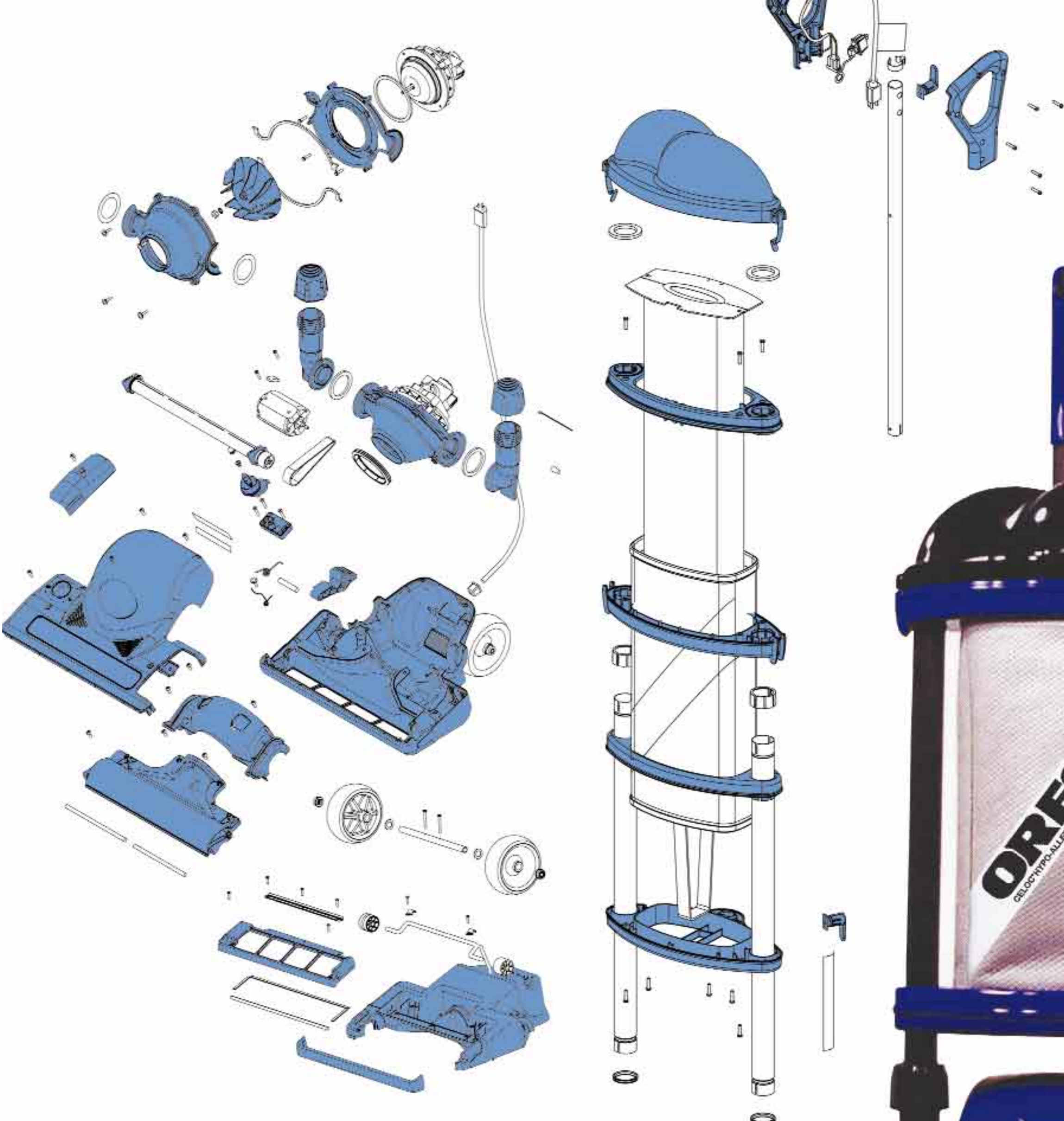
STRATASYS®

CASE STUDY

COMMERCIAL VACUUM RUNS ON RAPID PROTOTYPE PARTS



MANUFACTURER:
Oreck Corporation

APPLICATION:
Create prototype parts for testing

PRODUCTS:
Commercial and consumer vacuum products

CHALLENGE:
Reduce product development time

Reduce tooling costs

Build functional vacuum from prototype parts

SOLUTION:
Rapid prototyping with FDM Quantum® systems to make precision parts prior to tooling

RESULTS:
Tooling costs reduced by hundreds-of-thousands of dollars

Time-to-market reduced by 4 to 6 months

FDM Quantum paid for itself during first year

MANUFACTURER SAVES SEVERAL HUNDRED THOUSAND DOLLARS ON PROJECT'S TOOLING

THIS VACUUM WAS FUNCTIONAL AFTER BEING ASSEMBLED USING 31 RAPID PROTOTYPE PARTS.

New Orleans-based Oreck Corporation recently tried something different: It built a functioning commercial vacuum of prototype parts. Each of the 31 parts that would later be injection molded was built on rapid prototyping equipment using the Fused Deposition Modeling process (FDM®). While developing the new vacuum, the company trimmed about five months from the development process and netted several-hundred-thousand-dollars savings on production tooling.

Known worldwide for its commercial vacuums, Oreck Corporation made its name in the hotel industry with durable, lightweight products. The company's floor-care products are designed, manufactured and distributed from its manufacturing arm – Oreck Manufacturing Company (OMC) – in Long Beach, Mississippi.

> ***"Stability was important to us, too. A part is accurate right off the machine and doesn't change dimensions. If it's round when taken off the machine, it's still round a week later."***
>
> ***Ward Jensen,***
> ***Oreck Manufacturing Co.***

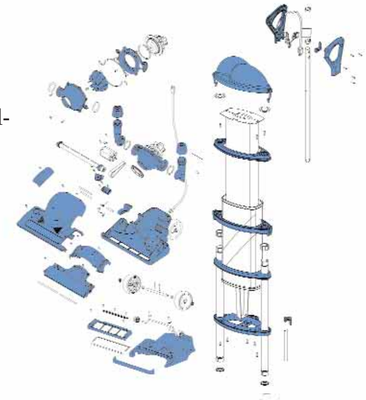
THE CHALLENGE

Streamline New Product Development

Building the functioning vacuum from prototype parts was the first project done after OMC brought rapid prototyping (RP) in-house. Adding RP was part of the manufacturer's plan to reduce product-development time, reduce tooling costs, refine product quality, and allow more projects on the drawing boards at once. In addition, OMC plans included offering rapid prototyping services to outside clients through a new business unit.

The Long Beach Manufacturing facility is a 355,000-square-foot plant with state-of-the-art modular assembly lines and ISO 9001-registration. Manufacturing teams work on incentive programs, which reward members for excellent performance. This manufacturing philosophy ensures efficient operations and high standards of quality are maintained. The facility's capabilities include industrial design, graphics design, electro-mechanical design, rapid prototype creation, model making, design and manufacture of injection molds, injection molding, assembly and distribution.

Waiting for Parts



This vacuum was functional after being assembled using 31 rapid prototype parts.

Since 1993, the product development team worked with service bureaus to get rapid prototype models. Because of the cost, these models were only built for a limited number of parts. During this time, it typically required 18 to 24 months to take a new product from concept to production. "It usually took a week to ten days to get the rapid prototype from the service bureau," says master model maker Bill Fish. "After evaluating it and making modifications [to the CAD file], we would send it back out and then have to wait another week to ten days to get the next iteration."

Using service bureaus the manufacturer got exposure to a variety of RP methods, according to Fish. "First we tried using SLA," he says. "Then SLS was introduced, and we liked the quality a little better. Then FDM arrived and gave us working ABS parts."

Each Brand of RP Offers Something Unique

OMC was satisfied with the quality and benefits of RP from its service bureaus, but due to the cost and the wait for parts, it decided to bring RP equipment in-house. Realizing that an in-house machine would have idle time, OMC decided that it would use this time to offer RP services to other manufacturers and become a service bureau itself. So before buying, it carefully considered which type of RP equipment would be best for both its own needs and the needs of future service customers as well. "The FDM system from Stratasys offered the capability of modeling in ABS. That was important to us," says Director Rich Conover. "And we liked the dimensional accuracy the FDM equipment offered and the fact that it can be used in an office environment."

This injection-molding tool for one component was used during the engineering pilot.

Shown are some of the 31 components prototyped on the Stratasys FDM Quantum.

"Stability was important to us too," says Engineering Services Manager Ward Jensen. "A part is accurate right off the machine and doesn't change dimensions. If it's round when taken off the machine, it's still round a week later."

"There is no hazardous or difficult-to-handle materials with FDM," says Jensen. If you work with the solvents associated with [another RP system maker], you can develop skin reactions. Environmental concerns are very important to us, and the FDM process is fairly clean. With FDM we don't have to worry about nitrogen purging or having a separate breakout room to contain powders. And you don't have the very real concerns of photopolymers and solvents."

"For our needs, it was pretty clear; ABS was the material preferred. But we had to look at the industry as a whole," Conover says. "Each type of RP equipment has something unique to offer. One method offers a high level of detail; another builds parts

Extended life testing revealed minimal need for change, due to the refinement achieved from rapid prototyping with FDM.

faster. No single method is best for all jobs. ABS plastic is probably the most prevalent material used for end products in our industry. We felt the FDM equipment would capture the majority of customer needs."

Conover also liked the fact that ABS parts are tough, he says. "The parts don't break if you drop them. The ABS plastic has some flexibility to it." But the clincher in the decision-making process was a project for which some major components were made on both FDM and another make of RP equipment. "The parts from the [other manufacturer] didn't fit together. The same components fit together when made with the FDM process."

"Occasionally we'll need a prototype that is better suited to creation on another type of RP equipment," says Jensen. "So we'll continue to use service bureaus to a small degree. But FDM solves most of our needs."

THE SOLUTION

In July 1998, OMC purchased a Stratasys FDM Quantum® rapid prototyping system so they could bring the process in-house. A new business unit – OEM Services (Oreck Engineering and Manufacturing Services) – was set up to offer development and manufacturing services to outside clients. And OMC continues to provide these services for Oreck products.

The manufacturer chose the Quantum because, among the FDM systems, it offered the largest build envelope and fastest build speed. The Quantum can build parts up to 600 x 500 x 600 mm (23.6 x 19.7 x 23.6 inch) in size. The functioning prototypes built on the Quantum can be tested, sanded, painted, and drilled. The Quantum can also be used to create tooling patterns and masters for silicone molds.

Working Model: The Dual Stack

During development of its next new product, the "Dual Stack" commercial vacuum, OMC discovered just how beneficial prototype testing could be. It set the goal of creating a working model completely from rapid prototype components, excluding the purchased components such as motor, belt, and bag.

The Dual Stack comprises 31 injection-molded ABS plastic components. Throughout the process of building and refining these parts, OMC progressed through an average of six to eight iterations for each component. "Without using the FDM RP, the several design iterations would have been very, very difficult and would have extended the development time considerably," says Conover. "We were able to catch 95 percent of the fit problems and revise the 3D models before going to tooling."

"For the first time since I've been in this industry, all the parts fit together during the pilot, which is not typical of injection mold tooling."

Rich Conover,
Oreck Manufacturing Co.

When the design engineers were satisfied that they had made the necessary improvements to each component, OMC designed and manufactured the injection mold tooling, and an engineering pilot was done. The engineering pilot used first samples taken from the production injection mold tooling.

"For the first time since I've been in this industry, all the parts fit together during the pilot, which is not typical of injection mold tooling," Conover says. "I can say that this is the best engineering pilot I've ever seen. Because of OMC's ability to do several iterations of each component, the parts not only fit together, but the unit functioned, even though it needed some minor changes.

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“After performing extended-life tests, we made some changes to the top cover and base plate baffles that directed more airflow across the motor to increase cooling efficiency,” Conover says. “The working unit was finished and painted and used as a show model.”

“Over the years, I’ve worked with various companies in this industry. Prior to the advent of RP, it was incredible, the amount of errors that couldn’t be caught until the final stages. Parts wouldn’t fit together; parts would leak. There was a lot of expense and a lot of headache in those days.”

Investment Proves Sound

The Dual Stack went into full production in the spring of 2000, and by any account, the money and time savings were impressive. “We reduced time to market by four to six months,” Conover says. “And we saved several hundred thousand dollars in engineering costs because we caught the problems up front before we started machining the production tooling. The FDM Quantum paid for itself in the first year.” Engineers functionally test the parts’ performance, and the product group uses them for life-span testing. The assembled FDM prototype parts are even used for preliminary UL testing.

Conover says that 10 to 12 iterations of parts are now common, whereas in the past they didn’t even speak in terms of iterations. “If it was a critical component, you may have taken two or three passes at it, but because of the cost, you couldn’t do more than that. Now we can make as many iterations as we want in order to improve performance and reduce changes at the tooling stage. Our engineering pilots are now as good or better than our pre-production pilots of the past.”

Most importantly, Oreck met its goal of getting products to market sooner. “We have much fewer engineering changes,” Conover says. “RP expedites the development process, which in turn expedites the entire manufacturing process, all the way through production.”

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