THE FUTURE IN LOW-VOLUME PRODUCTION

Dan Mishek of Vista Technologies (Part 2 of 3)

In part one of this three-part series, we discussed today's methods for managing "low-volume production." Defining what volumes should be called low-volume, and explaining why low-volume production needs to be dealt with differently than high-volume production. Comparing traditional manufacturing techniques with today's by highlighting two technologies for low-volume production, Direct Digital Manufacturing (DDM) and High Speed Milling for Rapid Tooling (RT).

This article is designed to help you decide which method of low-volume production you should choose. We will also dispel some myths of Rapid Tooling and show real life examples of low-volume production successes.

This is a platform of FDM parts used as DDM. The material is black ABS. No tooling was needed to manufacture these parts.

CHOOSING RT OR DDM

When should you choose one over the other? Let's start by defining DDM as the direct production of a finished good from an electronic (digital) representation of a part, using a software program to place material in a three-dimensional space (a three-dimensional printer).

We have identified seven attributes of the finished part for you to consider when choosing between DDM and RT.

30,000+ parts of this product were run until production tooling was online. "Bridge Tooling: is another use for aluminum molds

Part Complexity – The **more** complex the part, the better DDM will provide you with the desired outcome. DDM builds parts layer upon layer and is unbiased to geometry. It can build undercuts, trap volumes and work with zero draft. Rapid Tooling can also build parts with undercuts, but the cost increases.

Above is a .3 MM (.12") diameter cutter used in High Speed Milling.

Material – The **more** material options you need, the better RT will perform. Though DDM can build parts with ABS, PC and PPSF, Rapid Tooling can produce parts from those materials, and more. It is common for Rapid Tools to produce parts from Delrin, Ultem, Santoprene, Glass-Filled materials, PEEK, and PVC among many others.

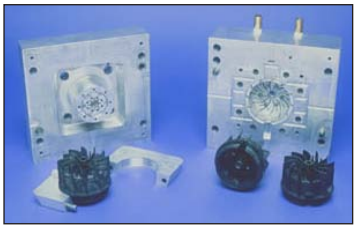
Quantity – The **more** parts you need, the easier and cost effective it is to use RT. While there is an initial cost for RT in building the tooling, the higher quantity of parts absorbs the cost. Rapid Tooling can produce thousands of parts very efficiently.

Tolerance – The **more** accurate the tolerance your parts require, then RT will be the best method. DDM can hold good tolerances with repeatability, but today's High Speed Mills will hold to tight tolerances.

Revisions – The **more** revisions you are going to have in your design cycle, the better DDM looks. DDM builds parts without tooling. You can make revision changes relatively quickly by changing the digital design, without the need for modifying tooling.

Surface Finish – If you need a **more** refined or smoother surface finish, then RT is the right choice. High Speed Milling running over 30,000 rpm's and using .3 mm (.012") diameter cutters that can produce a very smooth surface finish. You can also polish or texture the RT aluminum mold for your desired finish.

Speed – The **more** response you need, then DDM is your best choice. With DDM you can produce your first parts in 1 to 3 days. FDM, SLS SLA, Polyjet, or EOS can build your parts immediately without tooling or fixtures.



This mold shows a hand pick-out to capture the external threaded undercut.

LESS	RT= Rapid Tooling DDM = Direct Digital Manufacturing	MORE
RT	Part Complexity	DDM
DDM	Material	RT
DDM	Quantity	RT
DDM	Tolerance	RT
RT	Revisions	DDM
DDM	Surface Finish	RT
RT	Speed	DDM

To the left is a helpful guideline for your next project. You will need to evaluate the importance of each item and include the costs in your overall assessment. We also encourage you to evaluate each project independently. Just because DDM and/or RT does not work for your first application, your needs may change for your second application. You owe it to yourself and your company to keep evaluating RT and DDM for your low-volume production needs.

DISPELLING THE MYTHS OF RAPID TOOLING

Due to the inefficiencies of early methods used for "Prototype Tooling", Rapid Tooling has been slow to take off. Methods such as Keltool, Direct Aim, and Laser Form (SLS) tooling were very niche specific. These tools fell short when it came to tolerance, surface finish, quantities, and the materials that you could use with them.

Because of this, many people continue to believe this is true with today's technologies. People continue to believe aluminum molds can not shoot different materials, run high volumes, shoot parts with undercuts, or make mold revisions. This has all been proven FALSE!

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TODAY'S RAPID TOOLING

Today's RT is being constructed with 7075 T-6 aluminum and machined using High Speed Mills running over 30,000 rpm. Today's RT can be made to produce parts with undercuts, run multiple materials, can be modified for many revisions, and run tens of thousands of parts.

You can capture undercuts - Rapid Tooling uses machined hand pick-outs and manual slides to capture undercut features in the mold. It may take a little more time during the injection mold pressing, but for low volume products this should not be an issue because the cost savings in tooling can offset the cost of a few seconds.

You can make tool revisions - Aluminum tools can be welded, re-machined, inserted, polished, and textured. This is a cost effective way to get through your design concept before you spend your budget on production molds.

The part on the left had thick sections that made the part warp. The tool was modified to core out the thick areas on the right to produce a quality part.

You can run exotic materials - Not only can you run the staple materials such as ABS, PC, Santoprene, Nylons, etc, but you can also run engineering grade materials like Ultem, PEEK, PPSF, mineral-filled, and glass-filled materials.

You can run a lot of parts - Aluminum tools can run thousands of parts without wear on the tools. It does depend on part geometry and material choice, but is not uncommon to run 15,000 to 50,000 parts off an aluminum tool.

In the third and final part of this series we will show price comparisons between DDM and RT and where the breakeven points are in quantity vs. cost and complexity. We will show real life example and I will share my final thoughts on the future of low-volume production.

Dan Mishek is the Sales Manager and part owner of Vista Technologies. Dan has been published in Moldmaking Technology, Injection Molding, Manufacturing Engineering, and Time Compression. He has also presented at the RP&M Show ('07) in Chicago and Mold Making Expo ('07-'08) in Chicago and Detroit. Dan Mishek graduated from Mount Mercy College in 1997 with a double major in Marketing and Public Relations. He started at Vista Technologies in 1998. Vista Technologies was founded in 1996. Vista is a full-service Rapid Prototyping, Rapid Tooling and Injection Molding Service Bureau. Today, this privately held company has in-house capabilities of SLA, Polyjet, FDM, High Speed Milling, Mold Making, and Injection Molding.

POSITIONS AVAILABLE

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NatureWorks LLC is growing and has the following opportunities available if you would like to submit your resume. **Please e-mail cover letter and resume to: Julianna_Boehland@natureworksco.com**

Research Engineer: **0-3 yrs experience, B.S. or M.S. in Chemical Engineering.**
Apply chemical engineering principles, process knowledge, manufacturing experience, data analysis, and a bias for action to the validation, development, and implementation of process technology. (Located in Minnetonka, Minnesota)

Applications Engineer: 8 + years experience, Minimum B.S. in Mechanical Engineering, Chemical Engineering, Plastics Engineering or Polymer Science Masters preferred
Film Converting: Work with external customer base to evaluate Ingeo film in new converting processes, screen new applications for suitability for existing film products and identify limitations of existing film products.
Excellent knowledge of downstream film converting technology and processing is required.
Extensive Travel associated with this position in the Americas (Minimum of 50%)