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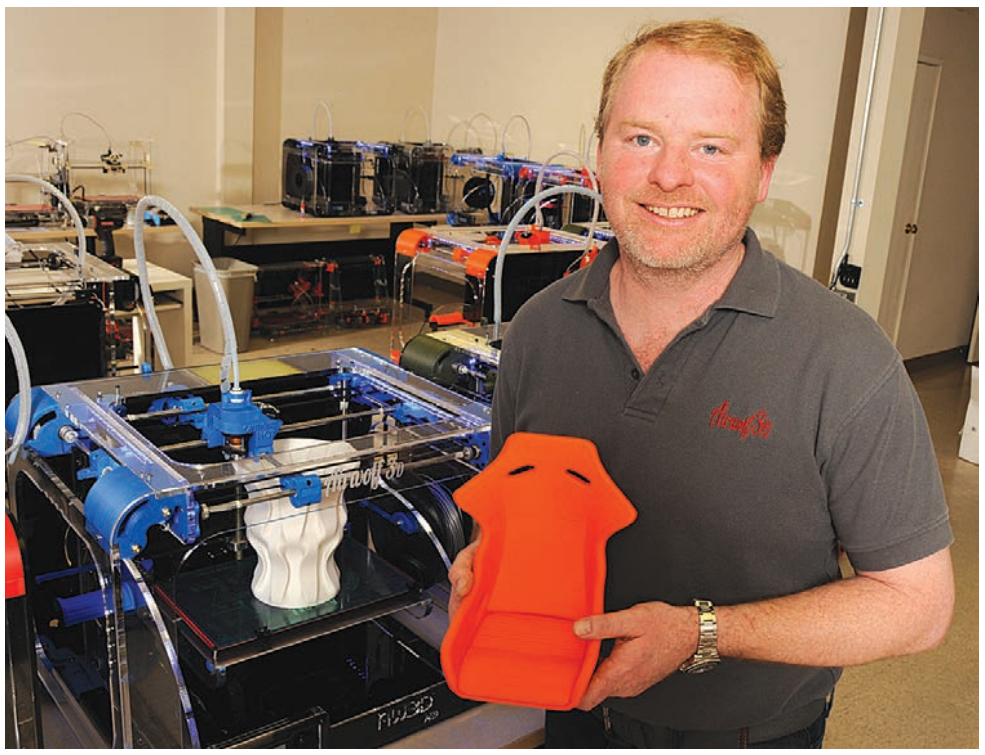
The New Fine Print

Costa Mesa Couple's 3-D Machines Push Envelope on Materials, Sell Fast

By CHRIS CASACCHIA



Erick Wolf: miniature sports car seat in hand, vase in process at company's airport-area shop

A startup launched by a husband and wife in Costa Mesa who had no manufacturing experience is landing big-name customers for its evolving line of 3-D printers that can churn out everything from tools and toys to car components and machine parts.

Airwolf 3D's growing list of customers include Irvine-based heart valve maker **Edwards Lifesciences Corp.**, equipment maker **Caterpillar Inc.**, and aerospace manufacturers **United Technologies Corp.** and **Honeywell International Inc.**

Its latest model, dubbed AW3D HD, which costs about $3,000, is flying off the shelves at the company's 5,000-square-foot headquarters. Recent sales of more than 100 units a month make Airwolf one of the fastest-growing players in the nascent 3-D printing industry, which is estimated at about $1 billion in annual sales now and expected to explode this decade.

"We're about four weeks behind trying to catch up," said cofounder **Erick Wolf**, a one-time patent lawyer who ditched his briefcase and ledger for lab glasses and soldering tools.

His wife **Eva**, who ran a consultancy and sold municipal bonds, also left the corporate world for the unknowns of a tech startup.

The career change is starting to pay off as demand surges, according to Erick Wolf, prompting the company to add space incrementally at its 5,000-square-foot headquarters even as it searches for a new home three times the size.

That's nothing new for the 2-year-old company, which has doubled its space every six months and gone from a two-man team to 19 workers.

"We're trying to move, but it's tricky finding a spot because the market is hot for real estate," said Erick Wolf, who studied engineering at Rensselaer Polytechnic Institute in New York. "We'll probably keep this and lease a factory."

The company's new printer, which debuted at the Paris 3D Printshow in November, took about three months to develop, as Wolf aimed to improve size, speed, accuracy and durability from earlier models. The high-definition capability of the machine brings greater precision and definition to products.

The device, which is 12 inches by 8 inches by 12 inches, expanded the printing area by about 40%.

It also can use 12 different materials, including laywood, a mixture of recycled wood fibers and polymer binders; thermoplastic rubber; laybrick that produce smooth or sandstone-like textures; nylon; and T-glase fibers that are approved for food contact in objects such as containers.

"Each application is unique," Eva Wolf said.

Most 3-D printers in the consumer market use only two materials: Acrylonitrile butadiene styrene, commonly referred to as ABS and used to create Lego-like objects, and polylactic acid, or PLA, which is derived from renewable sources such as corn starch or sugar cane that are used to make flexible rubber objects, including balls and other toys.

"This HD printer is able to bridge the gap between the professional and the consumer," Erick Wolf said. "We have a $3,000 printer that's competing with $10,000 printers."

Airwolf printers use what's known as fused deposition modeling. The building material is fed from a spool into the printer's hot end, where it's heated and deposited layer upon layer to produce a three-dimensional object. The technology is commonly used for modeling and prototypes.

The Airwolf operating system was developed by Lake Forest-based software maker **MatterHackers Inc.**, which also was the company's first customer. Matterhackers receives a fee per sale.

The printers can work with SketchUp, SolidWorks, Autodesk and other popular 3-D modeling software programs. Airwolf printers also are compatible with most open-source 3-D printing software. And the company is working with San Jose-based **Adobe Systems Inc.** to develop specific printer drivers for seamless integration, Erick Wolf said.

Airwolf printers are capable of making a variety of products, including screwdrivers, bolts, fasteners, plugs, food containers and sculptures.

Many Uses

Cerritos College was one of the first buyers of Airwolf's HD printer and is using the machine for its SolidWorks software design class.

Texas entrepreneur **Bryan Hickman** is using an Airwolf 3-D printer to produce mounts for his patent-pending translucent truck bed lights he hopes to sell to fire and police departments and commercial truckers.

The printer has saved him thousands of dollars in manufacturing costs as he attempts to bring the mounts to market, he said.

"I had to go with the 3-D printer," said Hickman, who purchased a machine in December and is interviewing for a spot on ABC's "Shark Tank." "Injection molding was about $300,000."

Encinitas-based **Orbis Robotics Inc.** is using Airwolf's 3-D printer to produce the base and midsection for its Teleporter, a factory floor robot that can conference in engineers, managers, suppliers and subcontractors through a digital head display.

The developing consumer 3-D printing market is led by Brooklyn, N.Y.-based **MakerBot Industries**, which was acquired last year for $403 million by **Stratasys Ltd.**, a publicly traded company in Minneapolis that specializes in industrial 3-D printers. MakerBot sells about 1,000 3-D printers a month for an average cost of roughly $2,900.

Rock Hill, S.C.-based **3D Systems Corp.**'s CubeX printer, which costs about $2,500, is a distant second with about 500 units sold monthly, according to Erick Wolf.

Solidoodle, also based in Brooklyn, sells about the same number, with its most current model costing about $1,000.

Chanhassen, Minn.-based **Afinia**, a unit of **Microboards Technology LLC**, sells about 200 units per month. Its latest model is about $1,600.

Airwolf rounds out the top five with its $3,000 model, which was the fourth-ranked 3-D printer on the market last year, according to trade website and product reviewer TechMedia. Its AW3D XL version was ranked No. 6.

OC Cluster?

Airwolf isn't the only OC company trying to capitalize on the growing market.

The segment is attracting a slew of new players every month, like Irvine-based **TJIKO Labs**. Founder **Luc Nikiema** began working on his 3-D printer-making kit about two years ago. His debut product, the Snap 3D printer, failed to reach its $25,000 Kickstarter fundraising goal earlier this year.

"The timing was not good," said Nikiema, who didn't launch a media and marketing campaign before the crowdfunding listing kicked off.

"We wanted to go to Kickstarter because we wanted to make the printer affordable for a lot of people," he said, but high manufacturing costs in California pushed the price to about $650. "We need to make it cheaper."

Irvine-based **Biolase Inc.**, which makes dental lasers, entered the fray last month after signing a deal to distribute 3-D printers for Stratasys. The products Biolase will distribute to dental offices are for prototyping and production, including fabricating orthodontic appliances on desktops.

The race for market supremacy bears watching as 3-D printer sales are forecast to grow nearly 16% annually to $3 billion in 2019, according to Los Angeles-based market researcher **IBISWorld Inc.**

Airwolf has climbed the leader board because its machines are undergoing constant design upgrades, whether that's reconfiguring printer materials, increasing strength, or modifying calibers to a customer's preference. It's a stark contrast to other players in the field that sometimes have to wait weeks for tooling parts and even longer for product runs.

Airwolf is creating three to four machines a day, sometimes improving the design on the production line. About 40% of the parts in the printer are made by the company's own products.

"Just today I made about 20 changes to the HD," Erick Wolf said during a recent visit. "We can change the machine very quickly, and we can adapt. Everyday we're evolving. That's how we leapfrogged over the consumer-level printing industry."

The duo never intended to make 3-D printers. The venture was born out of Erick's lifelong goal to build his own car from the tires up. California's storied car culture was one of the reasons he moved here in 1998 from Pennsylvania.

He needed to make car parts to chase his goal, so Eva bought him a $2,000 3-D printer for Christmas in 2011.

The product was junk, the couple agreed.

Erick salvaged the best parts and started sourcing components from around the world for his prototype.

Within a few weeks, he had a working model but "very different from the one we sell now," Eva said.

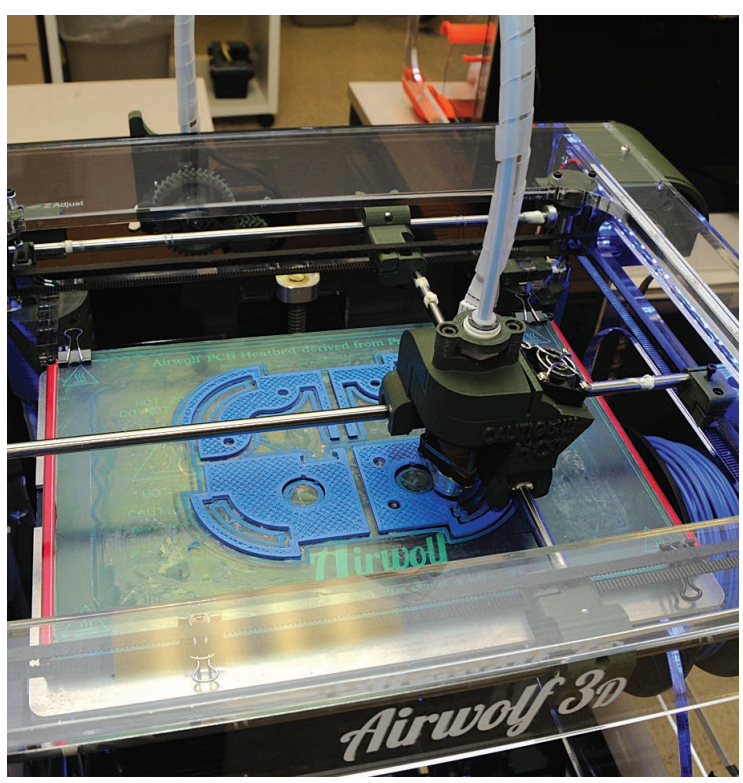
The duo put one up for sale on Craigslist to gauge interest.

Eureka—a startup was born.

Fast forward a few years, and Airwolf is one of the more promising companies in the emerging industry.

"We're selling a ton, and we can't keep up with demand," Erick Wolf said. "I think we're on to something."

Samples: Airwolf's latest machine can use up to 12 materials, make screwdrivers, bolts, fasteners, plugs, food containers, other items



AW3D HD: printer can replicate about 40% of its own parts