



Ricoh 3D

Optimising Machine Feet with nTopology



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RICOH
imagine. change.

Objective

Ricoh 3D is a trusted provider of technology, that transforms business processes and information management to help organisations around the world become more agile, more productive, and more profitable. The Ricoh 3D team has responded to the changing demands of the modern workplace and harnessed over 80 years of manufacturing experience to provide a full range of end-to-end solutions, including additive manufacturing (AM) services and 3D printing.

Application

Ricoh 3D sought the support of Measurement Solutions Limited (MSL), specifically in relation to their expertise with the use of nTopology – the next-generation of engineering design software. Ricoh 3D needed help to create a print-on-demand solution for a bespoke automation system, that a high-profile global food company required. Specifically, Ricoh 3D required an access kit: to create a complex part enabling heavy manufacturing equipment to be raised off the floor, in the form of ‘machine feet’.

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I have had the opportunity to explore many non-critical parts and basic applications but wanted to explore something different to develop a practical understanding of the growing benefits of additive manufacturing.

This project was an ideal opportunity, with the help of experts at Ricoh 3D and MSL, to showcase the ever-growing AM technologies and solutions, as well as creating ‘a talking point’ for our customer and their future scope for development using AM.

Tom Moule, Junior Engineer
(Design & Development)

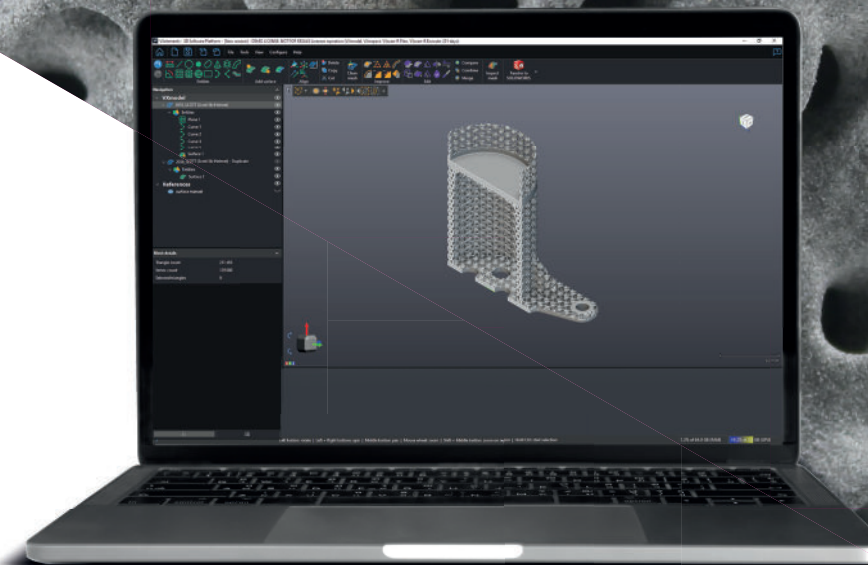
Challenge: A New Approach

The challenge faced by Ricoh 3D in this instance was obtaining 'Buy-In' from the Customer. Most companies would often opt for bespoke fabricated steel. However, this can prove difficult in manufacturing timescales, having to consider business time-frame pressures to work to and resulting global impacts, in addition to incurring high expenses.

One challenge was convincing the customer that this alternative solution would work more effectively; swaying them away from symmetrical and over-engineered large steel works and convincing them, that the solution would still have the performative ability to hold a machine of circa 500kg.

A new approach was adopted and initially, the original designs were limited to conventional CAD modelling methods. This limitation meant that standard cuts and parametric modelling would typically generate an over engineered component. The engineers at Ricoh 3D were familiar with optimisation and the ability to design components that perform to the specific application requirements, whilst also leading to organic and interesting shapes that are impossible to model via 3D CAD.

Having seen examples of optimised parts designed by MSL using nTopology, the engineers were inspired to adopt a new approach.



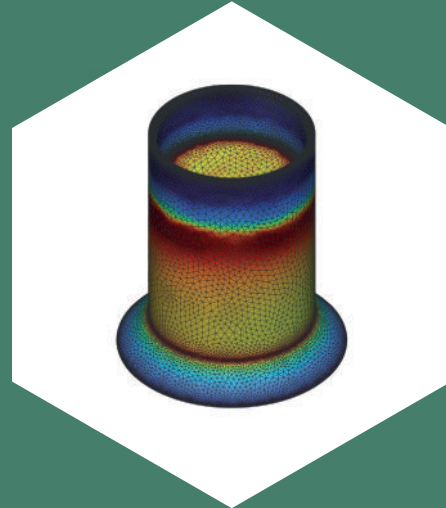


Solution: AM Access Kit

Optimising the Machine Feet in nTopology

Utilising MSL's nTopology expertise enabled Ricoh 3D to take a more advanced engineering approach to the design and development of the machine feet. In addition to which there was a much shorter lead time with this approach and therefore was also more cost-effective.

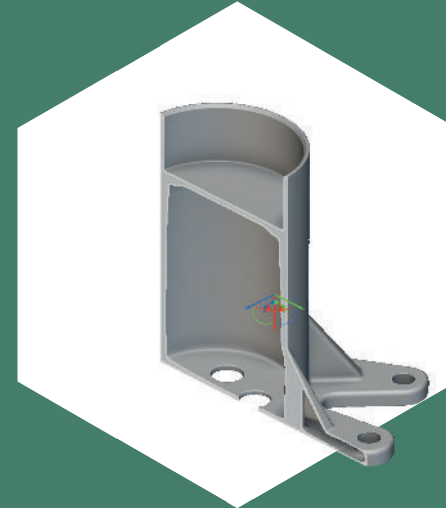
The lightweighted part(s) were manufactured as print-on-demand and assembled in a controlled environment at Ricoh UK Products Limited (RPL), The Home of Ricoh 3D. Furthermore, this satisfied an initial consideration for freight costs as the machine feet needed shipping overseas to the end customer, so 'lightweighting' the final product was extremely beneficial.



Step 1

Firstly, we imported the original part into nTopology and used the inbuilt FEA to perform a static analysis.

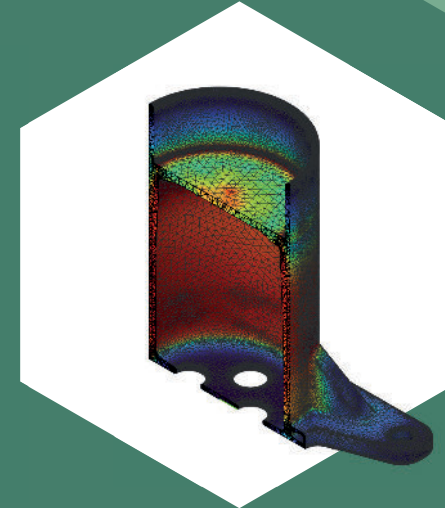
This showed us where areas of high stress were.



Step 2

We used the 'Shell' feature in nTopology to create a variable wall thickness.

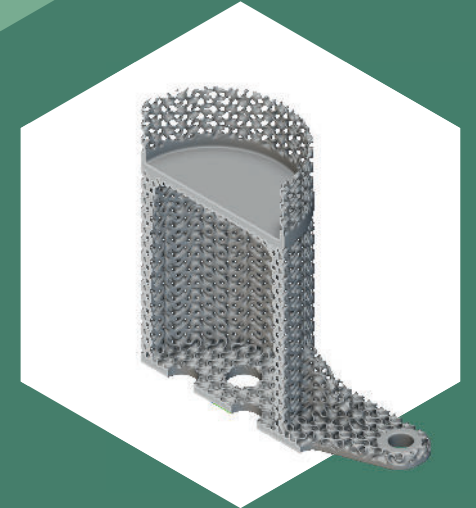
By utilizing the results of our static analysis we were able to remove more material from low stress areas and remove less material in areas of high stress.



Step 3

After further static analysis and despite removing nearly 55% of the material, the results showed we had scope to remove more.

We were happy with the overall geometry so turned as much of the structure as we could into a gyroid, removing more material, whilst maintaining good structural rigidity.



Step 4

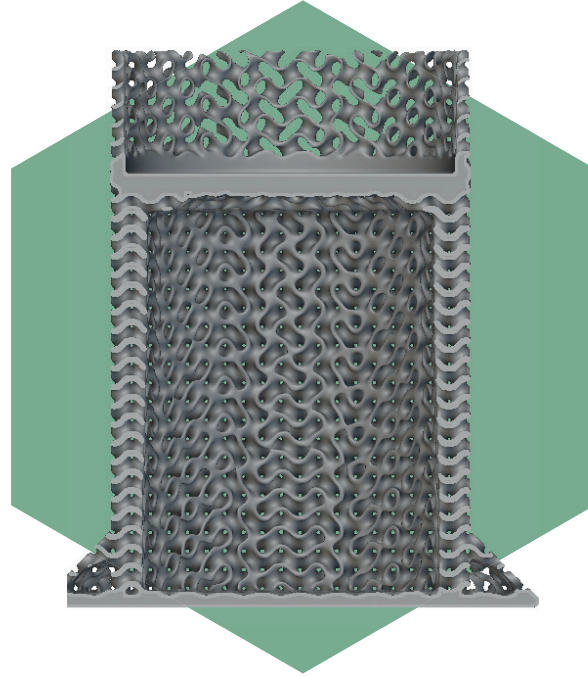
In nTopology we had complete control over the cell size and wall thickness. We used this to our advantage by again using our static analysis results to drive the gyroid structure.

We created a geometry with thicker walls in high stress areas, and thinner walls in low stress areas.



Results: Optimised Performance

As part of this project 12 machine feet were created, adopting nTopology software to optimise the machine feet meant they could safely account for the total weight of the machine at 500kg. The global customer requested that each foot be designed to withstand 60kg load – and the load capacity has been exceeded at a safety factor of 2 (120kg maximum load limit). Destructive testing was also undertaken in-house at Ricoh 3D to confirm the level of performance.

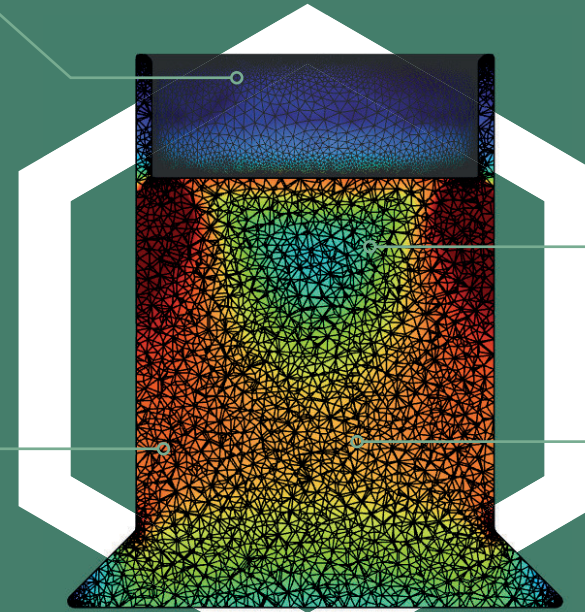


Withstand 60kg load

Print on-demand

120kg load limit

Lightweight





Testimonial

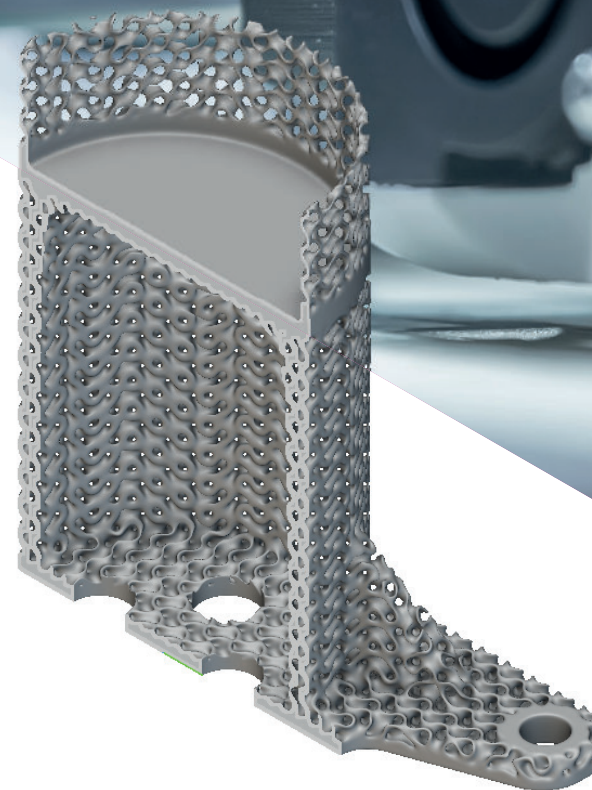
A perfect collaboration

This project has showcased the future scope of engineering design. Working closely with MSL has been a perfect collaboration between two companies and highlighting nTopology and its capabilities has moved the potential of AM even further forward.

I believe 'We are stronger together' and to enable metal replacements utilising other materials to be created is a fantastic development for our own customers too.

Thanks to the machine feet optimisation using nTopology, we have been able to create interesting and innovative 3D printed parts which both showcase the true performative abilities and modern aesthetics that 3D printing technologies bring."

Ricoh 3D Senior Engineer, Richard Minifie





3D Scanning, Inspection, and Metrology

With over 23 years' experience, MSL brings a wealth of engineering experience to metrology, combining tools and software from leading manufacturers to create integrated systems for your workflows.

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