

The Fortus Profit Potential

Six applications that can boost your bottom line

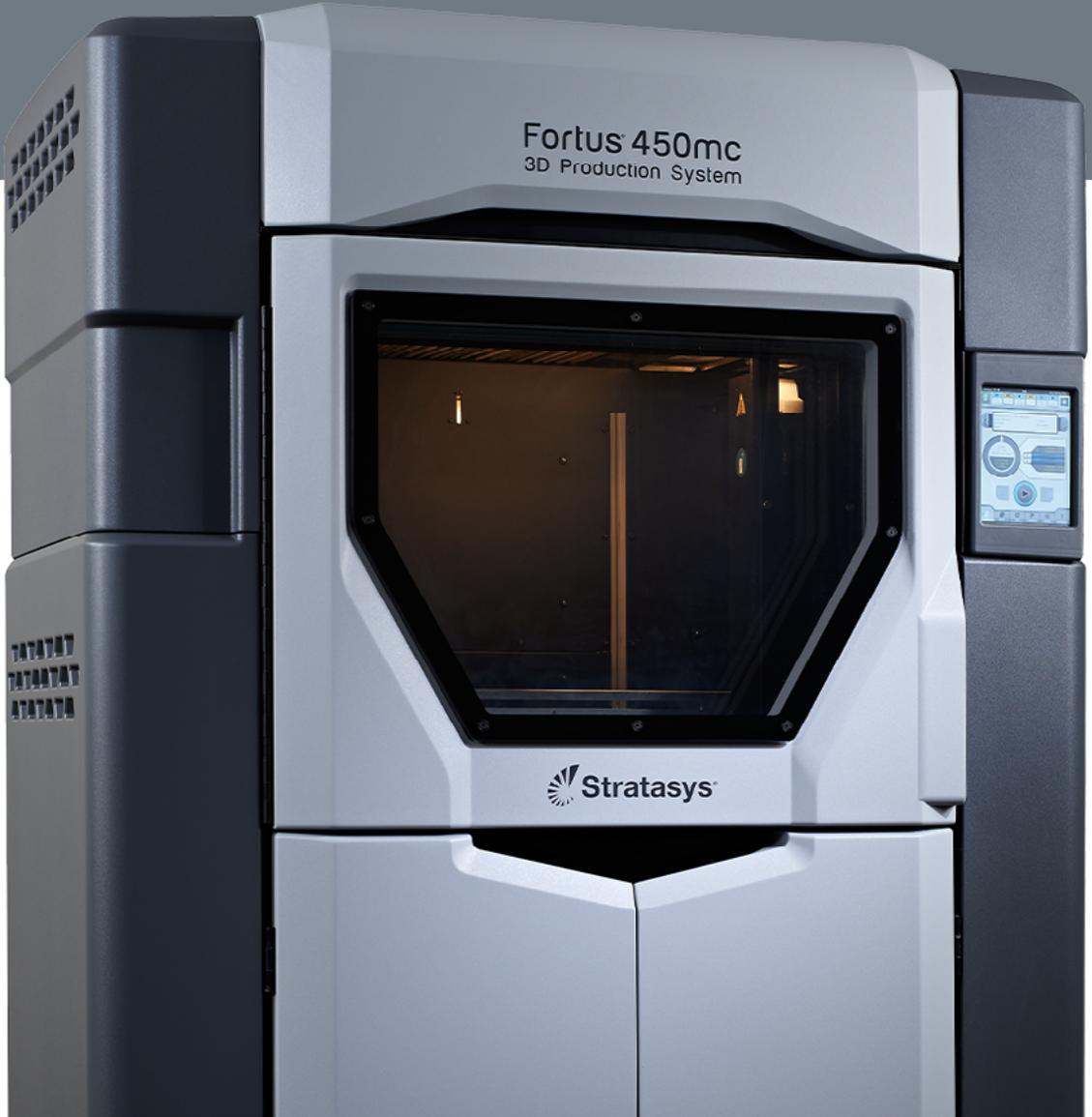


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BONUS MATERIAL

INTRODUCTION

The Fortus 3D Production System

Additive manufacturing technology is dramatically changing how things are made, and Fortus® 3D Production Systems from Stratasys® are at the forefront of this transformation.

Fortus systems are designed with flexibility to meet the user's needs, whether it's adopting digital manufacturing for the first time or getting high-performance materials and high capacity for demanding production environments.

The latest Fortus 3D Production Systems boast faster print times and improvements in the user interface. That ultimately means they're easier to use and increase productivity even further than previous models.

Fortus systems run on FDM® technology, which builds parts layer by layer from a CAD model using a variety of production-grade thermoplastics. With FDM technology, the traditional fabrication process is substantially simplified. Toolmaking becomes less expensive and time consuming. Intricate designs that are impossible to make with conventional tooling are now possible. As a result, manufacturers realize immediate improvements in productivity, efficiency and quality.

FDM technology also lets you to choose from a wide range of production-grade thermoplastics, each with specific qualities to meet your manufacturing needs. Whether it's the familiar family of ABS thermoplastics or advanced materials certified for aircraft

INTRODUCTION



Fortus 450mc™ 3D Production System

components, biocompatibility or food contact, there's an FDM material that will meet the challenge. Whether you're developing prototypes or end-use parts, the resulting component is made from the same durable material as traditional injection molded plastics.

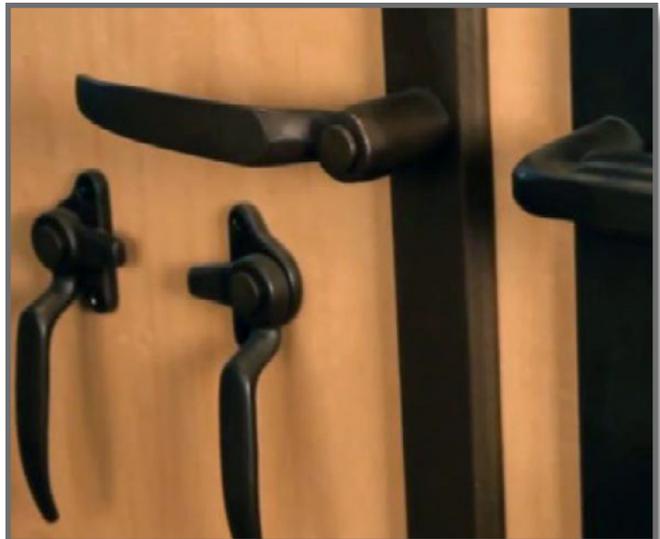
INTRODUCTION

Making the Most of the Fortus Production System

When it comes to leveraging the power of 3D printing, having a versatile family of 3D printers to choose from is essential, but making the most out of what they can do is what really matters. 3D printing has always been a perfect fit for rapid prototyping and will continue to serve this application very well. But the real beauty of 3D printing is that it removes the constraints associated with traditional manufacturing, providing a blank canvas upon which creative minds can develop new applications.

To help expand your knowledge of the awesome potential in Fortus 3D Production Systems, this e-book lays out six manufacturing applications typically associated with traditional production techniques.

- Jigs and fixtures
- End-use parts
- Sand casting
- Surrogate parts
- Thermoforming
- Molded paper pulp



Cast door handles made using FDM patterns for sand casting

INTRODUCTION

It will show how 3D printing can make dramatic improvements in both time and cost efficiency, when compared with traditional production methods associated with these applications. Real world examples are also provided to show that these aren't just hypothetical scenarios. The companies highlighted in this e-book found a way to transform traditional manufacturing applications using FDM technology and bring their operation to a new level.

CHAPTER ONE

Use FDM Jigs and Fixtures for Dramatic Time and Cost Savings

Manufacturing relies on tools including jigs, fixtures, templates and gauges to maintain quality and production efficiency. They are used to position, hold, protect and organize components and subassemblies at all stages of the manufacturing process. And although these tools are virtually invisible when production is running smoothly, their importance becomes evident when problems arise. To avoid production halts or product defects, new jigs and fixtures must be rapidly designed, manufactured and deployed.

The 3D Printing Alternative

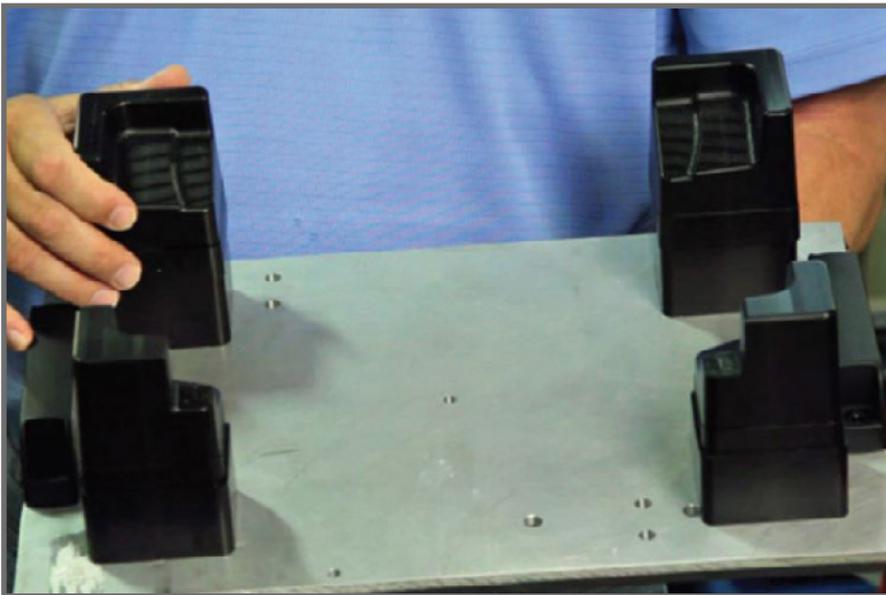
Jigs and fixtures are most commonly fabricated from metal, wood or plastic in quantities of just a few to several hundred using a manual or semi-automated process. On average, each tool takes between one and four weeks to design and build. However, elaborate or intricate tools may require several cycles of design, prototyping and evaluation to attain the required performance. In contrast to conventional manufacturing methods, FDM technology provides a fast and accurate method of producing jigs and fixtures. Additionally, these tools can be designed for optimal performance and ergonomics because FDM technology places few constraints on tool configuration.

What's more, adding complexity does not increase build time and cost. The efficiency of the FDM process makes it practical to optimize jig and fixture designs and increase the number in service. Engineers can easily evaluate the performance of the tool and make quick, cost-efficient adjustments to the design as needed.

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Use FDM Jigs and Fixtures for Dramatic Time and Cost Savings

Because FDM technology builds geometries from the bottom up, it's not subject to the same design constraints as hand fabricating or CNC milling. This makes it practical to produce jigs and fixtures that were previously not feasible from a cost or design perspective using traditional manufacturing methods.



FDM assembly line nest mounted on an aluminum blank

Customer Story

The Oreck Corporation is a well-respected manufacturer of vacuum cleaners, sweepers, and other household cleaning appliances. Oreck products are valued for being lightweight, exceptionally durable and easy to use. Every new Oreck vacuum incorporates 20 to 30 complex injection molded parts that must meet demanding dimensional tolerances to ensure proper assembly and performance.

CHAPTER ONE

Use FDM Jigs and Fixtures for Dramatic Time and Cost Savings

Before production of a new product can begin, sample parts called first articles are made for testing. Each first article is inspected by a coordinate measuring machine (CMM) before the mold is shipped to the manufacturing facility, and once again before the mold is placed into production. During each inspection, the first article must be held rigidly in place. If any shifting occurs during the inspection process, the CMM will register a false failure.

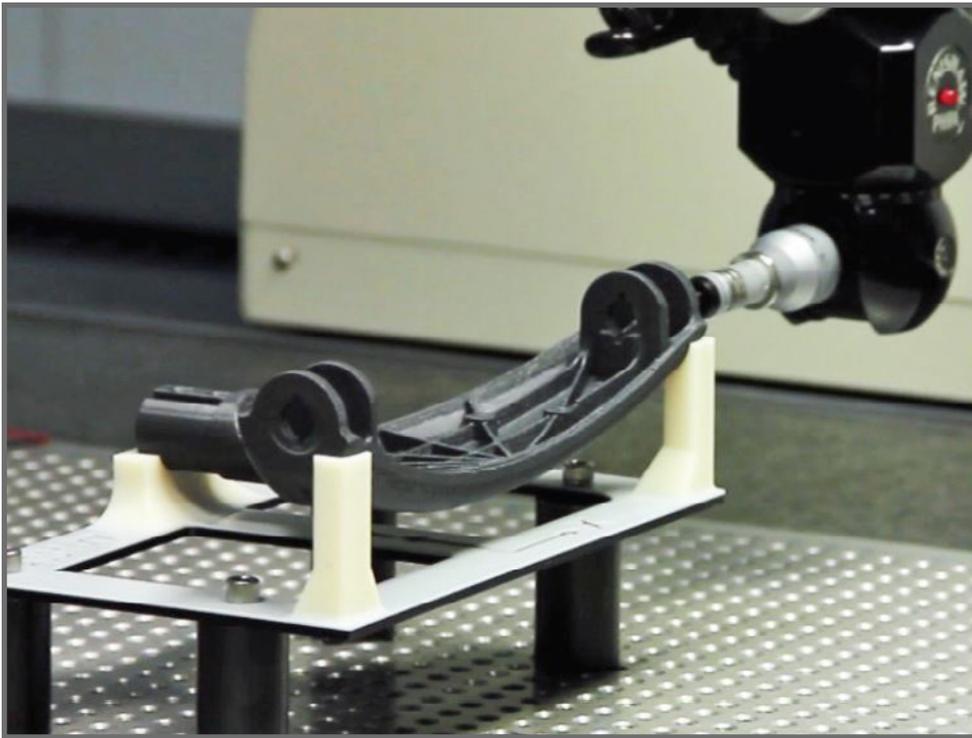
Previously, Oreck's quality-control team would manually attach a variety of modular aluminum clamps to hold the first article in place. This painstaking process generally took 30 minutes and was followed by up to four hours of CMM programming time. The total time to test all first articles for a new vacuum model was approximately 30 days. If a defect was found — which happened about once a month — the timeline was further delayed while the team investigated the problem.

Oreck now uses FDM technology to make fixtures that are specifically designed to quickly and perfectly position each first article for testing, eliminating the need for manual placement. Furthermore, they can create an FDM prototype of the first article to use in conjunction with the complementary fixture. This allows the quality-control department to preprogram the CMM while the first article is in production, virtually eliminating the risk of testing error. And the quality-control process that previously took a month is now done in one day — a 2,900 percent improvement.

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Use FDM Jigs and Fixtures for Dramatic Time and Cost Savings

“The accuracy and consistency of FDM technology allows us to move the programming stage up in the process, and essentially remove the first article inspection process from the critical path in the product development schedule. This makes it possible to start production faster,” said Craig Ulmer, senior QA labs technician for Oreck.



Oreck uses an FDM surrogate first article on an FDM fixture to conduct CMM programming.

CHAPTER ONE

Use FDM Jigs and Fixtures for Dramatic Time and Cost Savings



How does FDM compare with traditional methods for Oreck?

Method	Production time	Cost	Total inspection time
CNC	7 hours	\$250	30 days
FDM	3.5 hours	\$55	1 day
Savings	3.5 hours (50%)	\$195 (78%)	29 days (2,900%)

CHAPTER TWO

3D Printing End-Use Parts

Most companies that manufacture high-volume products are constantly looking for ways to stay relevant in today's marketplace. However the processes they use to manufacture their products are still heavily reliant on expensive tooling and long lead times. As a result, these companies are limited in their ability to respond quickly to market changes or implement product refinements. By integrating FDM technology into production, manufacturers can bypass the traditional constraints to quickly develop and manufacture new products, and improve existing ones.

The 3D Printing Alternative

FDM has unprecedented benefits for low-volume manufacturing and can also be used to bridge the gap between product concept and traditional manufacturing processes. FDM is well-suited for these manufacturing applications:

- **Pilot production:** Pilot production is commonly used to validate new products and processes 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.

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3D Printing End-Use Parts

- **Bridge-to-production:** This technique is an interim step between prototyping and full production that allows manufacturers to build products for sale while full-scale tools and production processes are being created or finalized. This is a great fit for FDM technology 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 low-volume, highly customized and/or complex products. In this scenario, FDM technology can maximize sales opportunities while minimizing cost and lead time because there's no minimum quantity requirement. Plus, part complexity doesn't add time or cost, so production can begin as soon as the CAD files are sent to the 3D production system.
- **End-of-life production:** As a product nears the end of its life cycle, investments in repairing or replacing tooling may not be justifiable, and high-volume production equipment and operators may be diverted to other products. FDM technology can be used to extend a product's life by manufacturing spare parts on an as-ordered basis, eliminating the need for physical inventory.

Customer Story

Nova Tech Engineering, based in Willmar, Minnesota, produces automated machinery for use by poultry hatcheries worldwide.

CHAPTER TWO

3D Printing End-Use Parts

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.



FDM end-use parts from Nova Tech Engineering

“We were spending a lot of time and money machining parts, which was detrimental to our overall operational efficiency,” said mechanical designer Jacob Rooney. He explored his options and discovered FDM technology could solve the problem. The company acquired two FDM systems mainly for prototyping, and later invested in a third dedicated to pilot production.

“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.”

CHAPTER TWO

3D Printing End Use Parts

Today, thanks to FDM technology, Nova Tech Engineering 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 using FDM technology, these took four weeks to produce at a cost of \$45,000. Now, they take only three days and cost \$1,500 — a savings of 89 percent and 97 percent respectively.



How does FDM compare to traditional methods for Nova Tech?

Method	Production time	Cost
Injection molding	4 weeks	\$44,175
FDM	3 days	\$1,490
Savings	25 days (89%)	\$42,685 (97%)

CHAPTER THREE

FDM Technology Can Accelerate the Sand Casting Process

Sand casting is the process of casting metal using sand as the mold material. When creating a sand cast mold, sand is packed around the pattern. The resulting mold cavity is then used to create metal end-use parts. If voids are required within the mold cavity, core boxes are used to create sand cores.

Sand casting is a cost-effective, efficient process for small-lot production or high-volume manufacturing when used in conjunction with automated equipment. There are three common types of sand casting patterns:

- Loose patterns are simply replicas of the cast piece.
- Split patterns are made in two or more pieces and doweled together to permit separate removal.
- Matchplates are similar to split patterns except the cope and drag sides are combined into a single piece.

The 3D Printing Alternative

The production of sand molds and cast metal parts is relatively straightforward and suitable for automated methods. However, fabrication of the patterns used to produce the sand molds is often difficult, time-consuming and expensive. The most common approach is to produce patterns using computer numerical control (CNC) machining, but the production costs are high and the lead time is substantial.

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FDM Technology Can Accelerate the Sand Casting Process

Problems like incorrect shrink compensation and design flaws generally require that the pattern be reworked, which adds to the expense and lead time. Gate and runner systems are typically cut from Ren board or a similar material, hand-carved and then sanded to the finished shape. This also adds expense and lead time.



Sand mold created from FDM pattern

Because of these problems, foundries have turned to additive manufacturing. To replace the machined pattern, additively manufactured patterns must withstand the ramming forces that are applied to pack the sand, be abrasion resistant, and be unaffected by the chemicals in the sand binders and mold release. Most additive manufacturing technologies have been unable to meet these challenges. However, FDM materials like ABS, polycarbonate (PC), PC-ABS and ULTEM™ 9085 thermoplastic resin meet all of these requirements.

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FDM Technology Can Accelerate the Sand Casting Process

FDM parts have the compressive strength needed for use as a sand casting pattern. The surface finish of FDM parts meets all the requirements of sand casting patterns when post-processed. Post-processing also seals the molding surface, to prevent release agents from penetrating and sand from sticking. Finally, FDM technology is also being used in both green and no-bake operations for pattern and core box production.



Matchplate with FDM insert in molding machine

Customer Story

Melron Corporation is a manufacturer of window and door hardware using traditional sand casting techniques and modern foundry practices. As a means of becoming more competitive in the global marketplace, the company began focusing on the production of high-margin, low-volume items for the residential and restoration markets.

CHAPTER THREE

FDM Technology Can Accelerate the Sand Casting Process

In the past, Melron used a subcontractor to machine matchplates from aluminum at a cost of approximately \$5,000 each with a delivery lead time of three to four weeks. However, the matchplates often required design changes. As a result, Melron began to consider rapid prototyping technologies but found that most were not able to withstand the ramming forces necessary to pack sand, and lacked abrasion and chemical resistance.

Melron then decided to investigate FDM technology. They started on a small scale by ordering an FDM matchplate from a service bureau. Then, because it worked so well, the company ordered an FDM 3D printer and began producing matchplates that combined pre-fabricated aluminum blanks with FDM inserts.

Thanks to FDM technology, the cost of producing matchplates is now approximately \$2,000 — a 60 percent reduction from CNC machining. Additionally, lead times have been cut in half, to one and a half weeks. Melron also uses its FDM machine to create a gate and runner system, saving an estimated six hours of hand work per matchplate.

“FDM is facilitating our transition to new markets by enabling us to produce matchplates at a lower cost and in less time than ever before,” said Dan Schaupp, Melron engineer.

CHAPTER THREE

FDM Technology Can Accelerate the Sand Casting Process



How does FDM compare with traditional methods for Melron?

Method	Production time	Cost
CNC	3 weeks	\$5,000
FDM	1.5 weeks	\$2,000
Savings	1.5 weeks (50%)	\$3,000 (60%)

CHAPTER FOUR

Use FDM Surrogate Parts for Faster Design Decisions

Sometimes a component's only function is to occupy the space that a machined or stock part will take in the final product. Claiming this space provides assessment and verification of critical installation issues such as assembly, serviceability, routing and interfaces. It also allows assessment of product performance aspects that are affected by clearance from a neighboring part or sub-assembly.

One evaluation option is to manufacture or purchase the component. However, for high-value parts with complex designs and possibly long lead times, the investment may be unwarranted and ill advised. In the time span between installation assessment and final product assembly, design modifications may occur, and parts may be damaged during repeated installation cycles.

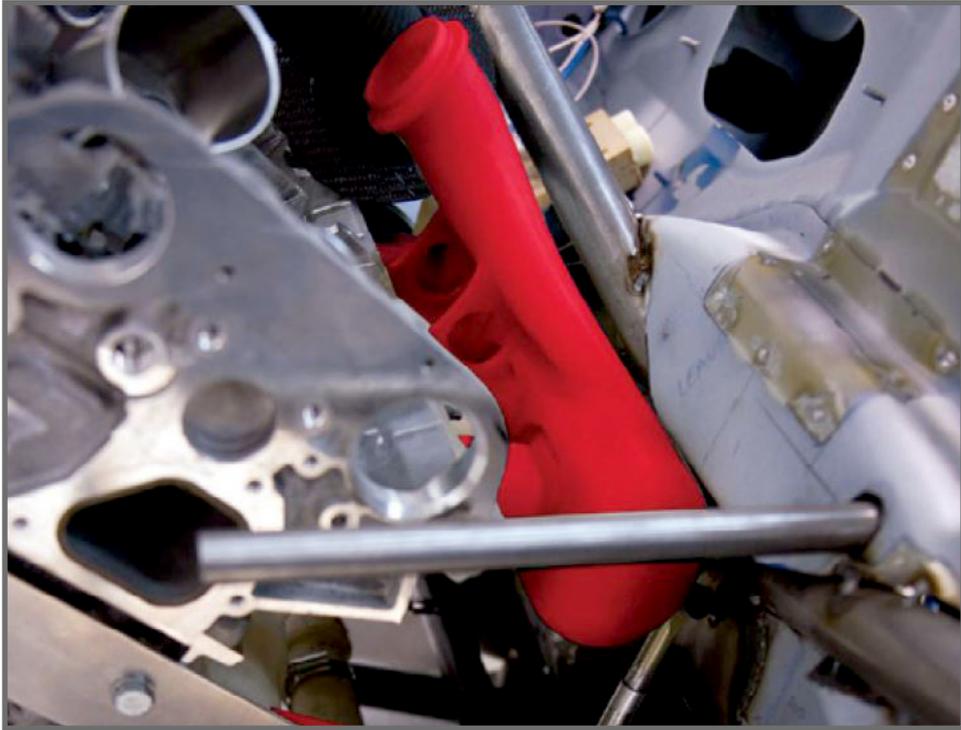
Another disadvantage of using production components is that work-in-progress expenses increase, and schedules may be delayed by late deliveries of components. This is especially critical when working on new equipment designs.

The 3D Printing Alternative

Mock-ups are typically substituted for production components during the assembly and interface evaluation phase of a project. For simple configurations, all necessary detail can be incorporated in a machined or fabricated part that is inserted in the product assembly. However, with complex, intricate

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Use FDM Surrogate Parts for Faster Design Decisions



Red FDM material in assembly mockup quickly identifies surrogate part

sub-assemblies, the mock-up may be oversimplified, masking installation and interface problems.

In contrast, surrogate components made with FDM technology preserve all of the critical details for an installation while minimizing expense and lead time. Additionally, since FDM systems build components layer-by-layer, surrogate parts can have sensors, stock parts, or hardware embedded directly into them.

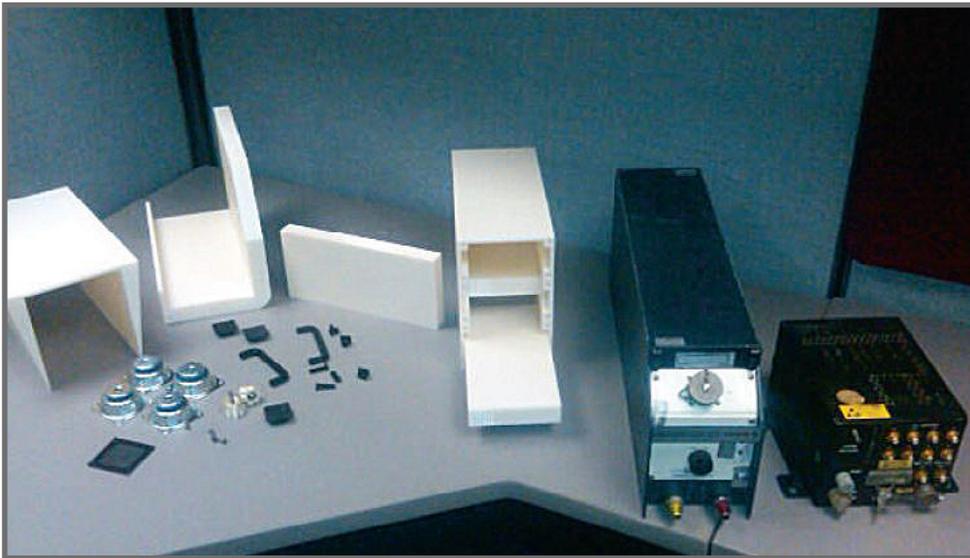
Produced as needed with up-to-date configuration changes, FDM surrogate parts will confirm clearances and interfaces for installation assessment, highlight serviceability issues, and validate routing interfaces for wiring harnesses and fluid

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Use FDM Surrogate Parts for Faster Design Decisions

conduits. As the product nears completion, the FDM surrogates can be used as a training aid for assembly technicians or field service personnel.

The FDM process constructs surrogates in hours or days at a fraction of the cost of production components. This lowers acquisition cost and defers work-in-progress expenses until final assembly, while shortening lead times to validate installations.



FDM surrogate part (white) can include production hardware for interface evaluation

When neighboring subassemblies are modified or the surrogate reveals clearance issues, design revisions are easily incorporated in subsequent iterations since the FDM process requires no tooling. New surrogates are conveniently produced to the latest design revision. The thermoplastic surrogates also offer the advantages of being lightweight and non-marring. This makes installation easier and reduces the possibility of damaging nearby components or structures.

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Use FDM Surrogate Parts for Faster Design Decisions

As the work process shifts to final product assembly or functional testing, FDM surrogates can highlight the need for removal. Manufactured from colored material — for example red — the surrogates are visible to assembly technicians. Optionally, embedded RFID sensors communicate the presence of non-production components. Either option will assure that all surrogates have been replaced with the production parts they represent.

Surrogate Configuration Options:

- Envelope: Verify fit and access for installation and service
 - Basic: Simplified representation that eliminates non-functional features
 - Advanced: Complete representation for assessment of functional clearances (e.g. sway and cooling zones)
- Interface: Validate routings and connections (e.g., fluid fittings and electrical connectors)
 - Integrated: Interfaces constructed in surrogate
 - Hybrid: Production hardware mounted to surrogate
- Ergonomic: Represent weight and balance in training aids, with the option to add ballast in the form of sheet, bar or shot material.
- Smart: Integrate feedback devices for surrogate detection and data capture
 - RFID: Encapsulate or attach tags for surrogate identification
 - Sensor: Embed or attach measurement devices

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Use FDM Surrogate Parts for Faster Design Decisions

Customer Story

Bell Helicopter manufactures the heavy-lift, tilt-rotor Osprey, the hybrid aircraft that combines features of both airplane and helicopter. To assess Osprey’s tail-wiring configurations, Bell’s Xworx facility used an FDM system to build polycarbonate wiring conduits. Technicians installed the branching conduit’s six mating sections inside the Osprey’s twin vertical stabilizers for on-the-ground confirmation of the wiring path.



“It takes a long time to design an aircraft. Starting from scratch it can take five years and it’s a rigorous development process to go through,” says RP lab technician Mike Storp. “When using FDM over the course of development for a new aircraft, there is great potential to reduce costs and development time.” Using FDM surrogates, conduits were ready for installation in two and a half days. This is nearly a six-week reduction from Bell’s alternative, using cast aluminum parts. And according to Storp, “We obviously saved money as well.”

As is often the case, the surrogates revealed needed design modification. According to Storp, “The efficient process allows us to do more design iterations than we could with other processes. That results in better-designed components.”

How does FDM compare with traditional methods for Bell Helicopter?	
Method	Time
Cast metal	6 weeks
FDM	2.5 days
Savings	5.5 weeks (92%)

CHAPTER FIVE

From Packaging to Aerospace — FDM Makes Quick Work of Thermoforming Tools



Thermoformed packaging cover and FDM mold

Thermoforming is the collection of manufacturing methods that heat and form sheets of extruded plastic. It is a relatively simple process that starts with heating a plastic sheet to a pliable state. Once softened, the sheet is forced against a mold with the desired shape using different methods.

In vacuum forming, a vacuum is drawn through tiny holes in the mold, “pulling” the pliable plastic sheet into the mold. In pressure forming, air pressure is applied to the top surface of the material, “pushing” it into the mold.

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Thermoforming is mainly used in the packaging industry. However, it is not limited to small products; hot tubs, aircraft cowling and refrigerator door panels are examples of relatively large thermoformed parts.

Virtually any thermoplastic available as extruded sheet stock may be used to thermoform prototypes or manufactured parts. Wall thicknesses can range from foils to thick-gauge stock — thicknesses ranging from 0.0005 to 0.5 in. (0.0127 to 12.7 mm) — with no molding stresses.

The 3D Printing Alternative

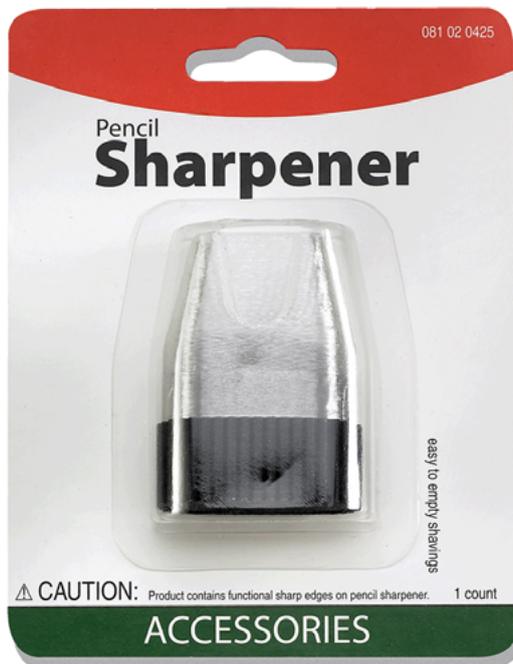
While vacuum formed production and tooling costs tend to remain reasonable for large parts, preparing tools for vacuum forming can be costly and time consuming. Tools are usually made of aluminum for large production operations while wooden tools are sometimes used for small production series. Regardless of material, tooling requires the time and labor associated with setting up and operating a milling machine. If machining is unavailable onsite, tooling may be outsourced, slowing time to market and potentially increasing design expenses.

Because thermoforming doesn't require extreme heat or pressure, additive manufacturing is a viable alternative. Although tool life will not equal that of aluminum, the materials available with FDM technology are ideal for prototyping and short-run manufacturing. Tool life ranges from 100 to 1,000 parts depending on the tool and part materials that are used.

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From Packaging to Aerospace — FDM Makes Quick Work of Thermoforming Tools

3D printing eliminates much of the time and labor associated with machining vacuum-forming tools. Data preparation is completed in minutes, so tool construction can begin immediately after tool design. Automated, unattended operations eliminate the time needed for fixturing, setup and operation of CNC machines. FDM technology offers the option to design vent holes into the mold, eliminating the labor and potential unevenness of manual drilling. It also allows building the mold as a porous structure for finely distributed vacuum draw. Customizing the internal structure to reduce the amount of material used results in additional time and cost savings. This custom interior can also be used to adjust the porosity around features such as deep draws.



*Thermoformed product blister packaging made
using an FDM mold*

CHAPTER FIVE

From Packaging to Aerospace — FDM Makes Quick Work of Thermoforming Tools

From an applications standpoint, FDM technology is a best fit for thermoforming when smooth parts are required or parts have challenging characteristics that include deep draws or organic shapes. Other good applications include when multiple designs are required and/or when lead time is short.

Stratasys ABS-M30™ material is suitable for most vacuum-forming applications. It offers mechanical properties that exceed the requirements of most thin-gauge sheets. The FDM process also offers materials that can withstand the high temperature required for some thermoforming materials, such as polycarbonate, HDPE and Kydex. These FDM materials offer increased resistance to thermal degradation, often resulting in extended tool life. Their increased compression resistance makes them suitable for higher-pressure forming of thicker materials.

Customer Story

Military aircraft are sophisticated tools for intelligence, surveillance, targeting and reconnaissance. One defense contractor uses FDM technology and vacuum forming to prototype and manufacture these complex systems. The company uses a Fortus 3D Production System and a Formech vacuum-forming system to reduce time, cost and labor demands for components including air ducts, engine cowlings and antennae covers. Vacuum forming replaces pre-impregnated carbon-fiber layup, which can be labor- and time-intensive.

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From Packaging to Aerospace — FDM Makes Quick Work of Thermoforming Tools

Using FDM technology to construct a tool, vacuum forming begins in as little as one day after a design is complete, with minimal labor. Since vacuum forming parts takes only minutes, prototypes are done in less time than it would take to create a fiber layup tool.

When a functional prototype was needed for an antennae cover, FDM technology helped create a thermoforming mold. A Lexan cover was formed to replace the traditional composite cover. Lead time shrank by half, and cost went down 34 percent.

How does FDM compare with traditional tooling methods?		
Method	Cost	Time
Fiber layup	\$580	4 days
FDM	\$380	2 days
Savings	\$200 (34%)	2 days (50%)

CHAPTER SIX

Molded Paper Packaging: A Perfect Fit for FDM Technology

Molded paper pulp, also called molded fiber, has been used since the 1930s to make containers, trays and other packages. Molded pulp packaging experienced a decline in the 1970s after the introduction of plastic foam packaging. But more recently the use of molded pulp packaging is growing due to its environmental sustainability.



FDM form for paper pulp packaging

Paper pulp can be produced from old newsprint, corrugated boxes and other plant fibers. Today, molded pulp packaging is widely used for electronics, household goods, automotive parts and medical products. It is also used as an edge protector or pallet tray for many shipping and handling applications.

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Molded Paper Packaging: A Perfect Fit for FDM Technology

The two most common types of molded pulp are classified as Type 1 and Type 2. Type 1 is commonly used for support packaging applications with 3/16 inch (4.7 mm) to 1/2 inch (12.7 mm) thick walls. Type 1 molded pulp manufacturing uses a fiber slurry made from ground newsprint, kraft paper or other fibers dissolved in water.

A mold mounted on a platen is dipped or submerged in the slurry and a vacuum is applied to the back. The vacuum pulls the slurry onto the mold to form the shape of the package. While still under the vacuum, the mold is removed from the slurry tank, allowing the water to drain from the pulp. Air is then blown through the tool to eject the molded fiber piece. The part is typically deposited on a conveyor that moves through a drying oven.

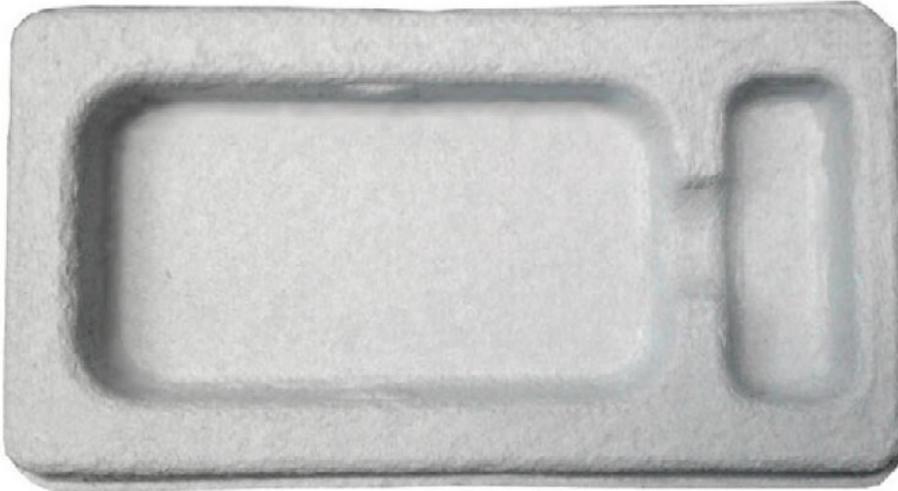
The 3D Printing Alternative

Molded pulp packaging tools are normally made by machining a metal tool in the shape of a mirror image of the finished package. Holes are drilled through the tool and then a screen is attached to its surface. The vacuum is drawn through the holes while the screen prevents the pulp from clogging the holes. It costs about \$30,000 and takes two weeks to make a metal tool for a typical large package.

FDM technology provides an alternative method for producing molded pulp tooling that provides dramatic time and cost savings and improves the appearance of the finished product. FDM molded pulp tooling can be produced in a fraction of the time and cost of conventional tooling because the FDM tool can be produced to be both porous and rigid.

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Molded Paper Packaging: A Perfect Fit for FDM Technology



Molded pulp packaging made using FDM mold

The FDM process eliminates the need for costly machining of the contour of the tool as well as the holes required to draw the vacuum. It also eliminates the need to attach the screen to the mold. FDM molds can be run alongside traditional molds with no alteration to the slurry formula, cycle time, vacuum pressure or other process variables, making it easy to integrate into any molded fiber operation.

Customer Story

SML Group is a leading supplier of garment trim and various types of packaging. Based in China, the company operates over 30 facilities around the world including the largest label factory in China. In the past, SML Group was not able to compete in the U.S. molded pulp packaging market because the time and cost involved in making conventional metal tools made it impossible to provide a prototype to customers.

“We decided to work with Stratasys to see if it was possible to make an FDM packaging tool,” said Jeremy Wolf, structural

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Molded Paper Packaging: A Perfect Fit for FDM Technology

packaging designer for SML. Stratasys worked with SML to provide a series of different FDM molded pulp tools in order to optimize the sparse pattern that allows a vacuum to be drawn through the tool. “The entire FDM tool is porous, which spreads the vacuum suction and produces a cleaner package with a better surface finish,” Wolf added.



FDM paper pulp tool with sparse fill to enable vacuum forming

The company now has a working tool just two days after design is complete, at a cost of about \$600. Wolf said. “At this price and lead time we can easily make prototypes for companies that are interested in molded pulp packaging. Prototypes are critical because original equipment manufacturers (OEM) often show them to retailers they want to carry the product. FDM tooling can also be used for production in quantities up to 10,000 or so.”

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Molded Paper Packaging: A Perfect Fit for FDM Technology

Wolf concluded, “FDM tooling has opened up exciting new business opportunities by making it practical to produce molded pulp packaging in low quantities that didn’t make sense in the past.”

How did FDM compare with conventional methods for SML Group?		
Method	Cost	Time
Conventional metal tooling	\$30,000	2 weeks
FDM	\$600	1 week
Savings	\$29,400 (98%)	1 week (50%)

BONUS MATERIAL

Webinar: “The Speed Myth”

3D printing can produce parts more quickly than conventional tooling methods and that could mean getting products to market faster. But when it comes time to determine the type of 3D printer to buy, the speed question is often at the top of the list. In truth, speed is only one of multiple variables that go into the manufacturing process. The time required to take a part from its CAD model to a product in-hand depends on many steps in between, each with their own set of variables.

In this webinar, titled “The Speed Myth,” 3D printing consultant Todd Grimm talks about speed as it relates to 3D printing. He makes the case that focusing exclusively on which 3D printer is fastest is a short-sighted approach and may result in making the wrong printer decision.

To find out how the speed question should really factor into your buying decision, download the webinar at this link.

www.stratasys.com/speedmyth

BONUS MATERIAL

Webinar: “Payback Time”

Despite the financial and productivity improvements you’ll get with a 3D printer, justifying the cost might seem challenging. However there are several ways to approach this effort, depending on your company’s goals and the best application of a 3D printer in your operation.

The webinar “Payback Time” uses the application of jig and fixture production to show how additive manufacturing produces savings that easily justify the cost of a 3D printer. Todd Grimm, additive manufacturing consultant, provides three real-world examples of how companies used the savings they gained by 3D printing jigs and fixtures to justify the purchase of their machines.

See how they did it in this webinar using the following link.

www.stratasys.com/webinar_jigsfixtures



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