

ENR501969

## **The Expedition to Net Zero: Sustainability Research Powered by Autodesk Fusion 360**

Mark Chester  
Manchester Metropolitan University PrintCity

Alan Dempsey  
Manchester Metropolitan University PrintCity

### **Learning Objectives**

- Learn how to develop sustainability research projects.
- Learn how to get multidisciplinary teams to work together effectively.
- Learn how the science of sustainability can have a real impact on additive manufacturing.
- Learn how Autodesk Fusion 360 is the tool being used to design parts to exploit these sustainability research advances.

### **Description**

How can university research help us transition to net zero? PrintCity has six large research projects (€50 million) that enhance sustainability and the circular economy transition to reduce our impact on the environment. Projects span a range of industries and grand challenges to make new materials and more-sustainable products, and extend the life of electronics. With an advanced digital manufacturing facility, PrintCity's research is delivered by a multidisciplinary team that is passionate about sustainability and proud to work for the United Kingdom's #1 Greenest University, Manchester Metropolitan. Projects include producing 95%-98% recycled FDM filaments from single-use plastics, 3D-printing concrete to replace virgin sand with recycled aggregates (demolition waste), and using 3D printing for repair. Learn how Autodesk Fusion 360 software is being used to design new, more sustainable products. Learn more about how PrintCity's sustainability research is helping us transition to net zero.

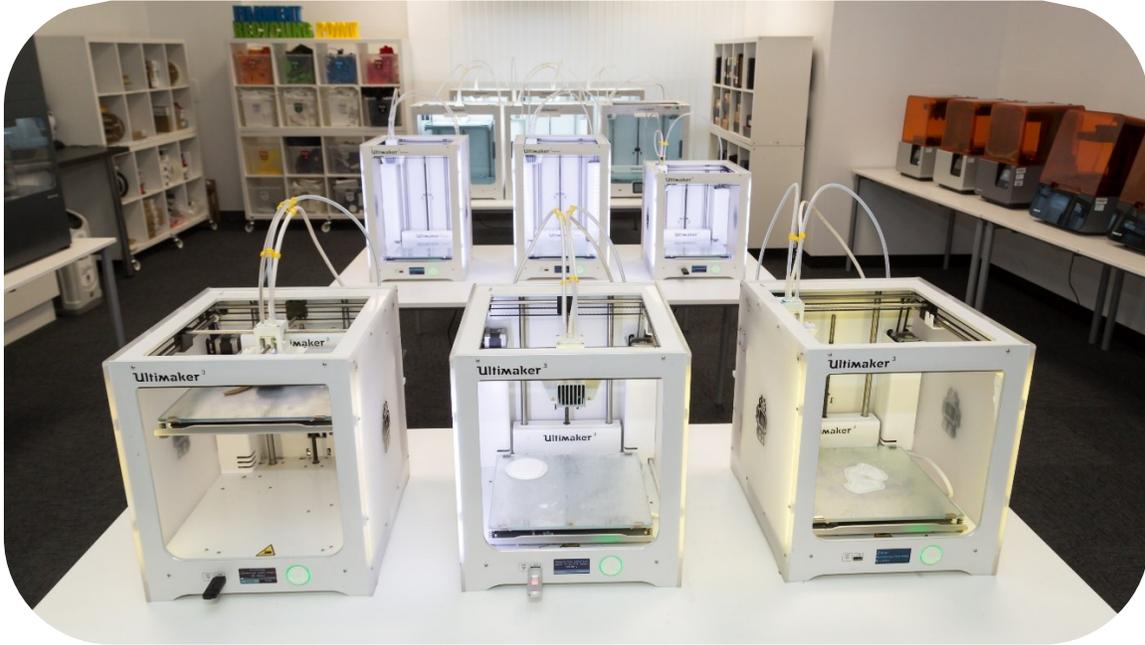
## Speaker



 **Mark Chester** on [LinkedIn](#)

Mark Chester is a Product Development Specialist on the PrintCity Network Programme at Manchester Metropolitan University. Within his role, he is responsible for helping companies in the Greater Manchester area to create new products, processes and services utilising digital manufacturing technologies such as additive manufacturing. Mark previously studied a BA in Product Design before transitioning across to the MSc in Industrial Digitalisation at MMU PrintCity. He now specialises in consulting and applying new digital technologies into SME's to enable innovation. Previously Mark was an Autodesk Student Ambassador and Gold Autodesk Certified Instructor for Fusion 360 within which he taught at multiple universities in the UK.

## About [PrintCity](#)



## [PrintCity on LinkedIn](#)

PrintCity is a 3D additive and digital manufacturing centre based in Manchester, a city with a rich industrial legacy and one of the UK's biggest technology hubs. We're home to manufacturing experts, designers, engineers and students on our MSc Digital Design and Manufacturing course. We collaborate with businesses, big or small, to make even the most ambitious ideas a reality. Additionally, PrintCity is home to six funded research projects with a focus on Additive Manufacturing, Sustainability and Circular Economy.

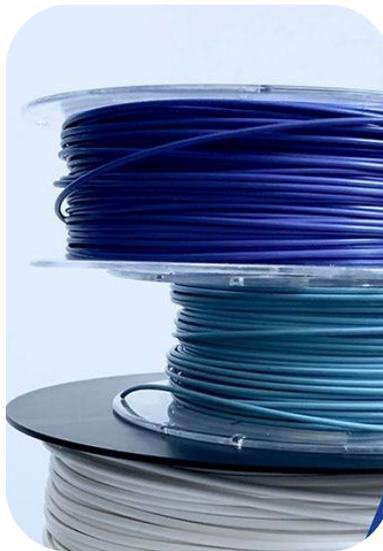
## About [Manchester Metropolitan University](#)

Manchester Metropolitan University is one of the most extensive higher education centres in Europe with 37,000 students and more than 1,000 undergraduate, postgraduate and professional courses. The University educates and trains large numbers of legal and business professionals, scientists, engineers, teachers, health workers and creative professionals. Manchester Met has invested £350 million in its estate and facilities during a ten-year plan to create a truly world-class campus in the heart of Manchester.

## Project Overview



Of the 62 million tonnes of plastic produced in Europe each year, only 30% is collected for recycling.



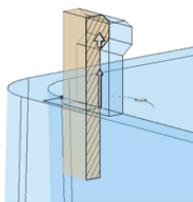
Scan for a free reel of recycled filament.



Transforms CE is a 6.93 Million euro research project funded by Interreg North-West Europe. The project focuses on transforming single use plastic waste (typically not recycled) and turning it into value added products using two manufacturing technologies, additive manufacturing and intrusion-extrusion moulding techniques.

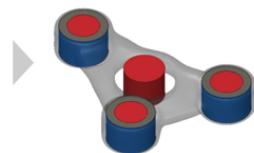
The outputs for the project include diverting 308 tonnes of plastic waste from landfill, and helping 20 companies across Europe to embed recycled municipal plastic into the manufacturing process to create new or existing products. 3D Printer users in the room can get a free reel of filament by using the QR code.

## Developing Better Products



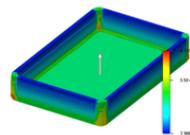
### Design

Create features ready for Injection Molding in the Plastic Workspace.



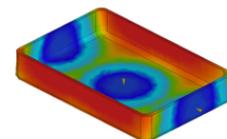
### Optimize

Optimize components using generative design or the volumetric lattice tools.



### Analyze

Use the design analysis tool to review parts for Injection Molding.



### Simulation

Simulate the Injection Molding process to identify faults and recommendations.

An image showing how PrintCity is using Fusion 360 within our Transforms CE Project.

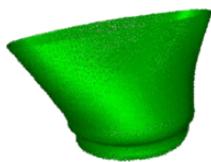


**3 – 5% is the rate at which the generation of waste electrical and electronic equipment (WEEE) is growing each year in the EU.**

The right to repair movement is beginning to grow as we see more Repair facilities starting to pop up across Europe. The aim of our ShaRepair project is to support and scale the repair movement to promote the use of technologies such as 3D printing to product spare parts and components. This project is also funded by Interregg North West.

Outputs for this project included reducing 175 tonnes of waste electrical equipment. Creating open sources tools to promote digital manufacturing including free CAD files. And finally free workshops for anyone to attend to learn how to repair.

## Repairing Products



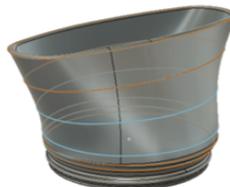
### 3D Scan

3D Scan broken components using our Ein Scan 3D Scanner.



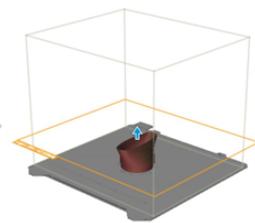
### Mesh Workspace

Insert and Modify 3D Scanned Meshes in the Mesh Workspace.



### Reverse Engineering

Use Fusion 360 to reverse engineer parts and prepare them for Additive Manufacturing.



### Manufacture

Prepare the component for 3D printing using the Manufacturing Workspace.

An image showing how PrintCity is using Fusion 360 within our ShaRepair Project.

**50 billion tonnes of sand is used every year..**



CIRMAP is a research project which is investigating how construction demolition wastes can be converted into Recycled Fine Aggregates which can be used within 3D printable concrete mortar mixes as a substitute for virgin sharp sand. The project is a 6.98 Million euro funded research project backed by Interreg north west as part of ERDF. The program runs across multiple partners across Europe.

The output of the project is to create suitable RFA concrete Mixes (recipes) which will be used to create street furniture which will be located across various sites across North West Europe.

### Fusion 360 for Concrete 3D Printing



#### Design

Create Organic forms using the Design Workspace



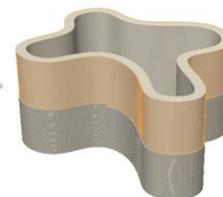
#### Pattern

Make complex patterns using the geometric pattern tool.



#### Visualize

Visualize furniture using the Render Workspace and AR exports.



#### Manufacture

Future: Use Fusion 360 Additive Multi Axis Workspace to drive our ABB Robotic Arm.

An image showing how PrintCity is using Fusion 360 within our CIRMAP Project.

## Useful Links

### About:

PrintCity: <https://printcity.mmu.ac.uk/>

Manchester Metropolitan University: <https://www.mmu.ac.uk/>

Man Met Road to 2030: <https://www.mmu.ac.uk/sustainability2030>

People and Planet Ranking: <https://peopleandplanet.org/university-league/2021/u224/manchester-metropolitan-university>

MSc Digital Design and Manufacturing :  
<https://www.mmu.ac.uk/study/postgraduate/course/msc-digital-design-and-manufacturing>

### Quotes:

Of the 62 million tonnes of plastic produced in Europe each year, only 30% is collected for recycling.

[https://circulareconomy.europa.eu/platform/sites/default/files/euric\\_-\\_plastic\\_recycling\\_fact\\_sheet.pdf](https://circulareconomy.europa.eu/platform/sites/default/files/euric_-_plastic_recycling_fact_sheet.pdf)

3 – 5% is the rate at which the generation of waste electrical and electronic equipment (WEEE) is growing each year in the EU.

<https://prompt-project.eu/project/>

50 billion tonnes of sand is used every year...

<https://www.bbc.com/future/article/20191108-why-the-world-is-running-out-of-sand>

### Research Projects

Transforms CE: <https://www.mmu.ac.uk/circular-economy-network/projects/transform>

ShaRepair: <https://www.mmu.ac.uk/circular-economy-network/projects/sharepair>

CIRMAP: <https://www.mmu.ac.uk/circular-economy-network/projects/cirmap>

ECO I: <https://www.mmu.ac.uk/circular-economy-network/projects/ECO>

Bio Plastics Europe: <https://www.mmu.ac.uk/circular-economy-network/projects/foodchains>

PrintCity Network: <https://www.mmu.ac.uk/business-school/business/sme-support/printcity-network/>