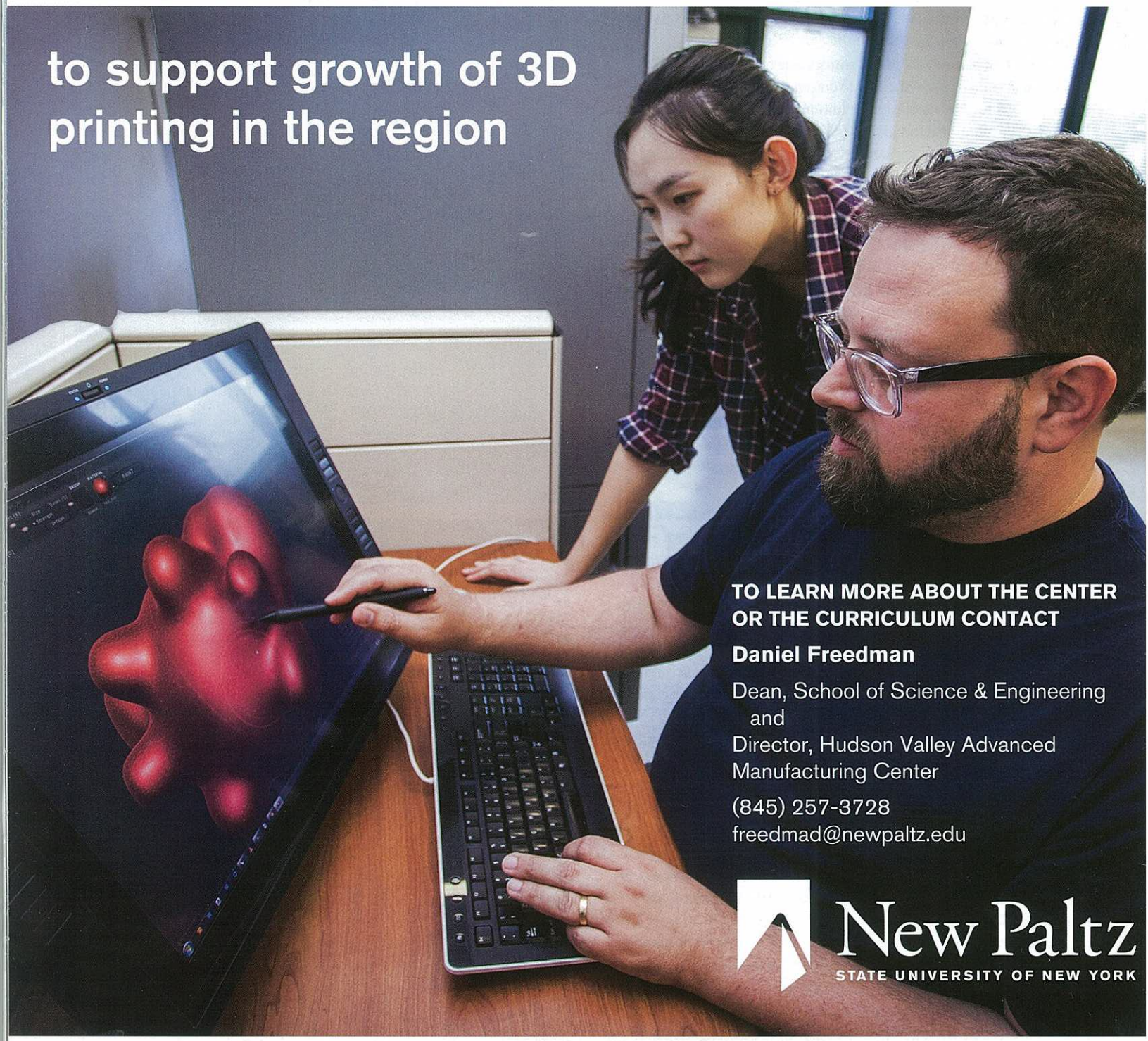
HUDSON VALLEY
ADVANCED MANUFACTURING CENTER
AT SUNY NEW PALTZ

HV3D
HUDSON VALLEY 3D PRINTING



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By Theresa Keegan

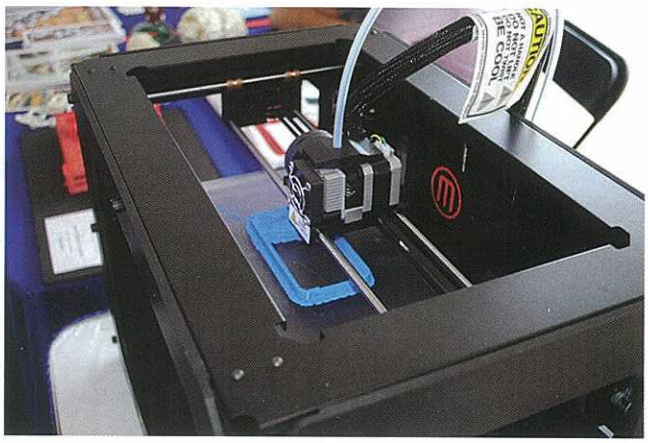
The Rise of the 3D printer

This isn't just one more piece of new technology, but a development likely to bring fundamental change to the manufacturing process. The Hudson Valley 3D Printing Initiative is aiming to help the area unleash 3D's full potential.

In colleges throughout the world, students are studying for jobs that do not yet exist. At SUNY New Paltz, a handful of undergraduates are studying for jobs evolving faster than even futurists can imagine. Welcome to the world of 3D printing, a field proving as limitless as the imagination, one that is already rocking the way manufacturing is approached.

"3D printing isn't just one more piece of technology," explains Daniel Freedman, Dean of the School of Science and Engineering and a coordinator of the Hudson Valley 3D Printing Initiative. "It seems like something that's fundamentally going to change how many things function."

The HV3D initiative is officially launching with class offerings this semester and hopes to ultimately expand and offer printing services to entrepreneurs as well as established businesses. The $1 million education effort, funded by a private $250,000 contribution and a $750,000 pledge from Central Hudson, is expected to run for three years. However, companies in the region are already embracing the technology, using it in everything from jewelry design to precision manufacturing.



And within the flexibility of 3D printing lies its real potential, as it creates items in paper, plastic and a variety of metals including gold and titanium. It takes a computer-aided-design (CAD) file and prints it using an additive method, building layer upon layer, rather than manufacturing's traditional reductive process.

"This is a new horizon we're rushing toward," says Robb Engle, vice-president of engineering at Sono-Tek Corp. The Milton-based company, which creates high-quality spray nozzles for coating applications, is continually testing new spray-shaping options. As with any cutting-edge company, prototype testing, though necessary, has proven a time-consuming and often expensive endeavor.

"To set up a machine to test a single part is a lesson in frustration," says Engle. But when the company started contracting with area 3D printers to create prototypes, the process time

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Prototype development by means of 3D printing has been heartily embraced by Hudson Valley manufacturers, as evidenced in the samples above. But when it comes to direct production, most are "giving the technology a little more time to mature."

"People will have the ability to design and test out new products in a more cost-efficient way… New Paltz's design program is a real strength and we have the comprehensive SUNY engineering program, so it's technology married with design work."

Daniel Freedman, Dean of the School of Science and Engineering

was reduced from an average of seven weeks to three days. "It was like a hand in glove fit," he says.

The company has a relationship with three nearby printers, keeping pricing and quality competitive. But a year ago, Sono-Tek finally decided to buy a printer of its own, opting for a lower-end model (prices range from $2,000 to $200,000) so that skills could be fine-tuned without incurring the expense of a more exacting machine.

"It's not something you're going to be successful at the first time around," says Engle.

This summer the company hired SUNY student Alex Cannella as an intern (see sidebar). The junior had made her own mark at the campus earlier in the year having taken a math algorithm and, programming it through a 3D printer, created a beautiful vessel.

"It's the first time it's ever been done," boasts Engle, who also sits on the advisory board of SUNY's engineering department. "Math is way too complex to sculpt it, but it's stunning to see the fine parts and the heavy parts and the parts that are just too fragile to have ever been machined. It's complex, with large masses and fine curving structures."

The precision of 3D printing is appreciated, but the rapid turn-around is really why this technology is changing manufacturing.

"We're faster to the table and spend less money in engineering and prototypes," says Engle. When a new nozzle request came in recently, the machine shop said it couldn't be manufactured. Instead, they created a computer design and ran it through the 3D printer.

"I went back to the machine shop and said 'Don't worry, we've got it.'"

But Engle knows the need for precision machining won't fully disappear. "Our machine shop will be around as long as the company," he says.

Neal Johnsen of Standfordville Machine & Mfg. is familiar with rapid prototype machines. His Dutchess County company actually manufactured parts for the initial printing machines when they were in developmental stages. But he doesn't use 3D printing. The 50, 500 and 5,000 production runs his company executes are done on CNC machines.

"We're not a prototype shop," Johnsen says. "As the technology develops and improves, we may find a need for it here, but not yet."

At Zierick Manufacturing Corporation in Mount Kisco, president Gretchen Zierick went to great lengths to research and analyze the purchase of a 3D printer for the company. The most desirable printer was a $60,000 machine, but that expense could not be justified. Instead, a $2,200 model was purchased and paid for itself within one week by reducing work requests on the tool room.

While it's not precise enough to be used in direct manufacturing, the company creates numerous prototypes to gauge the accuracy of both intricate and large pieces. It's also used to create custom fixtures to hold parts rather than resort to the time consuming and messy process of drilling through plexiglass.

"It's really working out well," says Zierick. She's thrilled with the ways the printer has aided the company, which makes electronic connectors for wires on circuit boards.

"They were making things the first day it was here and they're doing a lot more with it than they thought they would," she says. But, for the company's more exacting production needs, they continue to contract with vendors offering high-quality 3D printing.

Alex Cannella's 3D piece derives from the Legendre polynomials she studied in a math class and was developed as a project for her "Crafting in Virtual Space" class. Cannella plotted aspects of the polynomials, imported the graphs into Rhinoceros 3D software and revolved them to create vessels. The one she chose to produce took 30 hours to print on a 3D printer..

"We're giving the technology a little more time to mature," Zierick says.

The potential arenas for 3D printing extend well-beyond manufacturing, ranging from from cell regeneration, prosthetics and bone replacement to custom-made shoes and creating intricate designs on top of cookies.

Call it a disruptive innovation or disruptive technology, the outcome is the same: An existing market and value network will likely be displaced, and unpredicted uses will emerge thanks to the versatility of 3D printing.

"3D printing is democratizing the manufacturing process," says Sean Eldridge, president of Hudson River Ventures, which put up the private $250,000 toward HV3D. His faith in the effort is so deep he has also pledged another $500,000 of his own money to help local endeavors involving the technology.

"I think it's a great fit for the Hudson Valley, where we have a really great tradition of advanced manufacturing," says Eldridge. "We have a skilled and well-educated work force with a long history of culture in the arts and design."

The abundance of small and medium-sized manufacturers in the region is one of the reasons HV3D should succeed, Freedman believes. "People will have the ability to design and test out new products in a more cost-efficient way," he explains. The opportunity to have access, not just to the technology, but also to the school's engineering and design expertise, should aid in success. It's one of the first local efforts to recognize the ongoing integration of art and engineering, a melding that people embrace everyday when they use a smart phone.

"New Paltz's design program is a real strength," says Freedman, "and we have the comprehensive SUNY engineering program, so it's technology married with design work."

Profile: Alex Cannella

While some people consider art and engineering two drastically different career paths, Alex Cannella now sees them as complementary blends leading toward a rewarding career.

"I went back and forth between the fields," says the SUNY New Paltz junior. "But now I know I can do both." She expects, upon graduation with a degree in electrical engineering and a minor in design and fabrication, to create prosthetic devices.

A few recent experiences have guided her decision to pursue both art and engineering.

For starters, she learned her art professor had also majored in engineering and then earned a master's degree in art. Then SUNY New Paltz offered its new program that merges the two fields and finally, this summer, she experienced real-world implications as an intern at Sono-Tek, where almost all the employees are engineers.

"I got a different perspective," the 20-year-old said of her summer internship. And seeing the critical role manufacturing played in the overall process was incredibly insightful.

"I think when most people think of manufacturing they think of people who didn't go into a profession," she explains. "But the people who manufacture are critical. It's not just random." And she saw first-hand how manufacturers' contributions are essential to a product's success. "I just didn't really know the industry side. I think people shine a bad light on it (manufacturing) but they don't know about it."

She is now confident of one thing: "Anybody who does design should go through the manufacturing process."

And so when Cannella does begin her career, she'll be taking a different route than many expect.

"I'll start in manufacturing and learn the steps," she says, "and then I'll go into design." Where that will take place has yet to be determined. She would love to stay in the Hudson Valley to be close to her family in Rockland County, but fears there may be limited opportunities.

"I really want to be here, but I'm not sure I'll be able to find this kind of job here, so if something comes up elsewhere, I'll probably have to go for it."