eBook

The Benefits of Traditional and Additive Manufacturing from a Single Source

Obtain the best of both worlds: speed and ability to manufacture complex geometries with the precision and materials of traditional processes from a single part manufacturing service

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3D SYSTEMS On Demand

Contents

The Modernization of Traditional Manufacturing

While the basic methodologies of traditional manufacturing remain the same, there are many efficiencies and levels of automation that have augmented modern machinery over the past decade, including:

- Rapid tooling that speeds production, lowers costs, and enables greater customization.
- Intelligent software that provides built-in expertise for complex tasks and eases decision-making.
- Better, more intuitive interfaces between software and machines.
- Greater automation to speed production, reduce human errors, and minimize tasks traditionally done by hand.
- A new generation of software for more accurate pricing quotes and Design for Manufacturing (DFM) analysis.
- The ability to integrate traditional manufacturing with the latest additive manufacturing technologies.

In this eBook, we'll explore approaches that combine traditional with additive manufacturing to maximum effect.

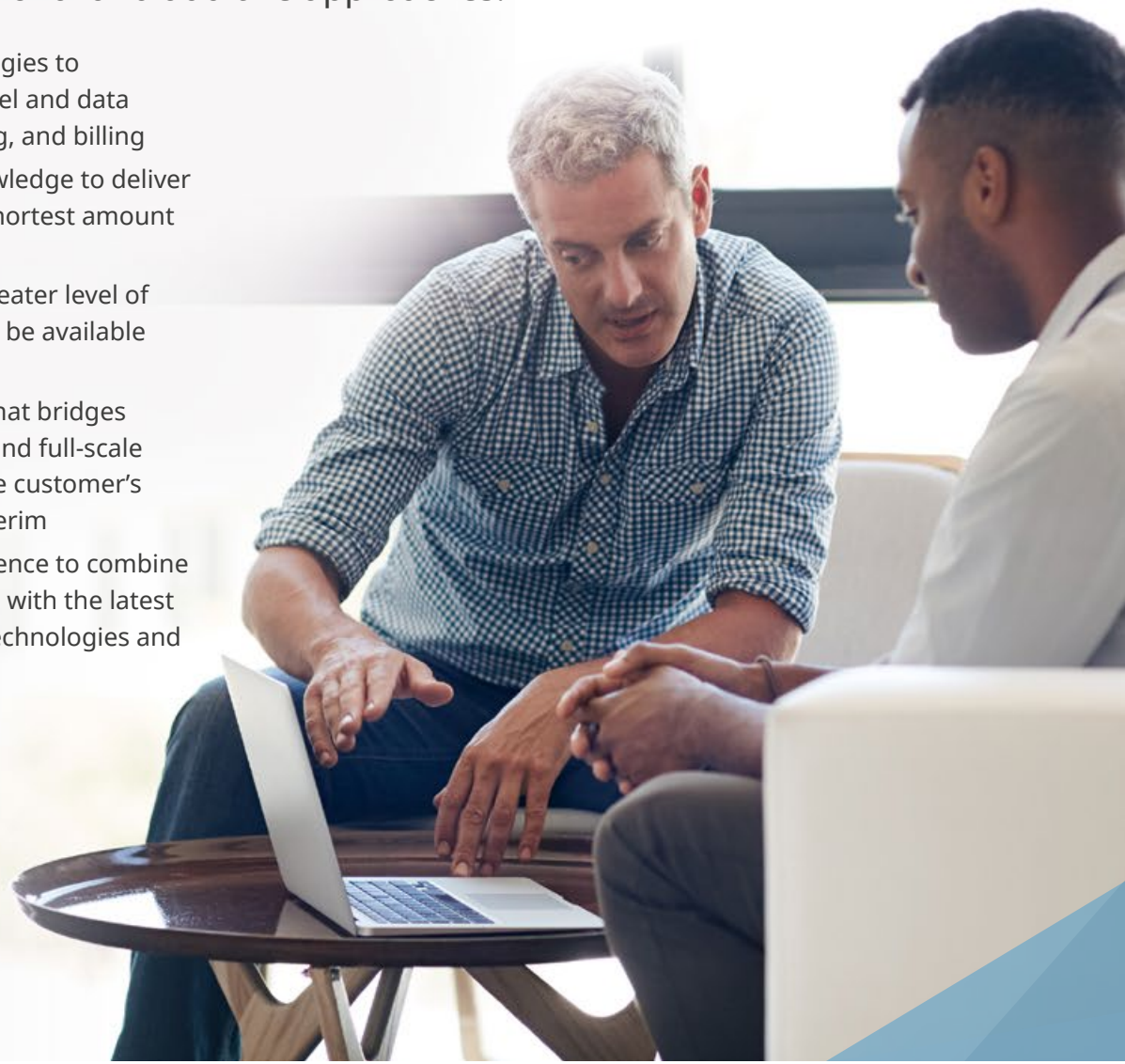
We will also discuss how to best fulfill your design goals, accelerate time to market, and make the most efficient use of your budget.

Putting the Customer in the Driver's Seat

There are plenty of options for external prototyping and production. But very few vendors offer a full range of production options especially both traditional and additive approaches.

At 3D Systems On Demand, we believe that design goals should drive production means, without compromising the original design intent. This requires the use of a manufacturing partner that has the resources and knowledge to deliver the following benefits:

- Proven processes that free customers from traditional production constraints, enabling stronger, lighter-weight, more flexible parts and assemblies that reduce part counts, increase performance, and lower costs
- A wide array of Design for Manufacturing technologies and services to accelerate product development
- Localized service with global resources
- The latest digital technologies to streamline ordering, model and data exchange, project tracking, and billing
- Collective worldwide knowledge to deliver the right product in the shortest amount of time
- The ability to provide a greater level of customization than might be available in-house
- Low-volume production that bridges the gap between design and full-scale production, protecting the customer's revenue stream in the interim
- The resources and experience to combine traditional manufacturing with the latest additive manufacturing technologies and materials

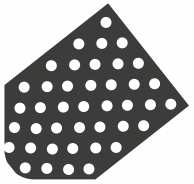


Delivering a Full Traditional Portfolio

A full-service provider should be able to offer a wide range of traditional manufacturing options, including:

CNC-Machined Plastic and Metal Parts

- From prototypes to production parts
- Dimensional accuracy



Sheet-Metal Parts

- Prototypes to low-volume production
- Large variety of metal options

Metal Die Casting

- Automation to maintain consistent quality
- Superior fine surface quality

Rapid Molded Parts

- Consistent parts, fine detail
- Continuous quality control

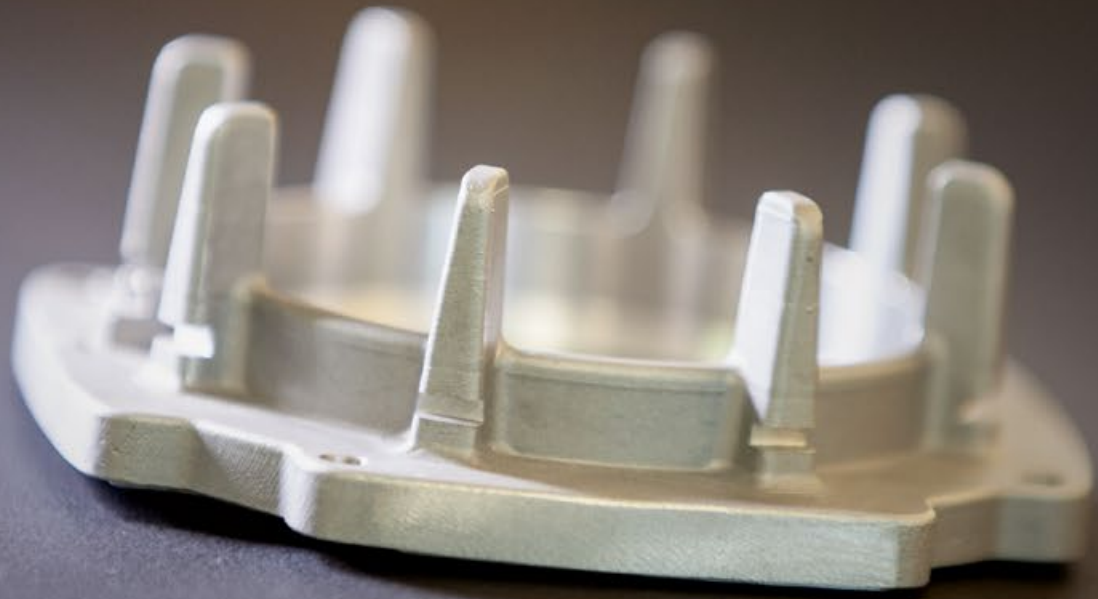
ON DEMAND SERVICE

Subtractive Manufacturing Approaches: CNC-Machined Plastic and Metal Parts

CNC machining is a solid choice for high-quality metal and plastic parts requiring the greatest degree of dimensional accuracy, critical surface finishes, and material-specific properties.

CNC machining from 3D Systems On Demand offers the following benefits:

- Wide range of materials
- Ability to hold tight tolerances
- Parts machined directly from 3D CAD models
- Standard delivery time of 1-2 weeks based on order
- Shorter lead time (2-5 business days) according to availability



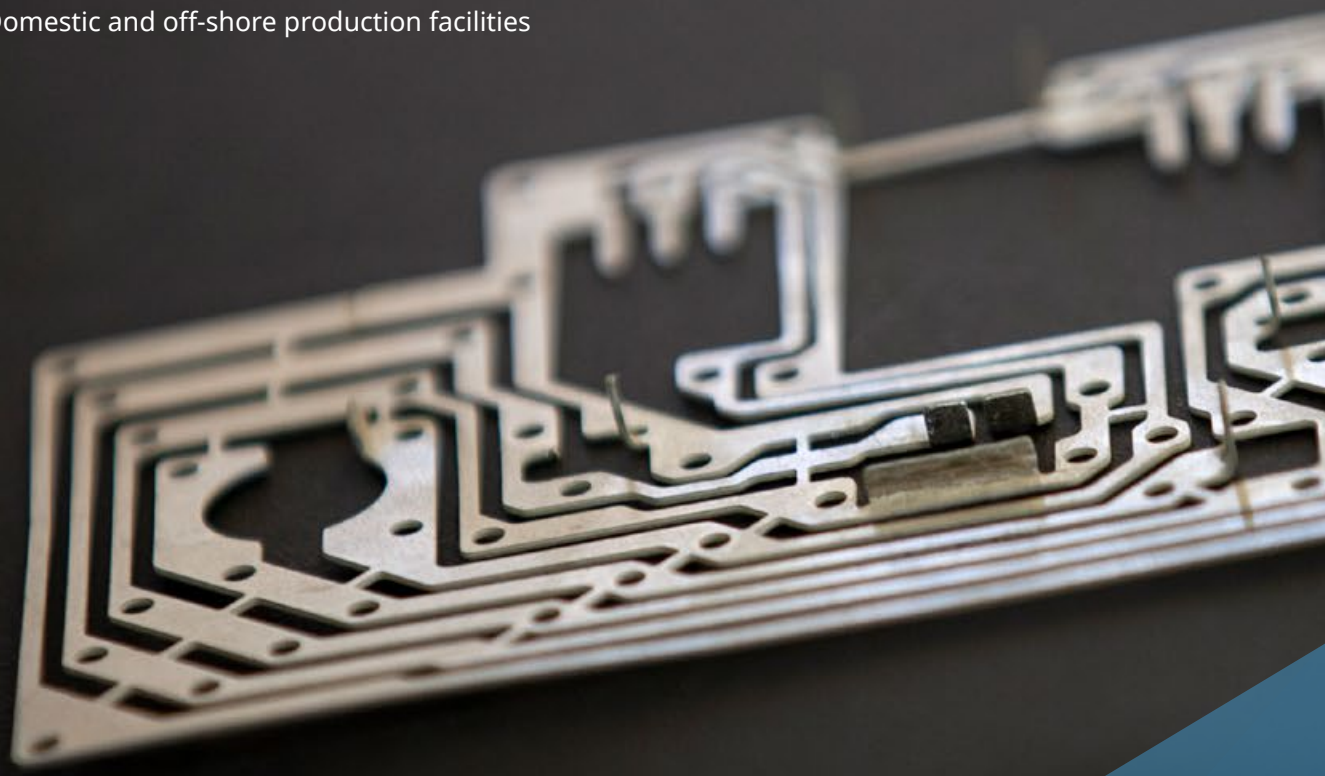
ON DEMAND SERVICE

Subtractive Manufacturing Approaches: Sheet-Metal Parts

State-of-the-art sheet metal fabrication services include vertically integrated metal forming, laser cutting/punching, CNC machining, and welding and finishing cells to support both prototype and production runs of high-quality sheet metal enclosures and housings.

Sheet metal part production from 3D Systems On Demand offers the following benefits:

- Quotes in 24 hours or less based on STEP, IGES or most native CAD files
- Wide range of metal options
- Sizes ranging from a small washer or bracket to midsize enclosures for home appliances to large airplane wings
- Material thickness ranging from 0.001” - 0.250”, and bent part sizes up to 36”x36”x6”
- Tolerance comparable to die tooling
- Prototype assemblies in as little as 4-7 days
- Domestic and off-shore production facilities



Traditional Manufacturing Approaches: Metal Die Casting

Metal die casting is especially suited for applications where large quantities of small- to medium-sized parts are needed.

Metal die casting from 3D Systems On Demand offers these benefits:

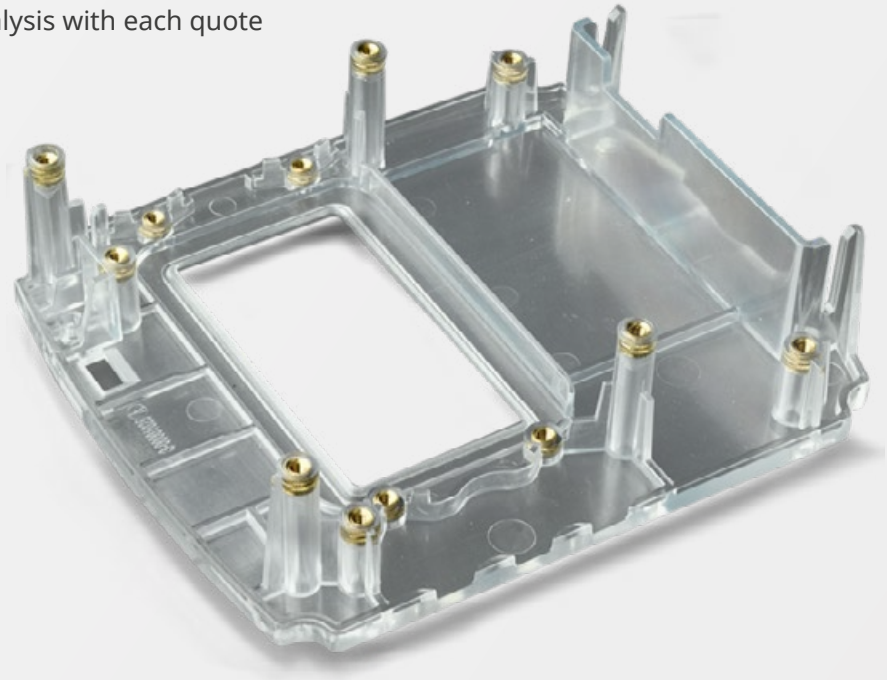
- Rapid turnaround times
- Automation to maintain continuous quality shot after shot
- Ability to accelerate project from prototype to production
- Secondary operations to produce features that cannot be casted
- Highest quality – superior fine surface quality, and dimensional consistency

Traditional Manufacturing Approaches: Rapid Molded Parts

Production-grade molded parts can now be produced at a fraction of the price of those made with the laborious tooling processes of the past. Today's tools can be constructed with quick-change mold bases and interchangeable soft tooling inserts, making them ideal for prototype production and bridge manufacturing.

Rapid molded parts from 3D Systems On Demand offer the following advantages:

- Lead times between 7 - 14 business days for T1 samples
- Quality molds that are typically good for around a 10K shot life
- Tolerances within +/- 0.005"
- A wide range of material selection, including ABS, PC, nylon, PC/ABS, PMMA and many more
- Ability to handle complex part geometries beyond "straight pull" designs
- Part sizes up to 8" x 6" x 2"
- Free Design for Manufacturing (DFM) analysis with each quote



Integrated Additive and Traditional Approaches

One of the significant developments in the last decade is the ability to combine the attributes of traditional manufacturing with additive manufacturing technologies to obtain the best of both worlds.

This integrated approach works best when you want to combine the speed and ability to manufacture complex shapes - only possible through 3D printing - with the precision and materials of traditional manufacturing processes.

Common applications encompassing integrated additive and traditional approaches include cast urethane, investment casting, and functional or appearance models.

Integrated Additive and Traditional Approaches: Room Temperature Vulcanization (RTV)

Using 3D-printed masters and silicone molds that defy traditional production timelines, high-quality parts can be produced at low- to mid-volumes without the cost and time of hard tooling.

The process results in parts that accurately mimic the color, texture, feel and physical properties of injection-molded parts.

Benefits of the integrated cast urethane process used by 3D Systems On Demand include:

- Ability to create 3D printed master patterns in hours and silicone molds in a few days
- Enables rapid and cost-effective pre-production and low-volume manufacturing runs
- Large material selection – rigid, flexible, durable, clear and high-temperature
- Ideal for marketing samples and test prototypes
- Delivers the ability to over-mold existing parts or hardware with a second material

Integrated Additive and Traditional Approaches: Investment Casting Patterns

3D printing enables rapid production of casting patterns in wax and proprietary SLA QuickCast® methodologies. With perfect surface finishes, these patterns drop seamlessly into the investment casting workflow.

3D-printed wax patterns from 3D Systems On Demand offer the following benefits:

- High-detail, high-resolution builds
- Highest surface-level finishes and complexity
- Quick lead times
- Can be created without tooling
- Accelerates the casting process
- No special finishing required
- Lower cost of initial development
- Capable of producing the finishes required by the aerospace and medical industries
- Easiest patterns to process

Patented QuickCast patterns offer the following benefits:

- Hollow build style reduces the amount of material to burn out
- Capable of producing large assemblies
- Highly stable resins that are developed specifically for foundry applications
- Rapid production compared to traditional tooling
- Provides valuable shrinkage and gating information prior to hard tooling
- Low moisture absorption and expansion of pattern
- High dimensional stability

Integrated Additive and Traditional Approaches: Appearance and Functional Models

Appearance models turn CAD models into highly realistic physical parts and assemblies for aesthetic review, trade shows, and sales presentations.

Functional models add another dimension: the ability to function as the finished product will in the real world.

Both appearance and functional models often contain parts and overmolds created with a combination of traditional and additive approaches.

3D Systems On Demand offers the following benefits for appearance and functional models:

- The ability to perfectly mimic quality and aesthetics of the real product in every detail: radius, soft edges, flashes and gaps, graphics, component assembly matching, and surface treatments such as painting, chroming and foiling
- The flexibility to produce models varying in size from a tiny hearing aid to a full-size prototype of an MRI scanner, at any level of detail and complexity
- The experience to create fully functional models that look, feel and behave like the real thing
- Access to materials and processes that span the widest range in the 3D printing industry, augmented by more traditional production processes and in-house craftsmanship
- The expertise and tools to create any type of finish and match any type of Pantone color that you specify

Instilling Design Confidence for Schweppes

Birdstone, a Melbourne, Australia, packaging agency turned to 3D Systems On Demand to help design a contemporary look for the Schweppes brand of sparkling waters and carbonated soft drinks.

Because Schweppes products are offered in both glass and PET (polyethylene terephthalate) plastic bottles, the project required using both additive and traditional technologies.

Early prototypes were produced in SLA to enable Schweppes to assess the proportions and how the new bottles felt in hand. Once the designs were approved internally, Birdstone worked with 3D Systems On Demand to replicate the specific appearance, weight and visual properties of glass and PET for customer testing.

CNC-machined acrylic (PMMA) with a high-polish finish was used to achieve the thinness and flexibility of the PET design. SLA 3D printing using a transparent, polycarbonate-like material with premium finishing was used for the glass design.

A total of six bottles were made across three design concepts, which were then subjected to a week of hands-on consumer research. The final design was selected based on these results, giving Schweppes and Birdstone reinforced confidence in the new direction.

Following the initial market release of the new bottles, Schweppes has continued to extend the new design family across additional bottle sizes.

"The market success and Schweppes' confidence in the design can be directly attributed to the meaningful research that was conducted, which was made possible by the high-quality prototypes."

Iain Blair, Birdstone Director

A Full-Sized Verification Car in Eight Weeks

3D Systems On Demand engineers can help players in the automotive industry reach development milestones faster by rapidly delivering prototype vehicles for design verification.

Using a high proportion of SLS and SLA 3D printing, alongside parts produced with laminated resins, carbon fibers, and urethane casting, a final car prototype can be completed eight weeks after accepting the CAD data.

The customer can then gather its design, production and maintenance teams to conduct comprehensive full-vehicle assembly, interference and other tests.

Vehicle testing options include:

- Complete assembly cycles
- Component assembly
- Ergonomic validation from the customer side
- Interference checks and optimizations for process improvements
- Accessibility for maintenance

Models that Look and Act Like the Real Thing

The futurist and writer Arthur C. Clarke famously said that any sufficiently advanced technology is indistinguishable from magic.

That's certainly the case with appearance and functional models, which typically include a combination of traditional and additive manufacturing along with a craftsmanship that harks back to a different era.

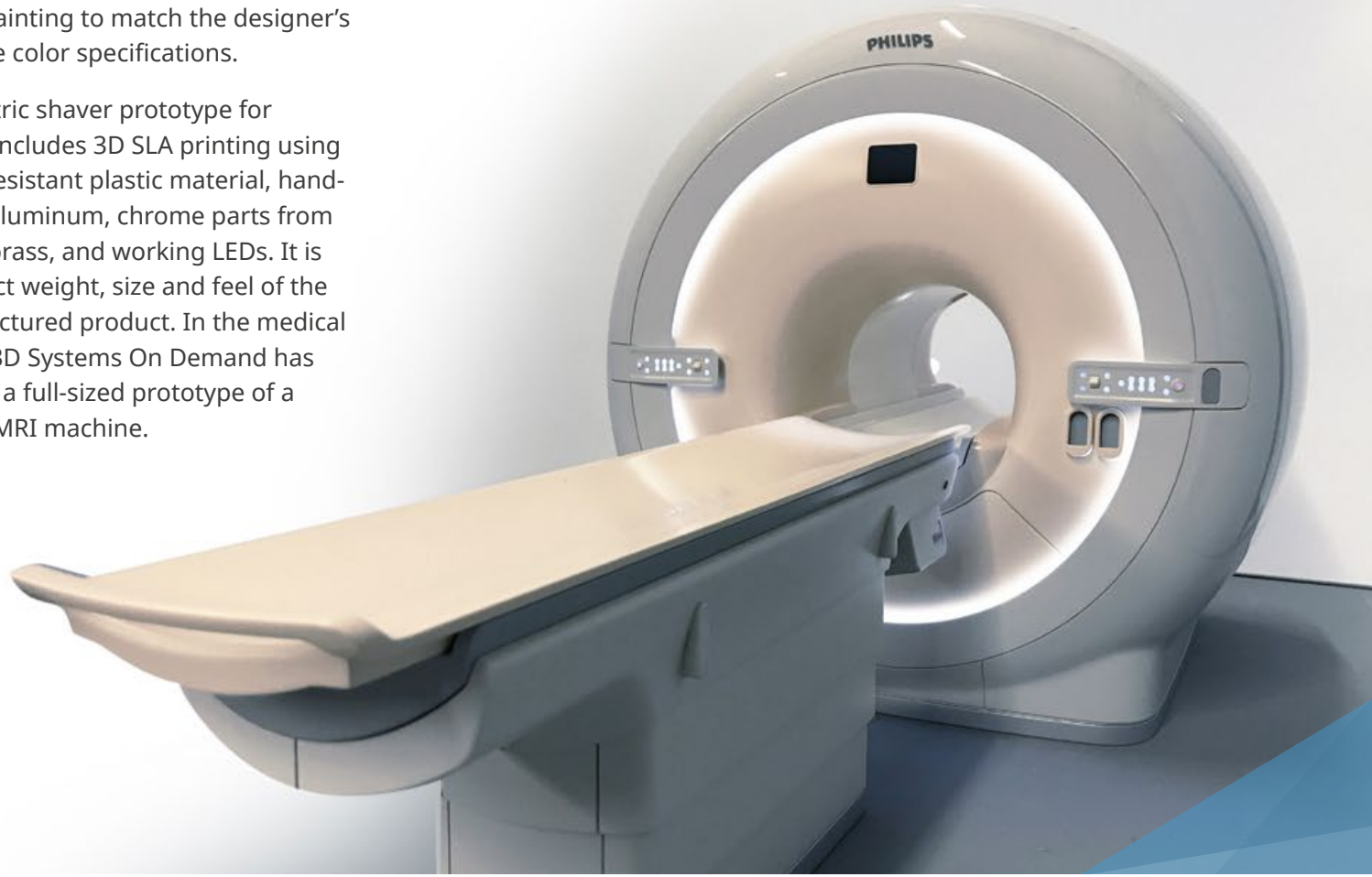
Applications for appearance and functional models span a wide range of industries and applications. 3D Systems On Demand has successfully delivered appearance and functional models for companies such as Philips Design (consumer and medical products), Whirlpool (appliances), Grohe (bath), Sonova (hearing aids), Sea Tools (underwater oil industry machinery) and many of the major automotive manufacturers.

Clock radio appearance models for Robert Bronwasser Design required a full arsenal of tools and skills, including 3D SLA printing using ultra-tough plastic materials, cast urethane from a silicone rubber mold, CNC milling, hand-molded cloth, and in-house spray painting to match the designer's Pantone color specifications.

An electric shaver prototype for Philips includes 3D SLA printing using break-resistant plastic material, hand-milled aluminum, chrome parts from milled brass, and working LEDs. It is the exact weight, size and feel of the manufactured product. In the medical realm, 3D Systems On Demand has created a full-sized prototype of a Philips MRI machine.

"The key is direct communication – what I call co-creation," he says. "There's great value in having direct contact with a model-maker that understands designers and has creative engineers on the team. Together, we build the best solution."

Dirk Vananderoye, Creative Director, Philips Design



Pushing the Limits of Motorcycle Part Production

There's a moment that every industrial designer dreads: When his or her ideal design bumps up against manufacturing reality.

Confederate Motors has faced that moment many times in the past, but not recently. Its collaboration with 3D Systems On Demand has given the bespoke motorcycle company the ability to turn even its most wildly imaginative designs into physical reality.

3D Systems provides SLA and SLS prototypes and molds that have accelerated product development and helped ensure quality for Confederate Motors.

That type of 3D printing expertise is expected from 3D Systems. Less expected perhaps are jointly developed assembly kits comprising 140 different parts. 3D Systems On Demand manufactures on a just-in-time (JIT) basis with a state-of-the-art sheet metal fabrication facility, including:

- Vertically integrated metal forming
- Laser cutting/punching
- CNC machining
- Welding and finishing cells

In a rare case where 3D Systems On Demand could not manufacture the part itself, it supplied the SLA master patterns for carbon fiber parts.

"Our relationship with 3D Systems is probably the best thing that's happened to me since I've been in this business.

It takes so much of the pressure off our small team and lets us focus on what we love to do, which is design the best possible bike imaginable."

Matt Chambers, Founder and CEO, Confederate Motors

Our Manufacturing Service Offering

3D Systems On Demand parts manufacturing service delivers the innovative technologies, materials, processes and expertise to quickly and cost effectively meet all your manufacturing needs, on time, every time.

Our global team of engineers work with you locally to accurately manufacture your design-to-3D CAD models into final production parts. By outsourcing your needs to 3D Systems On Demand, you'll work in collaboration with our expert engineers allowing you to streamline your production processes, improve productivity and reduce costs.

Our service includes everything from rapid and functional prototyping to appearance models and low-volume production using both additive manufacturing and traditional processes.

Why 3D Systems On Demand?

3D Systems is best known as the inventor and leading manufacturer of 3D printing systems. In that time the company has made millions of parts to help customers deliver on new production applications. That led to a demand for parts from design, engineering and manufacturing companies that don't own certain machines, require outside consulting assistance, or want to complement their in-house capabilities.

When the 3D Systems On Demand service bureau was established several years ago, the company expanded its expertise and resources through strategic acquisitions, not only for 3D printing and additive manufacturing, but for traditional approaches as well.

3D Systems On Demand now has a worldwide network of facilities to locally service companies that need a stable, reliable, well-resourced and uniquely experienced partner. Providing customized manufacturing of prototypes and low-volume part production.

Visit the 3D Systems website for more information or to get a quote.

Get in Touch

Melbourne - Austrailia
Tel: +61 3 9068 5899

Diadema - Brazil
Tel: +55 (11) 4933 0304

Le Mans - France
Tel: +33 (9) 71 08 06 71

Darmstadt - Germany
Tel: +49 6151 2749 018

Pinerolo - Italy
Tel: +39 0294 758 513

Budel - Netherlands
Tel: +31 852 250 482

High Wycombe - United Kingdom
Tel: +44 (0)20 3974 1362

Lawrenceburg, TN - USA
Tel: +1 877 994 2303