APPLICATION BRIEF

FDM for End-Use Parts

Overview

Although most companies that manufacture high-volume products are constantly looking for ways to stay relevant in today's marketplace, the processes they use to manufacture their products are still heavily reliant on expensive tools and long lead-times. As a result, these companies are limited in their ability to respond quickly to market changes or implement product refinements. What's more, companies often need a small quantity of product-grade components, but are constrained by resource or production limitations.

It is with these issues in mind that manufacturers are embracing the use of Fused Deposition Modeling™ (FDM®) as an alternative to traditional technologies.

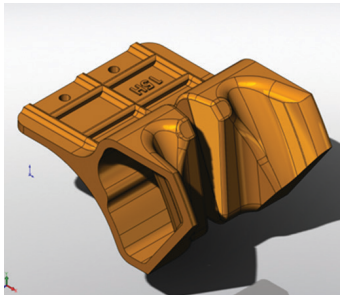
Application Outline

FDM is an additive manufacturing process that builds production-grade parts layer-by-layer from computer-aided design (CAD) files. By utilizing sophisticated 3D printing software and hardware, high strength thermoplastics, and significant throughput, FDM has unprecedented benefits for low-volume manufacturing. It can also be used to bridge the gap between product concept and traditional manufacturing processes. The following are manufacturing applications for which FDM is well-suited.

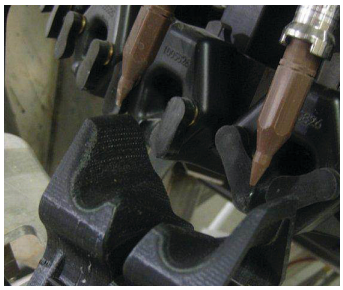
Pilot production: Pilot production is commonly used to simulate full production in mass-production industries. It often leads to a better product, lower development and manufacturing costs, a more efficient manufacturing operation, and reduced time to market. FDM can be used in this stage of production planning to quickly build one-off products and tools designed to speed the production process along.

Bridge-to-production: This technique is an interim step between prototyping and full production that allows manufacturers to build products for sale while manufacturing tools and production processes are being created and/or finalized. FDM is a great fit for bridge-to-production strategies because it requires no tooling, products can be built in hours instead of weeks or months, and manufacturers can respond efficiently and cost-effectively to the desires of the changing marketplace.

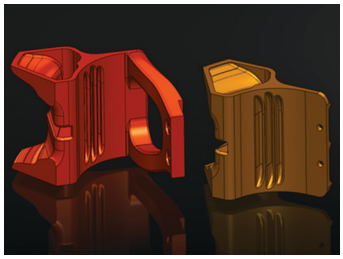
Low-volume production: Sometimes manufacturers build their businesses around the production of highly-customized, highly-complex or low-volume products. In situations like these, FDM can maximize sales opportunities while minimizing cost and lead-time because there are no minimum order parameters to fill. Plus, part complexity doesn't add time or cost, so



CAD model of a component for Nova Tech Engineering (NTE) that includes features which would be costly and time consuming to mold or machine.



Numerous variations of this FDM part are needed by NTE's customers for use in their daily operations



Design alternatives made possible with FDM include part consolidation (left).

BENEFITS OF FDM

Average lead time savings:
- 75% - 90%

Average cost savings:
- 50% - 90%

Greater inventory efficiency:
- Just-in-time (JIT) manufacturing
- Digital inventory

Greater design freedom:
- Part optimization for performance and ergonomics
- Consolidate multi-piece assemblies

FDM IS A BEST FIT

Quantity:
- Low volume (1-1,000+)

Revisions:
- Custom, configured-to-order or frequent modifications

Time to market:
- Days to weeks

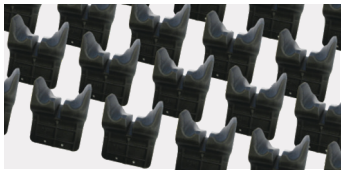
Optimization:
- Designed for performance

Size (XYZ):
- < 300 mm (12 inches) per side

Properties:
- Thermoplastic is acceptable.

Environment:
- < 200° C (390° F)

Tolerance:
- >+/- 0.13 mm (0.005 in)



Production lot of 3D printed end-use parts from NTE.

FDM FOR END-USE PARTS

production can begin as soon as the CAD files are sent to the 3D printer. Finally, a product can be designed purely for its function; manufacturers don't need to follow traditional production rules and practices.

End-of-life production: As a product nears the end of its life cycle, investments in repairing or replacing tooling may not be justifiable. FDM can be used to extend a product's life by manufacturing spare parts on an as-ordered basis, thereby eliminating the need for physical inventory.

No matter how it is employed, FDM allows manufacturers to ultimately present a better product to the customer, now and in the future.

Customer Story

Nova Tech Engineering (NTE), based in Willmar, Minnesota, produces automated machinery for use by poultry hatcheries worldwide. A key part of the company's success has been its ability to customize its machines to manage numerous types, breeds and sizes of birds. However, as the business grew, the cost of machining numerous part variations became increasingly inefficient, costly and growth-inhibiting. "We were spending a lot of time and money machining parts which was detrimental to our overall operational efficiency," reflected mechanical designer Jacob Rooney.

It was in the process of exploring his options that Rooney discovered FDM Technology™ was excellently suited for the job.

"We bought our first two FDM 3D printers mainly for prototyping. We later purchased another for pilot-production and manufacturing," said Rooney. "Today we use these printers for various applications such as rapid prototyping, creating casting molds, thermoforming, jigs and fixtures, and manufacturing finished parts."

Another distinct advantage is design freedom.

"FDM is the perfect fit for us," added Rooney. "It allows us to easily change designs so we can fit the parts to the equipment and the bird variety at any stage without being penalized by cost or delays," says Rooney.

Today, thanks to FDM Technology, NTE can create the many specialized parts their customers require but at a fraction of the time and cost. One example is the time and money it takes to create ten 12-piece carrier assemblies. Prior to FDM, these took four weeks to produce at a cost of $45,000. Now, they take three days to produce at a cost of $1,500 — savings of 89% and 97% respectively.

How does FDM compare to traditional methods for Nova Tech?

METHOD	COST	PRODUCTION TIME
Injection Molding	$44,175	4 weeks
FDM	$1,490	3 days
Savings	$42,685 (97%)	25 days (89%)

For first production lot of ten 12-piece carrier assemblies.

Application compatibility: (0 – N/A, 1 – Low, 5 – High)

- FDM: Idea (1), Design (2), Production (4)
- PolyJet™: Design (1)

Companion and reference materials:

- Technical application guide
  - Document
- Application brief
  - Document
- Video
  - Commercial
  - Success story
  - How It's Used
- Referenced processes
  - Metal Inserts
  - Color change
  - Building assembly parts
  - Integrated structures
  - Insight custom groups

CUSTOMER PROFILE

Forward-thinking manufacturers, engineers and designers that produce end-use parts for:

Reference Industries:
- Aerospace
- Automotive
- Medical
- Motorsports
- Processing equipment

Manufacturing characteristics:
- Low production quantities (1 to 1,000's)
  - Pilot, bridge, production or end-of-life
  - Custom or configured to order

Traditional technology obstacles:
- Cost outweighs benefit.
  - Changing design
  - Short product life
  - Tooling
- Unable to produce design with traditional methods.

REFERENCE COMPANIES

prodrive

ACIST MEDICAL SYSTEMS

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