

# The Magic Materializer

With its additive approach, 3D printing is transforming the world of manufacturing

> The House That Chuck Built is rising in Amsterdam ... very, very, very slowly. It is a 13-room canal-side dwelling that is being constructed entirely from thick plastic bricks forged on a 3D printer—a 21st-century magical materializer.

In the last few years, 3D printers have begun to revolutionize the way we manufacture objects, ranging from exoskeletons that enable paraplegics to walk to spare parts for the International Space Station.

It may not yet be “Beam me up, Scotty!” but stereolithography—as 3D printing was formally named by American engineer Charles W. “Chuck” Hull when he invented it, singlehandedly, late one night in 1983—fulfills the fantastical promise of replication-at-a-distance. It is a way to produce perfectly identical artifacts simultaneously, with error-free precision, anywhere on Earth, without the need for factories, cargo ships or trembling human hands.

In its most elementary form, a 3D printer is a home-copier-sized box that is fed what looks like thick plastic fishing line from a spool. Guiding the printer is a software program called a CAD, or computer-aided design file, which is encoded with the contours of the desired output. A printer head inside the machine melts and extrudes the plastic as a microscopically thin film that hardens immediately. Then the next layer is applied, and so on. Unlike traditional machining techniques that are “subtractive” (removing material by cutting and drilling), 3D printing is additive, allowing virtually any shape to be formed.

In the case of the 3D Printed Canal House in Holland, which is being built by DUS Architects to demonstrate the



A rendering of the Canal House. Inset: the house's building blocks, forged by a 3D printer.

architectural potential of 3D printing, the process will continue for the next three years. The printer in use there is 20 feet tall and each “brick” it births weighs 400 pounds. But a basic 3D printer for desktop use now costs as little as \$1,000 to \$2,000 from manufacturers that include FlashForge, MakerBot and Cubify.

Plastic is only the beginning: Hundreds of compounds, chemicals and even foodstuffs already are being used as raw material in “additive manufacturing,” as 3D printing sometimes is called, including ceramics, titanium and silicone. Several major corporations, including GE, Ford and Boeing, already have incorporated 3D printing into their design, prototyping and manufacturing streams.

Meanwhile, Chuck Hull, the combined Benjamin Franklin, Johannes Gutenberg and Steve Jobs of stereolithography, turned 75 last spring with no letup in his inventiveness after earning more than 60 U.S. patents. Hull

is the founder and chief technology officer of 3D Systems Corp. of Rock Hill, South Carolina.

“I’m old enough that I should have retired long ago,” Hull told CNN in 2013, “but it’s so interesting that I don’t.”

Three decades ago, Hull was working for a company that used powerful ultraviolet lamps to instantly harden plastic coatings on tabletops. He noticed that, if he added layer upon layer of plastic, a three-dimensional object gradually would arise.

It was a “Eureka!” moment—and one that Hull felt moved to share with his wife, who was home sleeping soundly. “I called her up, got her out of her pajamas, told her to come down to the lab and see this,” the inventor recalled, 30 years later.

“What was her reaction?” Hull was asked.

“She said, ‘This had better be good.’”