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Milwaukee has a strong heritage of manufacturing, which continues to be one of the most significant drivers of the local economy, despite the recession.

However, manufacturing today is not what it used to be. Techniques, machinery, systems, materials and the products made have changed drastically in the past decade. Technological advances are moving faster than ever today, and manufacturers need to continuously upgrade their existing products and create new products for the evolving marketplace.

Manufacturers increasingly are looking to universities to help them continue this global innovation process. Manufacturers also are relying upon universities to educate their engineers – the people who design the products and the processes to build them.

To meet these growing demands, several of the Milwaukee area's largest universities are developing engineering outreach programs, in which students will be able to work on projects submitted by companies looking for innovation, cutting-edge technology and new techniques.

The Rapid Prototyping Center (RPC) at the [Milwaukee School of Engineering](#) (MSOE) and its affiliated Rapid Prototyping Consortium will serve as a blueprint for programs established at other universities.


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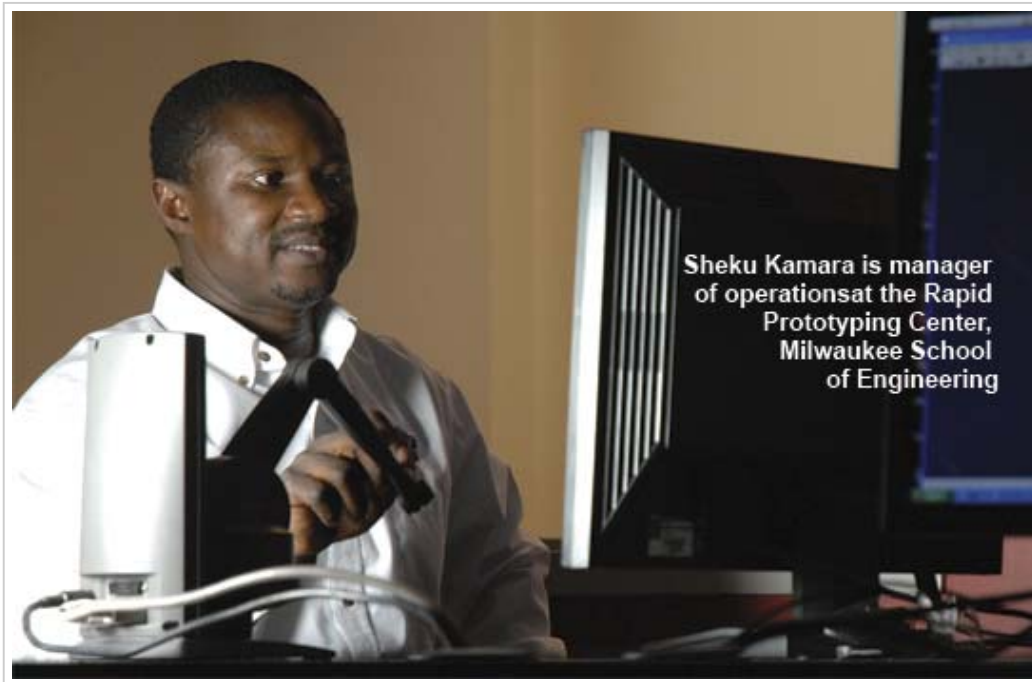
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Established in 1991, the center serves as an extension of the research and development departments of 66 manufacturing companies across North America. All of the companies that utilize the center are members of MSOE's Rapid Prototyping Consortium. Members are charged an annual fee, which gives them access to the center, its machines and resources.

The consortium's membership includes [Harley-Davidson Inc.](#), [Bombardier Recreational Products](#), [GE Healthcare Technologies](#), [Johnson & Johnson](#), [Rockwell Automation Inc.](#) and many more.

The RPC creates prototypes based on computer-aided drafting (CAD) designs. Using a series of high-tech machines inside its labs on MSOE's campus, the center can create an almost limitless range of designs. Only a handful of other public and private institutions in the world have the range of capabilities the RPC has.

"At one point in 2002, we were the only university in the world to own an SLA (stereo lithography apparatus) machine," said Sheku Kamara, manager of operations at the RPC. "In terms of variety (of machines), there is no university that has what we do. And there is no university that is even close that has the (industry) cooperation that we have."

Unique capabilities

The machines inside the RPC can create prototypes from CAD designs in a matter of hours, and the products are often delivered in two or three days.

The RPC has five stereo lithography apparatus (SLA) machines, which use lasers to create prototypes from a liquid gel. The laser burns the prototype in slices between 20 to 400 microns (a human hair is about 180 microns).

Other RPC capabilities include:

- Selective laser sintering (SLS), which makes prototypes using a laser to solidify plastic-like powders.

- Laminated object manufacturing (LMO), which sprays layers of material using a technique that operates similar to an ink jet printer.

- Fused deposition modeling (FDO), which spreads layers of resin using a technique similar to a hot glue gun.

- ZCorp, which uses a three-dimensional printer to create models.

All of the prototype-building machines are controlled by computers and are based on a client-supplied drawing created using CAD software.

Custom creations

Many of the parts made by the RPC are used for meetings with investors, presentations to boards of directors, display models for trade shows and other non-operating functions.

"Most of what we do is when a company is designing or modifying a product and they need a physical prototype," Kamara said. "They say a picture is worth a 1,000 words, and a prototype is worth a 1,000 pictures."

The center produces prototypes of new component designs for pumps and motors, valves, propellers and impellers, pipes and tubes, exhaust systems, fuel tanks and many other components of the manufacturing process.

The RPC's different techniques produce prototypes with varying strengths, flexibility and price points, enabling the center to produce more than just a visual aid for presentations or trade shows.

Many of the prototypes made by the RPC have saved consortium member companies such as Dresser/Waukesha Engine valuable time and money in the design of new products or systems because of the ability to test CAD designs created by engineers.

"This approach reduces risk and shortens the design-to-production process by producing an actual part for testing and analysis before the design is 'frozen' and expensive tooling is ordered," said Steve Towner, director of product integrity at Dresser/Waukesha Engine.

"They have made sample fixtures for us, and in one case it was a part that is very difficult to make with traditional techniques," said Dennis Maller, vice president of engineering with Trombetta Corp. in Menomonee Falls.

Johnson & Johnson, one of the RPC members, has asked the center to create models of individual patients' hips taken from a CT scan. The hip is used by surgeons to create custom hip socket replacements before they undergo surgery, Kamara said.

Working model

The corporate-university partnership has helped evolve the center into an entity that blends aspects of a for-profit business with the academic approach of a university, Kamara said.

"The difference is that we still have our university hats on – we're solving problems," he said. "We don't look at our relationship (with consortium members) as a one-time thing. We try to see what is the best solution for our companies."

The center helps the companies continue the process of innovation, Kamara said.

"A lot of companies might think that it's a school and will take a long time," Kamara said. "We tell them we can't afford to fail. Our goal has to be that if we tell [Harley-Davidson](#) they will get a part tomorrow, they'll get their part tomorrow."

That responsiveness has inspired confidence among the member companies.

"We treat the Rapid Prototyping Center as a valuable extension of our engineering department," said Chris Lange, engineering manager for residential products with Pentair Water Flow Technologies in Delevan.

Trombetta points to its membership in the RPC as a strength when making sales pitches to customers.

"We use this as an extension of our R&D capabilities," Maller said.

The consortium is made up of non-competing companies, and existing members have the ability to block competitors from joining.

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"These guys are not competitors, and they give each other what an outsider never experiences," Kamara said.

"We use (the consortium) for rapid prototyping, but we also use it for solving problems that we don't have answers for," said Steve Johnson, senior project engineer at [Broan NuTone LLC](#) in Hartford. "Within the consortium, we can post questions to ask each other. And in the meetings, we're able to share technology and have the ability for networking."

The meetings also are a source for continuing education for working engineers, said Randy Kulow, manager for rapid prototyping and test equipment in the plumbing design and fabrication area at [Kohler Co.](#)

"We can also use them for vendor contacts, peer contacts, discussing best practices and information exchange," Kulow said.

Student experts

The RPC has only two full-time employees – Kamara and Vince Anewenter, its rapid prototyping operations technician. A large share of the work is performed by MSOE students. The center now employs 12 undergraduate and two graduate students.

The students are paid for their work at the RPC and must agree to a two-year employment commitment and a non-disclosure agreement.

When a member company needs prototypes, it submits CAD drawings via the RPC's secure website. The students inspect the drawings and call the R&D departments of member companies, Kamara said.

Engineers from consortium companies say their interactions with the center are very business-like, even though they are almost always dealing with students when they call.

"We know that they are students, but they are extremely knowledgeable about the processes and products. They're very application sensitive. They help guide us to the right machine or product depending on the application. It's a very interactive process," Lange said.

Growing demand

Because of continued demand for its products and new machines, the RPC was moved last September to a 4,500-square-foot facility in one of MSOE's buildings on Broadway in downtown Milwaukee.

Shortly after making the move, the RPC acquired a new SLA machine – bringing it to a total of five. It also recently acquired a nitrogen condenser, which allows it to produce its own source of liquid nitrogen.

Next month, the center will receive a second SLS machine, which will produce parts at a faster rate than its current machine, Kamara said.

"We want to be at the leading edge, the bleeding edge, but one that produces results," Kamara said. "We need to balance when we look at a new technology. Can we afford to get into it? We can't afford to fail. We don't want to have something new come out but miss out on it. But we also have to ask, 'Is there demand for it?'"


About Eric Decker


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