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Rapid Prototypes Speed Diabetes Equipment to Market

Biorep uses an Eden250 to develop fast parts to test ideas and sell concepts to management

By Doug Smock, Contributing Editor, Materials and Fastening -- Design News, December 15, 2009

A medical device manufacturer in Florida is getting to market faster with better designs through use of a 3-D printing system to rapidly make prototypes.

"One of the great things it has enabled us to do is test the proof of concept first without worrying about details such as manufacturing," says Felipe Echeverri, engineering director of **Biorep Technologies** in Miami. "The other thing is that we can leave it unattended overnight."

The Eden250 3-D printing system from **Objet Geometries** was used extensively in the development of a patent-pending pinch manifold. Pinch valves are used in medical labs to keep fluids, such as blood, in silicone tubing from coming into contact with any equipment components. "There are many pinch valves out there, but none that are noncontact where you can select multiple tubes," says Echeverri. "We knew it didn't exist in the market, so we had to design and build it."

Biorep, which was founded in 1995 as a pro bono engineering partner to the **Diabetes Research Institute** (DRI) in Miami, relied on its own machine shop to make prototypes. The workload grew, and included development of equipment used to isolate islet cells from the pancreas. This enabled advanced-stage diabetics to receive transplants, allowing them to live insulin-free. The work resulted in several honors for the president and co-owner of Biorep, Ramon Poo (pronounced Poe).

Biorep then began to outsource models to service bureaus to cope with a mushrooming workload.

"When we outsourced 3-D printed models, they were often more expensive than the cost to machine them in-house, and it wasn't much faster," says Echeverri. "We knew we could really accelerate our design productivity if we had the ability to print a part overnight, in our office."

Seventeen metal and plastic parts for the pinch manifold were prototyped on the Eden250, a smaller, entry-level machine. Eight polyacetal parts are used to pinch the tubing, shutting off the flow of fluids. There are also two parts made of Ultem, a polyetherimide engineering plastic developed by Sabic Innovative Plastics. Biorep had previously used Ultem in the Ricordi Chamber, which isolates and purifies insulin-producing cells from a donor's pancreas. The two metals used in the manifold are stainless steel and anodized aluminum.

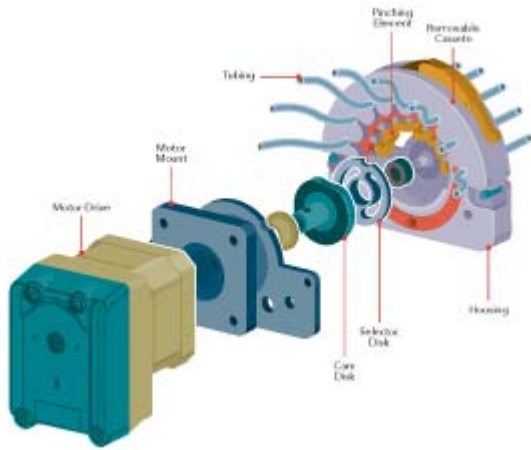
Fluids only come into contact with the tubing, which is disposable. The prototypes were used to sell the concept to management. Biorep's manifold, which is now for sale, uses a series of cams and a motor to control fluids in multiple channels. Functional prototypes were machined, and at that time parts were designed for manufacturability (draft angles, gate locations and so on).

Another technology developed jointly between DRI and Biorep is a silicone membrane petri dish. A standard plastic dish allows oxygen in from the top. Scientists at the Diabetes Research Institute wanted to test a dish in which oxygen could reach from the top and the bottom.

"Silicone is permeable to oxygen, so we decided to try to create a silicone membrane petri dish," says Echeverri. "DRI scientists developed a proprietary silicone blend that enhances oxygen permeability — we call the design the "Oxygen Sandwich" because it envelops the cells in oxygen from above and below."

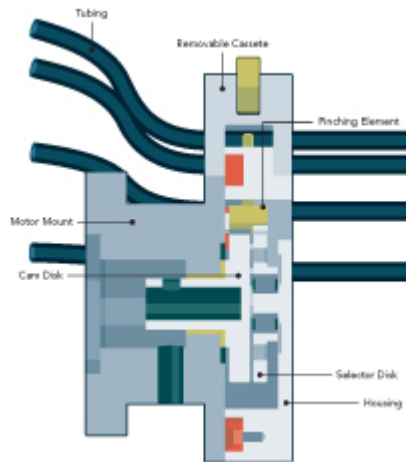
Echeverri's team (which includes eight design engineers and 11 seats of SolidWorks) prototyped parts on the Eden250. "The final design of the membrane is just 300 microns thick — strong enough to be handled in a lab without getting damaged and taut enough to prevent sagging. We did a lot of prototyping with different configurations to arrive at that conclusion," says Echeverri.

It took just six months to go from concept to field testing. "Six months is an incredibly short time to get a medical device into field testing," says Echeverri. "Our ability to produce rapid prototypes in-house cut the development time in half."



This illustration shows several parts for a pinch manifold made from stainless steel and aluminum that were first prototyped on an Eden250. Source: Biorep

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Eight polyacetal components pinch the tubing, shutting off the flow of fluids. Source: Biorep

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