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The Revolution In A Box

Manufacturing meets the Internet in a new technology that could make factories obsolete

BY FRANK GIBNEY JR./LITTLE FALLS

Next time you have to wait six weeks for the kitchen door or lawn furniture you ordered, think of Gene Kirila. He would have you order your custom whatever at a store register, then direct you to drive around back, where--Presto! Out it would pop from a portable minifactory.

Kirila has devised a system that will make almost any product, anywhere, anytime. Well, at least anything that can be molded--which is just about everything we touch these days. Kirila's Virtual Engineered Composites (VEC) process is a factory in a box. The box can be as small as a mop basin or as big (so far) as a 40-ft. freight container. Plopped down in the middle of Azerbaijan or Arizona or Angola, it could start pushing out toilet seats one day and pipeline sections the next. VEC's big secret: a digitally controlled chemical molding system that can be operated on site or, via the Internet, from thousands of miles away. Says the peripatetic entrepreneur: "It's like a 3-D fax machine."

The VEC process is to manufacturing what dos was to the personal-computer business in its early days. If it proves itself, it will lead the way toward an entirely new system of manufacture in which we can make things digitally. "If operating systems could run computers, they should be able to run a factory," Kirila says. "My big question was this: How do you leverage everything that is happening in the information age and use it to build tangible products?" Another big question: How does the box work?

Say you want to introduce the Jacuzzi to newly affluent Chinese peasants. Instead of shipping the tubs from California, you simply ship the VEC unit, or cell. To make the tubs, two composite skins are draped over a foam model, and a thermochemical reaction causes them to harden into shape. (Because no metal bending is involved and the "thermoset" process uses chemistry, not immense heat, the molds cost a fraction of the conventional version.) The skins are then attached to a universal frame. The cell is closed and filled with pressurized water, which braces the skins together. Then composite materials are injected into the mold and catalyzed, causing the materials to harden. Unlike injection molding, a common manufacturing process, VEC's "floating mold" uses an operating system that constantly adjusts the water pressure and chemical balance. It sounds simple. But when you consider that there are up to 800 variables in the process--and thus 800 things that can go wrong--the complexity is astounding.

Since the entire unit is virtually self-contained, it can be assembled and running anywhere in a matter of days. If the market in baths dries up, you can switch the mold skins to make another product within an hour. Labor? O.K., you have to add hardware or electrical wiring to the finished product. But the VEC cell requires three people and very little technical expertise--as long as there is a link to the mother node.

The man who started this revolution is a beefy football jock who dropped out of college because he didn't think he was learning enough. Kirila grew up working the family farm in the shadow of

the struggling steel mills of Pennsylvania's Shenango Valley, 60 miles north of Pittsburgh. He was as fascinated by manufacturing as some teenagers are by cars. In high school he was devising weight machines for his football teammates. An injury sidelined him in 1984, and he dropped out of Youngstown State University to get into the fitness-machine business. With a $500 deposit from a customer, he and a friend started Pyramid Fitness Machines in a barn. By 1993 it was a $44 million company.

Kirila, 35, is the kind of guy who sleeps only because he's dog tired, and then he's likely to bolt out of bed and down to the office with a new idea about moving molecules. On business trips to Tokyo (Japanese firms were his biggest customers), he would get his distributor to arrange access for him to factories. He spent two nights prowling the catwalks above a Nissan Maxima assembly line, studying every human and robotic move below. Obsessed? He dragged his wife on a factory tour of China and Japan during their honeymoon.

In 1993, Kirila sold his company to fitness giant Cybex and started Pyramid Operating Systems. That's when he and his engineering chief, Bob McCollum, devised a software program to control each step in the manufacturing process. A company offered them a lucrative contract to build storm drains, but Pyramid didn't have the $2 million needed to fashion or tool the proper steel mold to shape the pipe. That's when McCollum came up with a startlingly simple--and cheap--idea. Instead of a metal mold, why not fashion two pieces of composite in the shape of the product, inject the resin into the cell and brace the flimsy mold with pressurized water?
It took months of hair-pulling setbacks, but they figured out how to digitally control the chemicals, water pressure and the mold itself, and began fabricating larger and larger products, from pipe to custom boat hulls. The average cost to tool a mold: a mere $25,000, nearly a 99% cost reduction. "Once we had the floating mold," says McCollum, recalling their excitement, "we wanted a whole factory in a box."

Pittsburgh venture capitalists wanted nothing to do with it. Despite Kirila's charisma and his successful start-up, they saw in him a college dropout from a depressed steel valley. He faced an age-old paradox: his idea was too big to get funded, but he couldn't prove its worth unless he had the millions to start building stuff.

Enter Irwin Jacobs, the Minneapolis-based financier whose takeover antics in the 1980s struck fear into the hearts of companies like ITT and Disney. Jacobs, a reformed predator, now runs Genmar Holdings, a remnant of his buccaneering days and a company whose principal business is building pleasure boats. Boatbuilding is messy, environmentally hazardous and so unpleasant a job that Genmar has a hard time getting workers to do it. Pyramid built a few test hulls for Genmar, but Kirila's system wasn't refined enough for Jacobs' engineers. "They were 90% there, and we needed 100%," says Jacobs. "So it represented a multimillion-dollar leap of faith."
Jacobs saw the potential--he hadn't forgotten everything he learned in the '80s--and offered an all-or-nothing deal to buy out Pyramid. It sounded like a deal with the devil. But Kirila knew he needed someone with deep pockets and a commitment to make VEC bigger.

By all accounts, the gamble has already proved worthwhile. For 25 years, the Genmar factory at Little Falls, Minn., has used the same caustic, grubby process to churn out Wellcraft and Glastron fiber-glass runabouts. Men and women in blue coveralls layer or spray fiber glass over

each hull. Half-finished boats are scattered around the warehouse, overshadowed by stacks of used molds. The stench of styrene is overpowering. The manual layering process is so imprecise that each hull is different; imperfections have to be corrected by hand.

Next door, at a VEC test site that has produced 1,000 hulls in the past year, the air is clean. It's quiet. Three technicians in smart yellow shirts and blue jeans supervise two VEC cells. One man watches a monitor that shows injection flow, temperature and pressure levels. If something goes wrong, an alarm rings in Little Falls and at the VEC solutions center, 1,400 miles south. Kirila's experts regularly tap into the Little Falls plant via the Internet to adjust production settings and troubleshoot problems.

Every 35 min., each cell produces a new hull; next door it takes eight hours and at least twice as many people to finish one. Each completely recyclable plastic mold produces a dozen boats; next door it takes a mold per boat, and each year thousands of used molds have to be buried in landfills. Each VEC hull is so strong that Genmar has announced a lifetime warranty instead of the normal five years.

Next month Genmar will unveil the world's first automated boat plant at Little Falls, a sprawling 100,000-sq.-ft. facility that will turn out 10,000 boats a year. Jacobs has invested more than $30 million so far, but no matter. Says he: "This is game-changing technology, period." He and Kirila have been inundated with inquiries from competitors wanting a piece of the VEC action. Other calls have come from the likes of Ford, Volvo, Owens-Corning and Gulfstream. Household-products and construction-materials companies want in too. Elsewhere, advanced manufacturers like Rockwell are experimenting with remote engineering. Honeywell already offers remote monitoring for certain automated plants. Says Kirila: "VEC is just the first of many new operating systems to come."

The VEC process could reorder manufacturing because it allows low-volume manufacturers to cut retooling costs for new products. If the boatbuilding example is any indication, it could mean labor reductions of up to 50%. Most of all, it shows that intellectual capital can be transmitted anywhere to make anything.

"We've always had giant brick-and-mortar factories close to the source of raw materials or communication," says Richard Morley, one of America's leading manufacturing experts. "This kind of technology means we can manufacture at the point of consumption."

Although technically he works for Genmar, Kirila figures that at some point his company, now called VEC Technology Inc., will go public. For the present he has a mandate to spread the gospel of digital manufacturing and fund start-up companies that aim, as he puts it, "to raise the clock speed of manufacturing culture." Jacobs is planning to do what Kirila originally intended: to lease the patented VEC system in the same way that Pitney Bowes used to lease stamp machines. "We're proving we can do it better, kinder, cleaner," says Jacobs, who has lost none of his salesmanship. "The world is going to come to us." And learn how to make things the new-economy way.

Molding the Future

VEC technology means that thousands of molded products can be manufactured faster, cleaner, cheaper and by remote control over the Internet

MAKE IT THE HARD WAY...

For decades, fiber-glass boats have been manufactured by hand, using costly, time-consuming and environmentally unfriendly methods like "spraying chop," above. Output is slow and keeping workers difficult

...OR MAKE IT THE NEW WAY

Now, instead of being sprayed on manually, fiber-glass resin is injected into a flexible mold, sealed in a cell, catalyzed and in 35 min. transformed into...a 17-ft. Glastron hull. The entire process is digital