable flexibility with open market software and control solutions.

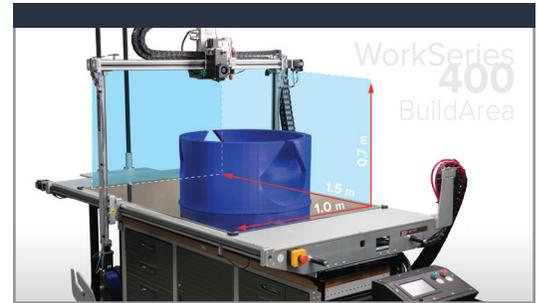
<https://3dplatform.com/>



Why 3DP

3D Platform has taken the approach of open market filament – we do not limit to specific materials or types. It allows users to find the best material for their process. Additionally, one time use molds can be printed out of less expensive, and easier to print materials than multi-use molds.

The plastic sheet to be formed can vary depending on the process. Lower temperature mold materials can be made on a 3D printed mold pattern that was printed with lower temperature, yet structurally sound, materials such as PET-G. One of the recommended materials by 3DP for 3D printing mold masters is Polymaker's PC-MAX™. This a polycarbonate material that has been specially engineered by Polymaker to print with lower warp than typical polycarbonate. It has also been engineered to print at a slightly lower surface temperature than other polycarbonates making it more suitable for open build platform 3D printing.



3D Platform specializes in the production of large format 3D printers. A large format 3DP WorkSeries machine can provide you with up to a 1m x 1.5m x 0.7m build area and the world's fastest filament fed extruders. With that much area you can print multiple small molds or a single large mold. The HFE900 extruder can produce parts at 16x the speed of the industry standard extruders used on other large format 3D printers.

Results/ROI

The master shown in the images is approximately 2 foot x 2 foot (.61m x .61m) and was printed out of Polymaker PC-MAX™. Polymaker PC-MAX™ is approximately \$53 per kilogram. The mold used approximately 2 kilograms of material to print for a total material cost of \$106*.

At an average cost of \$50/hour of machine run time (typical price of operation by a 3D print provider) this part cost approximately \$1200 to make. The advantage of 3D printing over the traditional method of machining the pattern is that the overhead cost is much less, and the operator is freed to focus on other jobs and tasks versus operating the machine. Some post processing was required to achieve the surface finish quality required in certain areas of the pattern. This cost about \$500 in time and material. Lastly, the finished pattern was mounted to a piece of MDF that provide additional clearance during molding to ensure proper material adhesion to the mold.

	Machined Pattern	3D Printed Pattern
Material Cost	\$240	\$106
Machine Time / Print Time	20 hours	24 hours
Machine Cost / Hour (include CNC operator)	\$100	\$50
Subtotal Machine Cost	\$2,000	\$1,200
Post Processing Cost	\$500	\$500
Total Pattern Cost	\$2,500	\$1,700

Tips/Community

3D printing thermoforming patterns provides users with an alternative to the expensive and time-consuming mold making process. Users need to consider the following when determining if 3D printing is the right process for making their molds:

- **What sheet material will final parts be made from?** High temperature materials will require a higher temperature 3D printing material.
- **What is the geometry of the part?** Use 3D printing for geometries that are difficult for traditional machining processes. Avoid certain geometries that are difficult for 3D printing (overhangs, bridging, etc.).
- **What surface quality is required for the pattern master?** If no FDM "lines" visible in the final mold—post processing required (Polycarbonate is ideal for post processing for best surface finish).
- **Can the mold be coated in a high temperature resin once 3D printed?** Can provide increased lifespan, and allow for lower temperature materials usage.

*Source: <http://www.polymaker.com/shop/polymaker-pc-max/>