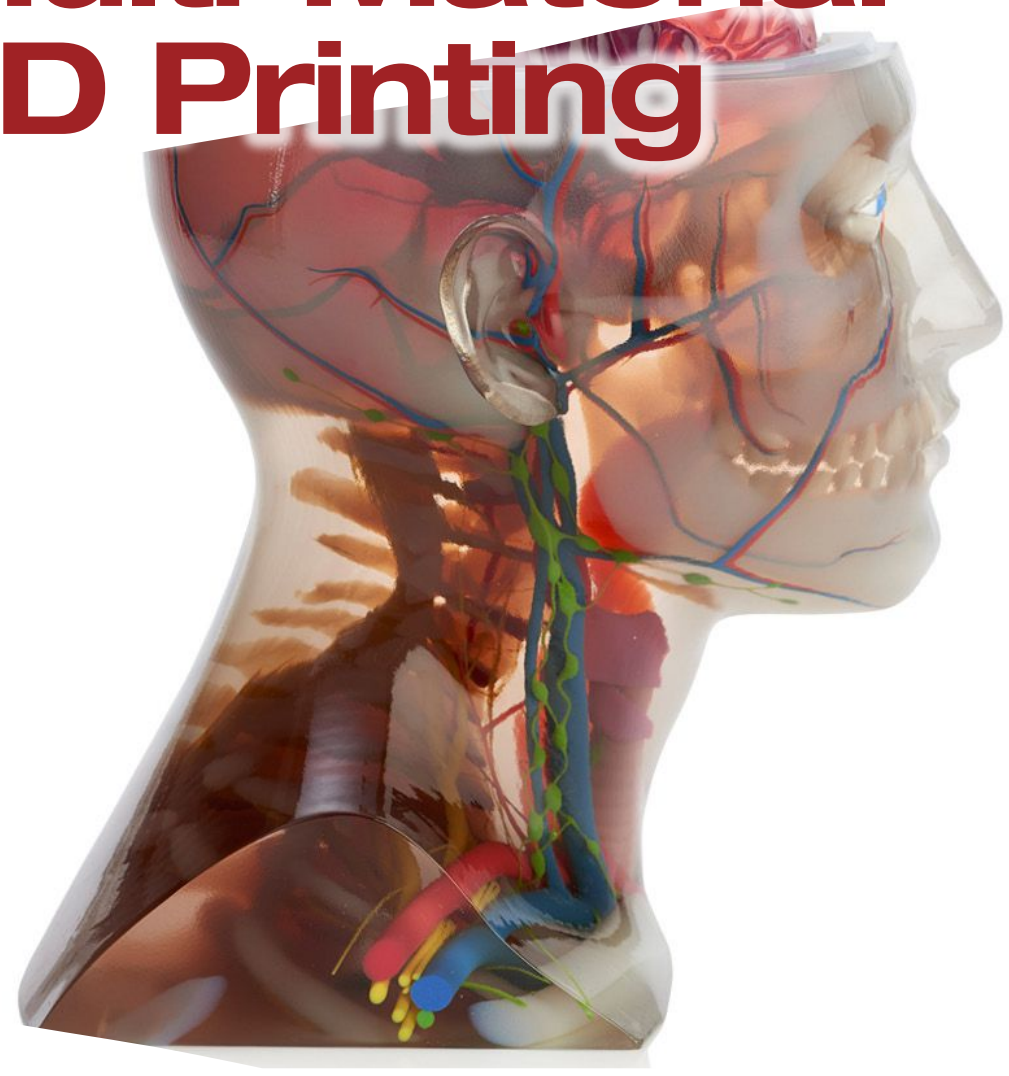


Prototypes Get Real with Multi-Material 3D Printing



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Digital Engineering

Take the Stratasys J750 3D Printer for a test drive in this video.

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EH Publishing, Inc.

Editorial Office

111 Speen Street, Suite 200
Framingham, MA 01701-2000
Phone: 1-800-375-8015

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Why Multi-Materials

Creating 3D-printed prototypes has become a standard design engineering process for good reason. Holding the physical representation of your digital design allows you to see things you may have missed on the screen, better understand how parts interact and more quickly test and iterate improved designs.

But the benefits of 3D-printed prototyping extend well beyond the engineering department. Colleagues in sales, marketing and management find prototypes to be indispensable as they present designs for approval from executives and to clients to make sales.

Realism is especially important in 3D-printed prototypes being presented to those who aren't as intimately familiar with them as the design engineering team. Using multiple colors to make the prototype look like the final product and materials that represent the feel of the final product is so critical that many companies have become accustomed to hand painting parts and gluing different materials together to make a more realistic prototype.

Multi-color, multi-material 3D printers remove time-intensive finishing processes. Perhaps even more important: It gives design engineering teams the freedom to unleash their creativity and prototype more design variations in less time.

Jamie Gooch, Editorial Director,
Desktop Engineering
Peerless Media
Comments? E-mail me at
jgooch@deskeng.com

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Prototypes Get Real with Multi-Material 3D Printing

Create more realistic prototypes with a life-like feel in a full range of colors and material properties.

This sports shoe prototype was produced with full color, smooth surfaces, and a rubber-like sole — all in a single print operation on the Stratasys J750 3D printer. Image courtesy of Stratasys.

Additive manufacturing has long been touted as a better way to prototype. The more realistic the 3D printed part, the better. To fully leverage 3D printing to test drive novel concepts and create functional prototypes with a higher degree of realism, engineering teams need easy access to a range of material and color choices.

If seeing is believing, design professionals must be able to create lifelike finishes and textures to give colleagues and consumers a feel for the design experience—for example, mimicking the look and feel of the natural wood grain on a luxury vehicle interior as opposed to a set of rigid, white parts. Moreover, to be effective, 3D printers should enable engineers to produce highly realistic parts and assemblies in a single print operation without requiring complex post-processing steps such as assembly, sanding and painting.

For years, design teams have tapped 3D printers as a rapid prototyping tool. Being able to quickly transfer designs from the digital to the real world results in huge product development time and cost savings. However, a prototype output using a standard, single material 3D printer may require additional effort to finish, such as assembly and painting to adequately communicate the design intent.

Breakthrough Technology Advances

Companies across the industrial, medical and consumer sectors are taking note of changing technology and embracing multi-material 3D printing as a way to deliver more realistic prototypes. While users of first generation multi-material 3D printers bumped up against hurdles related to color range and part quality, next-generation models like the Stratasys J750 3D Printer leverage new photorealistic color technologies, a vast range of materials properties, and breakthroughs in workflow efficiencies to bring consistency and simplicity to the rapid prototyping process. These new multi-material offerings allow engineering teams to innovate by creating concept models, whole product prototypes and manufacturing tooling on the same 3D printing system, allowing them to explore the consequences of design decisions in vivid detail before committing to a specific iteration.

Beyond empowering a new level of realism, the latest round of multi-material 3D printers is a game changer in another important way: accelerating product delivery by eliminating labor-intensive painting and assembly processes typically required to pull together working prototypes. The ability to get to market ahead of the competition is a key differentiator in today's fast-paced business climate regardless of industry or company size.

Medical Marvels

Multi-material 3D printing is already having an impact throughout the medical field. For example, medical device manufacturers are tapping 3D printing to produce new product prototypes far more quickly and less expense compared to traditional manufacturing methods. By keeping this part of the design process in-house as opposed to outsourcing to a third-party rapid prototyping shop, companies are assured of faster turnaround and a more expedient feedback loop. They can also change and reprint parts quickly, advancing their ability to get products into clinical trial and out on the open market to improve patient outcomes.

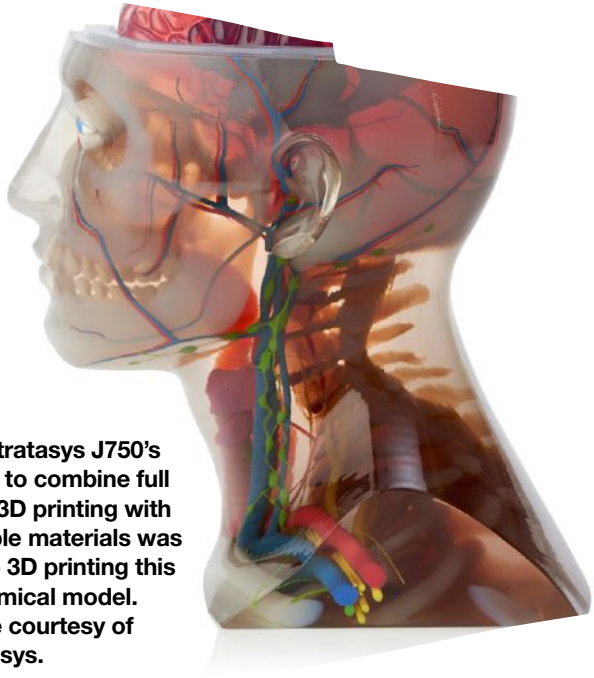
For medical professionals, multi-material 3D printing advances also enable the design of anatomically accurate training models that can't be replicated with conventional manufacturing methods. Through the use of colored, flexible materials, hollow channels and chambers, design experts can 3D print models of human organs or limbs that realistically simulate human tissue complete with all the standard pathology, flexibility and detail. These life-like models provide a no-risk setting for doctors to practice new surgical procedures, maximizing the learning experience and helping them train on delicate and state-of-the-art procedures. Because the models can be produced with proper appearance and tactile resistance, doctors can also plan the best surgical approach, which results in shorter operating times and better post-operative results.

Support for multiple colors and materials is also well suited to the production of prosthetics, orthotics and surgical guides as they need to be tailored to an individual's specific needs. By shaping the guides to a patient's specific anatomy, doctors can deliver more precise treatment, which reduces post-operative complications and expedites patient recovery.

Manufacturing and Design

On the manufacturing front, multi-material 3D printers are upping the game by enabling highly realistic prototypes and facilitating better design decisions. At Adidas Group, the technology is allowing designers to continually refine their concepts, by detecting and eliminating errors in a much shorter window (days instead of weeks) than their traditional process of hand-building models and functional prototypes. It's a similar story at Thermos Company, which switched from an outsourced rapid prototyping service to in-house 3D printer to jumpstart the design of its insulating containers, lunch boxes and other consumer goods. The design team now employs several 3D printers to continually iterate and refine designs, which has reduced its prototyping process down to hours instead of days at a cost of about one-fifth of its former outsourcing partnership.

The ability to print several ideas or variations of a design in the same production lot also gives manufacturers greater prototyping flexibility. New multi-material printers like the Stratasys J750 have a six-material capacity, which means the most widely-used materials can be loaded in the printer at one time, minimizing the need to make changes during subsequent print runs. The ability to print several variations of a design



The Stratasys J750's ability to combine full color 3D printing with multiple materials was key to 3D printing this anatomical model. Image courtesy of Stratasys.

in the same production lot encourages more iterations and ultimately results in optimal designs.

Synergy, an Israeli product development company, has been able to foster more effective design collaboration with its clients thanks to its expanding use of multi-material 3D printers. While it was always able to share designs easily with customers using 3D CAD models, it could take weeks to produce a functional prototype using traditional prototyping methods. Now, using Stratasys' new J750 3D Printer, the design team is able to quickly iterate designs and eliminate other production processes because everything can be produced in a single print run leveraging the unit's support for multiple materials and durometers (see "Reinventing Invention" below).

The ability to produce highly realistic prototypes efficiently and economically can be a game changer for competitive differentiation. Next-generation multi-material 3D printers push realism to a higher level, cementing the technology's place as a critical asset for design collaboration and innovation.

Reinventing Invention

Product-matching 3D printed prototype keypad for an automotive emergency response system produced on the Stratasys J750 3D Printer, featuring soft-touch buttons, backlighting and color textures.

Clients rely on Synergy, a product development company in Netanya, Israel, to transform bright ideas into viably manufacturable, marketable products. Industrial designers and engineers often work around the clock to perfect the grip on a medical device or the appearance of a phone charger.

"The first time the entrepreneur sees his idea and feels it in his hands, is a crucial moment. We need to give him the most realistic prototype possible," said CEO Michael Librus. Dream designs can be rendered onscreen quickly, but functional prototypes can take weeks of investment in labor and outsourcing – especially when products have complex designs and diverse materials.

Design ideas are embraced, refined or abandoned based on the look and feel of a prototype. To hasten and sharpen that decision-making, Synergy brought a Stratasys J750 3D Printer in–house. It produces whole-product prototypes in full color, even with multiple materials, textures and gradients, in as little as a few hours.

So when Synergy redesigned a keypad for an emergency-response system used in the aftermarket automotive industry, the Stratasys J750 played a key role. The project meant producing multiple designs for the panel, which mounts above the rearview mirror, to test which would best fit the car's interior and pass ergonomic and mechanical testing. Each iteration included soft-touch buttons, backlighting, graphics, housing and internal connections to the electronic panel.

Before the Stratasys J750, Prototyping Manager Omer Gassner would have tapped several vendors to create a single keypad panel prototype: CNC machining and water printing for the body, casting for the light pipes, sanding for smoothness and then silicone engraving and additional printing for the buttons. It would have taken ten days to two weeks to create, at a cost of $700 per unit. With the Stratasys J750 it took just hours and cost $200 per unit.

Tamar Fleisher, Synergy art director, said clients appreciate the realism and responsiveness that the technology adds to product development. "Now our customers can make instant decisions about the ergonomics of a product—about the touch and feel—as well as test how it fits into its environment," Fleisher said. "The ability to simulate light transfer on the panel meant my client could decide about every detail of the design. And if a design change was needed I could go to my computer, make the design change and print it in a matter of hours."

For Librus, photorealistic prototypes empower him to fulfill the dreams of innovation that bring customers to Synergy. "I'm just glad that we have the J750 in-house," Librus said. "We wouldn't do it any other way."

Stratasys Launches the J750 3D Printer and PolyJet Studio Software

By Jamie Gooch

The Stratasys J750 multi-material, full-color 3D printer features a six-cartridge material capacity to keep the most used resins loaded. Image courtesy of Stratasys.

The new Stratasys J750 is part of the company's series of Objet Connex multi-color, multi-material 3D printers. It allows customers to choose from more than 360,000 different color shades (thanks to Stratasys' work with Adobe) plus multiple material properties — ranging from rigid to flexible and opaque to transparent, according to the company. The J750 has a build envelope comparable to the Stratasys Objet Connex3 500 3D printer, but twice the material capacity, four times the number of jets, twice the speed and smaller layer thicknesses.

"We can place drops in mixtures of colors that are consistent across the entire part," said Roger Kelesoglu, Global Sales Enablement, Stratasys, at a launch event at OtterBox's headquarters. "This is a really big thing for people who value color — that we can accurately address the color gamut that we state in all directions in X, Y and Z from print to print

With the J750, users can choose from over 360,000 color shades plus material properties ranging from rigid to flexible and opaque to transparent. Image courtesy of Stratasys.

An automotive fuse box prototype 3D printed on the Stratasys J750. Image courtesy of Stratasys.

on the same machine, or from machine to machine. The color consistency in unmatched."

The Stratasys J750 features a six-material capacity to help minimize downtime associated with material changeovers. The newly designed print heads — which are included (up to eight per year) in the J750's three-year warranty that comes standard — means simulated production plastics, like Digital ABS, can be 3D printed in half the time of other Stratasys PolyJet systems, according to the company.

Skip Post-Processing Steps

The ability to dial-in specific colors, materials and finishes can help companies skip the post-processing step required to make many types of parts look realistic for use by focus groups, or by executives or clients making final part design decisions.

"With the introduction of the J750, we are harnessing more than 25 years of experience to set a new historical milestone in 3D printing — reaffirming our commitment to keeping customers always on the cutting edge of innovation," said Josh Claman, chief business officer, Stratasys, via a press release. "With its one-stop realism, the J750 is quite simply a game changer. By combining full color with multiple materials and a streamlined workflow, it recalibrates the impact of 3D printing in the product development cycle. Informed design decisions can be made immediately after the concepting stage. The time saved by eliminating the painting and assembly process can lead to faster product delivery times. The J750 is a multi-purpose system that can also produce production tools, manufacturing molds, teaching aids, and other models — truly raising the bar in 3D printing versatility."

Software-Driven 3D Printing

Stratasys has also released its new PolyJet Studio software, showing that its acquisition of GrabCAD is bearing fruit. The software's new interface allows users to choose materials, optimize the build and manage print queues. Assignment of colors, transparencies and rigidity is eased via familiar design controls, according to the company. Color textures can be loaded fully intact via VRML (Virtual Reality Modeling Language) files imported from CAD tools.

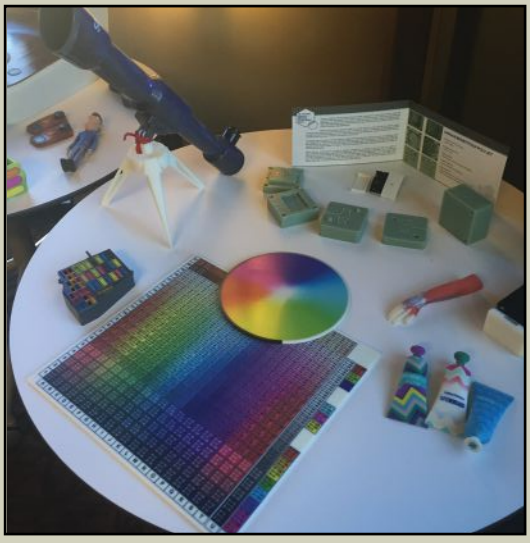
At the J750 launch event, Claman said GrabCAD has become Stratasys' software development group. "We bought GrabCAD because we realized software is going to be a key element in the adoption of 3D printing," he said. "Simplifying the workflow, automating more tasks, developing standard platforms that work maybe across all printers — that's where most technology markets head, that's where we think this one is going."

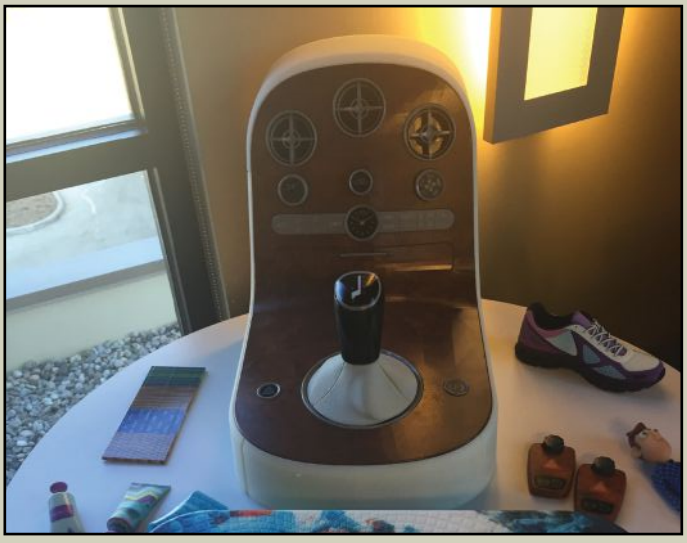
Claman also said he sees Stratasys entering into a "third phase" after the merger with Objet, then the acquisitions of MakerBot, Solidscape, SolidConcepts and Harvest Technolgies. In the third phase he says the company will transition toward solutions-focused business to solve specific customers' problems in vertical markets and will shift its technology development roadmap toward manufacturing.

—Jamie Gooch is editorial director of Digital Engineering magazine. This article was originally published on DE's site at digitaleng.news/de/stratasys-launches-the-j750-3d-printer-and-polyjet-studio-software/

Stratasys J750 Product Specifications

- Model Materials: Vero family of opaque materials including neutral shades and vibrant colors; Tango family of flexible materials; Transparent VeroClear and RGD720
- Digital Model Materials: Unlimited number of composite materials including over 360,000 colors, Digital ABS and Digital ABS2 in ivory and green, rubber-like materials in a variety of Shore A values, translucent color tints
- Support Materials: SUP705 (WaterJet removable)
- Build Size: 19.3 x 15.35 x 7.9 in. (490 x 390 x 200 mm)
- Layer Thickness: Horizontal build layers down to 14 microns (0.00055 in.)
- Workstation Compatibility: Windows 7 and 8.1
- Network Connectivity: LAN – TCP/IP
- System Size and Weight: 55.1 x 49.6 x 43.4 in. (1400 x 1260 x 1100 mm); 948 lbs. (430 kg)
- Material Cabinet: 26.4 x 46.1 x 25.2 in. (670 x 1,170 x 640 mm), 335 lbs., (152 kg.)
- Operating Conditions: 64-77 °F (18-25 °C), relative humidity 30-70% (non-condensing)
- Power Requirements: 100–120 VAC, 50–60 Hz, 13.5 A, 1 phase; 220–240 VAC, 50–60 Hz, 7 A, 1 phase
- Regulatory Compliance: CE, FCC, EAC
- Software: PolyJet Studio 3D printing software
- Build Modes: High Speed with up to three base resins, 27-micron (0.001 in.) resolution; High Quality with up to six base resins, 14-micron (0.00055 in.) resolution; High Mix with up to six base resins, 27-micron (0.001 in.) resolution
- Accuracy: 20-85 microns for features below 50 mm; up to 200 microns for full model size (for rigid materials only)
- Resolution: X-axis: 600 dpi; Y-axis: 600 dpi; Z-axis: 1800 dpi





An assortment of parts produced via the Stratasys J750 3D printer were on display at the company's launch event this summer.

OtterBox Speeds Product Development with the New Stratasys J750 3D Printer

By Jamie Gooch

Perhaps not surprisingly, there are otters everywhere at OtterBox, the mobile phone and tablet case maker based in Fort Collins, CO. Framed otter photographs adorn the walls, an otter statue stands outside a conference room and a spiral slide sculpture — complete with bronze otters and fish — winds down from the second floor into the lobby. Many of the journalists that Stratasys flew in for a press event here took a ride on that slide, but we weren't there for the otters. We were there to see Stratasys' latest 3D printer, the J750, in action.

It's not all fun and otters at OtterBox. Making the No. 1 selling case for smartphones means molding millions of parts every day in the company's facilities in the U.S., China and Mexico. New device launches, like the latest iPhone, often dictate the company's tight production deadlines.

This otter sculpture/slide winds its way down from the second floor into the lobby of the OtterBox headquarters in Fort Collins, CO.

Racing to Retail

"Our main goal is to supply all the resources possible for the engineers to get their product onto the peg at the same time, if not before the device we're making that product for launches," said Brycen Smith, engineering technician supervisor at OtterBox, during his presentation at the company's headquarters. "The J750 plays a huge role in that — not only from ideation and creation, but into our approval processes … really developing those new products, the new technologies, the new innovations OtterBox is known for."

The company typically has eight weeks to design cases for a new device to get them "on the peg" (hanging up in the store) after it receives the CAD geometry for the device. Within the first 24 hours, OtterBox is 3D printing what it calls "feature location verification prints." These first prototypes serve to precisely locate all of the features on the device — screen, power, volume, charging port, camera, speakers, etc. — to ensure the case functions flawlessly, said Smith. He says they usually 3D print five to 12 iterations of the location prints in an 8-hour day.

OtterBox uses a proprietary prototype ordering system internally that allows engineers to input all the information needed for 3D prints: the part file and the desired materials, color, textures and finishes. Technicians print out these material- and color-specific parts so engineers can put them on a device and get a feel for their fit and function. They can then iterate until they're satisfied that a prototype is ready to be sent up the chain of command

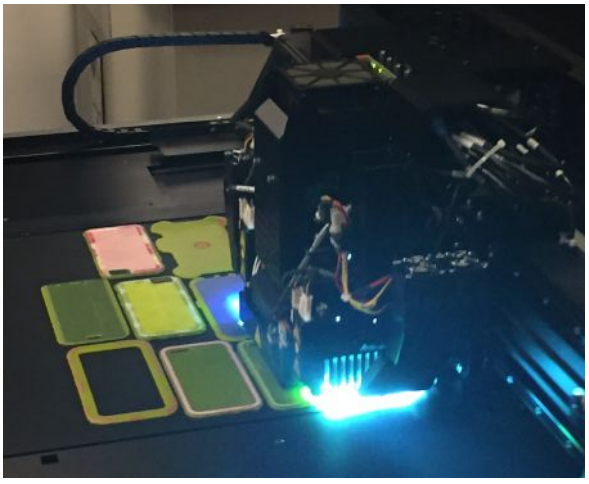
for approval. On average, the company is running 750-1,000 prototype parts per week.

Having a realistic prototype is critical to ensure focus groups and company decision makers can see and feel what the final case will really look like. They're also sent to the packaging team so they can design attractive packaging with a perfect fit, manufacturing and marketing, and to retailers so they know what to expect.

The prototypes leave nothing to chance. They're a critical step in the company's design process, which the J750 speeds up considerably. Before the design freedom made possible by multi-material, full-color 3D printing, Smith said the company's technicians would 3D print prototypes in white and then paint each potential design to exact specifications.

"That's one color a day per part," he said. "So they're painting one part, you've got to mask it off, wait for it to dry, paint the other color, mask it off again, paint it again, come back and do some final touches … We can't hit eight weeks to market doing that."

Brycen Smith, engineering technician supervisor at OtterBox, said they were 3D printing parts on the Stratasys J750 the day it was delivered.



The Stratasys J750 on-site at OtterBox, creating multi-material prototypes.

Smith said the J750, which OtterBox has been beta testing since late 2015, matches the spectrometer (color) and durometer (hardness) specifications of the cases within final manufacturing tolerances. It allows OtterBox to accurately mimic the production parts in a fraction of the time it used to take to paint each one.

Testing and Manufacturing

The look and feel of a cellphone cover is obviously important. People interact with it several times a day and, for some, a phone case is a way to express their personality and sense of style. But a good-looking case that doesn't protect your phone or tablet would be a design failure. OtterBox sends its cases to its PIT (Prototype, Innovate, Test) Lab to ensure they can stand up to abuse.

In the PIT Lab, various tests are performed to simulate real-world drops, exposure to chemicals (such as hand lotions and detergents), scratches, and the temperature and humidity changes a case might be subjected to. While OtterBox tests production parts, 3D printing is used to create fixtures and jigs to help the test engineers work more efficiently. For example, a jig is 3D printed to make sure the screens for the

An assortment of prototypes created by OtterBox on the Stratasys J750 3D printer

OtterBox Defender series of cases fit just right.

"When we are releasing that product into mass production, it's dialed in exactly where we want it to be," Smith said. "We might have 1,500 tools in production at one time, and to make one small change during tooling could affect every one of those tools."

3D printing is integral to product development at OtterBox. It helps keep all its stakeholders on the same page, allows decision makers to make informed choices based on realistic prototypes and ensures manufacturing is setup correctly the first time.

"Without it, we'd be in a world of hurt," said Smith of the Stratasys J750 3D printer. "It's huge. Cost savings — I couldn't even quantify it in numbers, monetarily or in days. It's huge savings all around."

—Jamie Gooch is editorial director of Digital Engineering magazine. This article was originally published on DE's Rapid Ready Tech site at rapidreadytech.com/2016/04/stratasys-j750-3d-printer-polyjet/