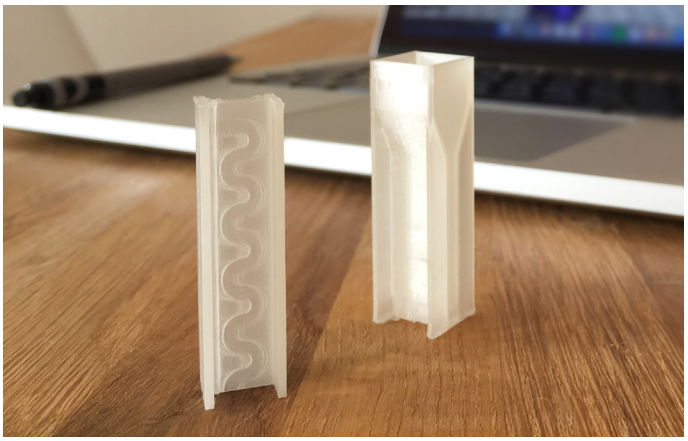
Ultimaker

Precise, affordable microfluidics research devices



"Before, we were making parts from machined metal or whittled from wood. Each one would take a couple of days and it was hugely more expensive. Now, our Ultimaker 2+ is even outperforming more expensive specialist microfluidics production machines."

— Matthew Partridge, Research Fellow, Cranfield University

Researchers at Cranfield University are using Ultimaker 3D printers to develop some of the cheapest customizable microfluidics ever made that are delivering results which will impact fields such as medicine and space research.

Organization
Cranfield University Centre for Engineering Photonics

Industry
Research, Engineering, Medicine

Challenge
The Cranfield team needed a way to design and create microfluidics devices at low cost for experiments to develop optical sensors.

Solution
An Ultimaker 3D printer can print at the minute levels of detail needed for such research. The team use 3D design software to create a device then 3D print iterations until they have one that works perfectly.

Results
3D printing the microfluidics devices has reduced costs as there is no longer any need for more expensive materials and machining. Faster, easier iterations also enable researchers to achieve a better final product.

Cranfield University - Introduction
Microfluidics are a branch of technology which focus on the manipulation of very small samples of liquids, often about the size of a drop of water. You'll find it used in medical diagnostics, DNA chips and even research in outer space – anywhere that it's only possible or easier to use tiny samples.

At the Centre for Engineering Photonics at Cranfield University in the UK, Matthew's team of researchers is working on developing optical sensors for these uses. But producing microfluidics devices from scratch can be expensive, so the team started experimenting with using 3D printing back in 2014.

Since then they have published their research showing how they used an Ultimaker 2+ 3D printer and materials to create viable microfluidics devices, reducing their production costs and discovering lots of other benefits of having a 3D printer in the lab.

Challenge

Before using an Ultimaker 3D printer, the Cranfield University team relied on a full-time technician to make the unique devices needed for experiments. Matthew notes, "Materials costs dropped massively after moving to FDM. Before we were making things out of steel, aluminum, PTFE, plus the cost of the technician time."

Solution

The first step to creating the microfluidics devices is using 3D design software. A student will do a rough design first and print it to validate the overall idea. Then they produce iterations to check each property of the device which will be needed in testing, making changes and printing a new iteration each time. The team use a 0.4 mm nozzle on the Ultimaker 2+ to achieve features down to approximately 20 microns.

Results

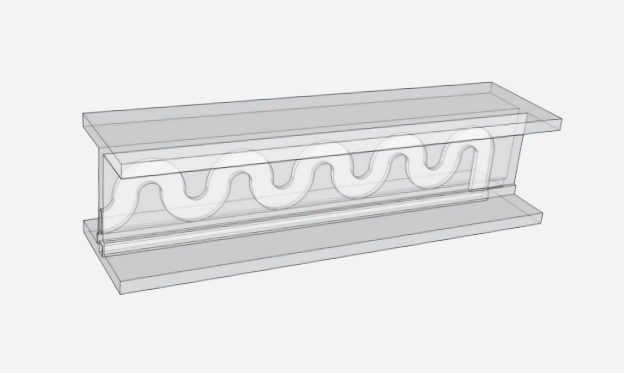
Reduced production costs not only save budget, but as the price of further iterations is now so low, there is no longer a barrier to achieving the absolute perfect design. This means that at a lower cost, the lab is achieving better results than ever. Their Ultimaker 2+ is running nearly non-stop 24 hours a day and it's even outperforming a specialist 3D printer for microfluidics devices, achieving smaller channels in the Ultimaker printed devices.

The team has also benefited from having a convenient tool to print anything else they need at short notice, like a laser mount or a visualization aid for any project.

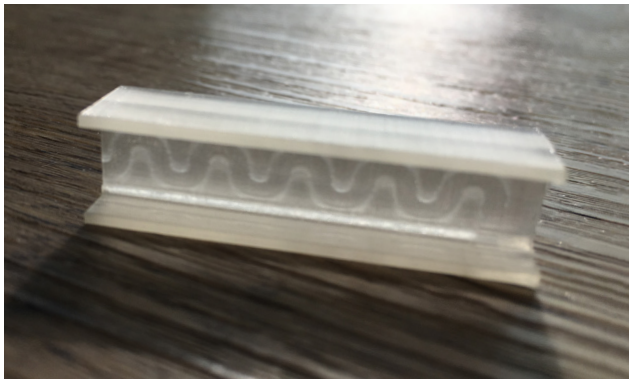
Costs

The cost of printing a microfluidics device has been reduced significantly compared to without a 3D printer, paying for a technician and machining metal parts. The team still have their technician but he now gets to focus his time on larger projects instead of easy to solve problems around the lab, bringing benefits elsewhere.

	Technician	Specialist microfluidics 3D printer	Ultimaker 3D printers
Cost per hour	£15	–	£0.20
Cost per device	–	£0.80	£0.08



A 3D model of the Cranfield University team's design for a 3D printed microfluidics device.

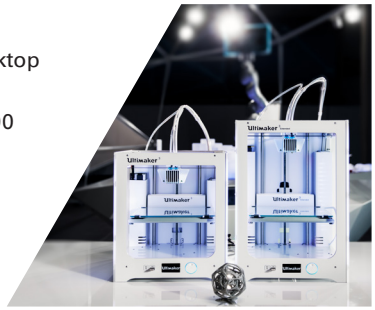


The fluidic channel is visible inside the device – a straight channel down the side and a snaking path through the middle.

The team also discovered their 3D printer had countless other uses, from 3D printing mounts for experiments to creating educational visualization aids.

About Ultimaker

Since 2011, Ultimaker has grown to become a leading brand, creating accessible, professional desktop 3D printers. The company has offices in the Netherlands, New York, and Boston, with production facilities in both the U.S. and Europe. With a growing team of over 200 employees, plus over 24,000 active community members, Ultimaker strives to deliver the highest-quality 3D printers, software and materials, without compromise.



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