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Mike Zeigle / Trek



Trek slashed its new product development cycle with an Objet 3D printer.

#### CASE STUDY

# Wheels on Fire

## TREK ACCELERATES DESIGN CYCLES WITH OBJET 3D PRINTER

### AWARD-WINNING BICYCLE MANUFACTURER NOW PRODUCES 4X AS MANY PROTOTYPES AS BEFORE

Trek was founded in 1976 with a simple mission: build the best bikes in the world. The company has won multiple awards for design and innovation. Mike Zeigle is the Manager of Trek's Prototype Development Group. The group has nine people, a machine shop with five computer numerical controls (CNC) machining centers and a metal fabrication/welding shop.

Prototyping plays a crucial role in all phases of Trek's product development cycles. Building prototypes for the company's industrial designers, mechanical engineers, graphic artists and marketing staff keeps Zeigle's staff of programmers, machinists and welders busy. In most cases, they are prototyping bike parts, but occasionally they also prototype tooling mockups and accessories such as shoes and helmets.

When Trek's annual costs for service bureaus reached \$275,000, Trek's engineering and design manager decided to purchase an in-house rapid prototyping system. Zeigle researched stereolithography (SLA) and Fused Deposition Modeling (FDM) tools. He quickly narrowed the field down to SLA, but still had concerns about the machines' cost, space and maintenance requirements. Then a colleague suggested the Objet500 Connex™ 3D Printer, a clean, office-friendly machine that produces parts that rival in quality and finish those made with SLA.

Unlike the other technologies Zeigle considered, the Objet500 Connex 3D Printer offers the ability to print parts and assemblies made of multiple model materials with different mechanical or physical properties in a single build. Parts produced on the Objet 3D Printer have smooth and durable surfaces and exceptionally fine details. The system can print living hinges, soft touch parts and overmolds that other technologies are incapable of prototyping. The high quality output and multi-material printing capabilities of the Objet 3D Printer make it possible to closely emulate the look, feel and function of an exceptionally wide variety of end products.

The Objet500 Connex's ability to mix two materials together in order to provide nearly any desired durometer and its ability to combine two materials in one part were key selling points. "The Objet Connex was the only rapid prototyping machine we evaluated that would allow us to do one build with multiple materials and durometers," says Zeigle. "You can't do that with SLA or other brands of 3D printers. The Objet Connex changed my perception of 3D printing."

Zeigle and his team were also impressed with the quality of the parts produced on the Objet Connex. "The part quality and finish of the Objet Connex are as good as the SLA parts we used to get from our service bureau," he says. "And we can have a part in just a few hours compared to several days and lots of paperwork when we were outsourcing."

### Objet Connex enables breakthrough design for new Speed Concept bike

Zeigle's team uses its Objet Connex printer for virtually every bike Trek produces. Most recently, it played a key role in the company's launch of its new Speed Concept 9 Series, a time-trial bike used in the Tour de France and Iron Man Hawaii. This bike's frame design features aerodynamic cross-sections that lower wind resistance and improve speed. Virtually every part of the new design was prototyped on the Objet Connex and then shipped from Trek's Wisconsin headquarters to a California facility for wind-tunnel testing at wind speeds of 30 MPH or more.

#### AT A GLANCE

<b>Challenges</b>	<ul style="list-style-type: none"> <li>• Reduce rapid-prototyping expenses and accelerate design cycles with in-house system</li> </ul>
<b>Solution</b>	<ul style="list-style-type: none"> <li>• Objet500 Connex 3D Printing System</li> </ul>
<b>Results</b>	<ul style="list-style-type: none"> <li>• Trek now produces 4x as many prototypes as before, enabling better designs and faster time-to-market</li> </ul>



Trek previously spent considerable amounts purchasing prototypes from service bureaus.



The company selected the Objet500 Connex because of its multi-material capabilities.



Trek now produces four times as many prototypes, resulting in better designs and faster time to market.

“The designers had several ideas for the aerodynamic cross-section design in particular, and wanted to see the impact on wind resistance,” explains Zeigle. “So we printed multiple parts that they could snap onto the main bike frame and test in the wind tunnel.” The team also accessories such as water bottles and bento boxes to make the testing conditions more realistic.

“The fact that we were able to print multiple iterations quickly enabled the designers to experiment more and still make all their deadlines,” explains Zeigle. The end result is a bike design called the Kamtail Virtual Foil that’s garnered major media attention.

In the past, the Trek team produced prototype parts out of aluminum or dense foam using CNC processes in its machine shop and mixed them with SLA parts outsourced to a service bureau. It took a week or more to make a CNC part and several days to get an SLA part. Today, the lead time for a part made in house on the Objet 3D Printer is usually less than one day. Lupe Ollarzabal, the engineer who runs Trek’s Objet Connex printer, says that having the Objet Connex in house has made a big impact on Trek’s productivity. “Our Objet Connex enables us to either get a new product to market quicker or to get a better product to market on time – and in many cases, it’s both,” said Ollarzabal, whom Zeigle describes as the go-to guy for designers who need a prototype part immediately. “Either way, we win and so do our customers.”

Trek’s designers are also prototyping a lot more frequently. “75 percent of the prototypes we create are things we never would have prototyped before,” says Zeigle. “When we outsourced or had to rely on our in-house milling operation, it was just too expensive and time-consuming to do a lot of prototyping.” Zeigle notes that the Objet Connex has also helped significantly reduce tooling mistakes that can add weeks or months to a product launch schedule.

Today, says Zeigle, Trek’s Objet Connex printer runs almost continuously. “At first, we had one part time person who ran our Objet 3D Printer,” he recalls. “Within six months, as designers started prototyping more, it became a full-time job. Our current machine runs all day long, all week long, and sometimes into the weekend. If we get any busier, we will be at the point where we’ll need to add a shift or purchase another Objet Connex, maybe both.” “Stratasys’s service has been excellent,” adds Zeigle. “I wish all of our vendors were as responsive as Stratasys. On a scale of 1 to 10, they’re a 10.”



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