TRUE TO NATURE

PROTO CALL

REPORT

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UWE Bristol | University of the West of England

C F P R
Centre For Print Research

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Introduction

True to Nature Limited (TTN) is a Bristol based independent TV production company that specialises in premium and innovative natural history content. The company values emotive storytelling and invests in technology that can support this through innovative filming techniques and perspectives.

TTN uses drones, that have revolutionized the world of photography, allowing for stunning aerial shots that were once only possible with expensive equipment and specialized expertise. One essential component of aerial photography is the use of camera filters, which can dramatically enhance image quality by controlling light and reducing glare.

TTN has asked the Centre for Print Research (CFPR) to design and prototype a versatile and convenient camera filter solutions for their high-end drone.

This bespoke filter holder has to be specifically designed for their drone, offering a bespoke solution that is lightweight, easy to change, and adaptable to various shooting conditions. In this report, we will provide an overview of our prototype, highlighting its features.

The drone

The drone that TTN owns is a “DJI MATRICE 30T FOLDABLE ENTERPRISE”.

This drone does not have the thermal camera that is included in all the 3d models.

The Gimbal

This professional drone has a set of cameras and tools all integrated within a gimbal.

The M30 Series integrates wide and zoom Cameras with a laser rangefinder.

Wide Camera

Figure 1 wide camera : Equivalent Focal Length: 24 mm, DFOV: 84° - 12 MP 1/2" CMOS Sensor - Video Resolution: 4K/30fps

Zoom Camera

Figure 2 Zoom - 48 MP 1/2" CMOS Sensor - 5x-16x Optical Zoom - 200x Max. Hybrid Zoom - Photo Resolution: 8K - Video Resolution: 4K/30fps

Laser Rangefinder

Figure 3 Range finder - Range: 3 m - 1200 m - Accuracy: ±(0.2m+D×0.15%)

The 3d model

The first idea was to scan the M30T drone to have an accurate reference. After a quick research, we have found a 3d model on line, which is perfectly matching the real thing.

We have downloaded the model, converted to Rhino format and double check the measures.

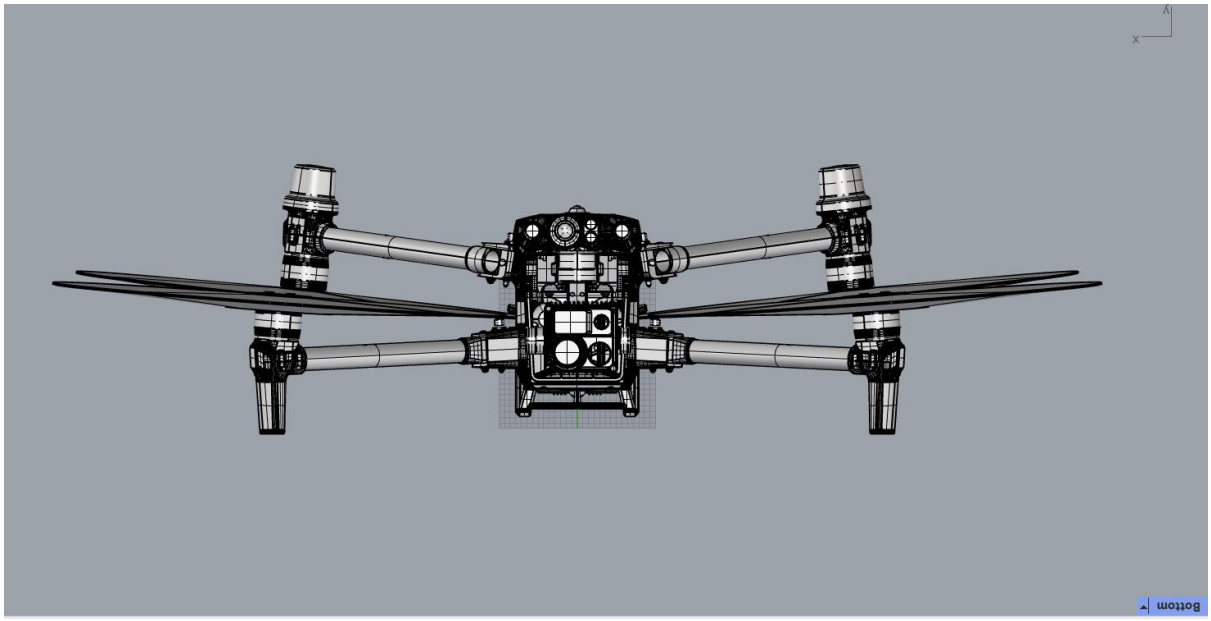

Figure 4 a snapshot of the 3d model in Rhinoceros

After a first check, we then printed a part of the gimbal and checked the measures again. There is tiny deviation, as a consequence, the 3d model used for the design and simulations has been slight scaled to reflect the variation.

In the following images we show the 3d model and the comparison between the original model and the reconstruction made for the prototype.

Figure 5 a rendering of the 3d model, imported and elaborated

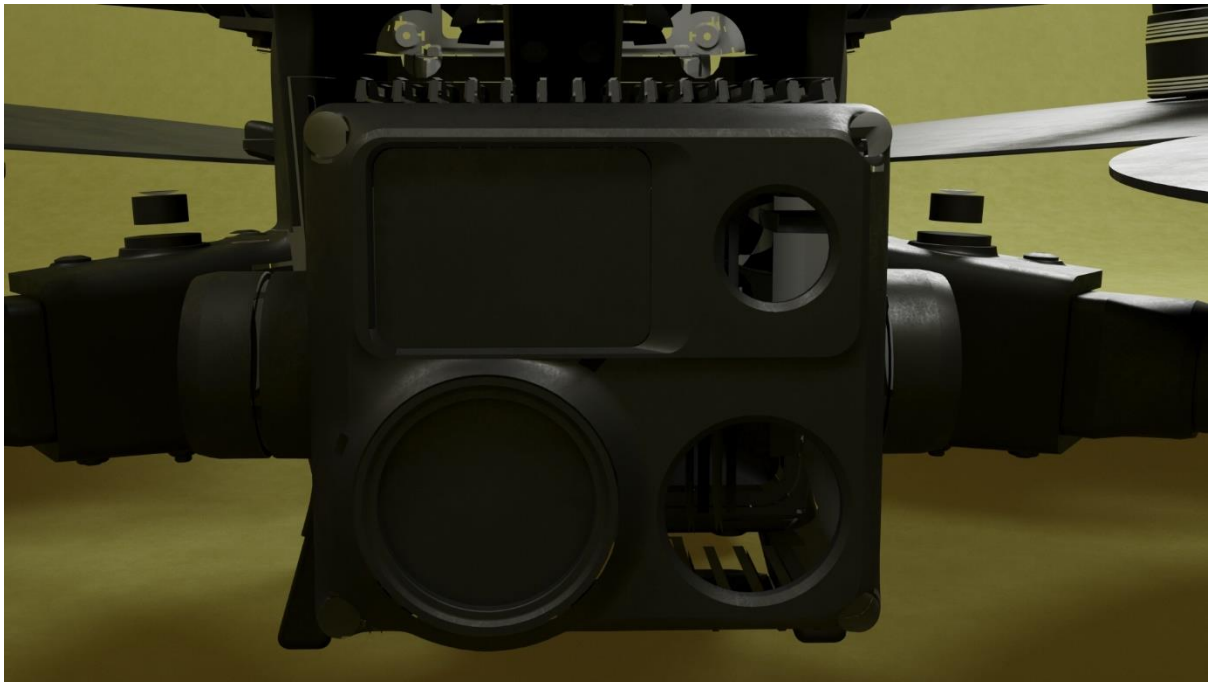

Figure 6 front view of the gimbal model

Figure 7 a comparison between the dummy replica and the 3d model (right)

The ‘dummy model’ has then been printed and used as a reference and replica of the original one.

Figure 8 picture of the 'dummy model', replica of the original drone

List of possible routes

We have tried different routes and selected the most promising.

Super light – racoon eyes

The first approach has been to design and print a super light 3d printed filter holder, with the idea of replicating a sort of sunglasses.

Figure 9 racoon eyes, sunglasses approach

This approach has a main advantage, and it is to reduce at the maximum the surface used for the holder, and therefore to minimize the weight.

The idea is to trim the lenses with a laser cutter and to glue it on the holder. With this system, you will have a pair of glasses for each filter and mount it on the camera.

The holder is then secured on the gimbal thanks to a strap.

Figure 10 Racoon eyes - both the holder and the strap

While this system works nicely, there are a couple of disadvantages, the first one is that this approach requires one 3d printed holder for each filter and this could be more expensive than just cutting the filters and replacing them on a single holder, and the second one is that the strap does not provide enough support and stability.

Figure 11 a picture of the prototype

Figure 12 the holder mounted on the gimbal

Light and sturdy – the metal one

The second approach has been to us as much as possible a ‘2d’ approach, by cutting and folding an aluminium sheet, providing both a light result and a sturdy object.

The idea is to cut (2d cutting) and then to fold the filter holder. We started with a low cost paper prototype, as in the following image.

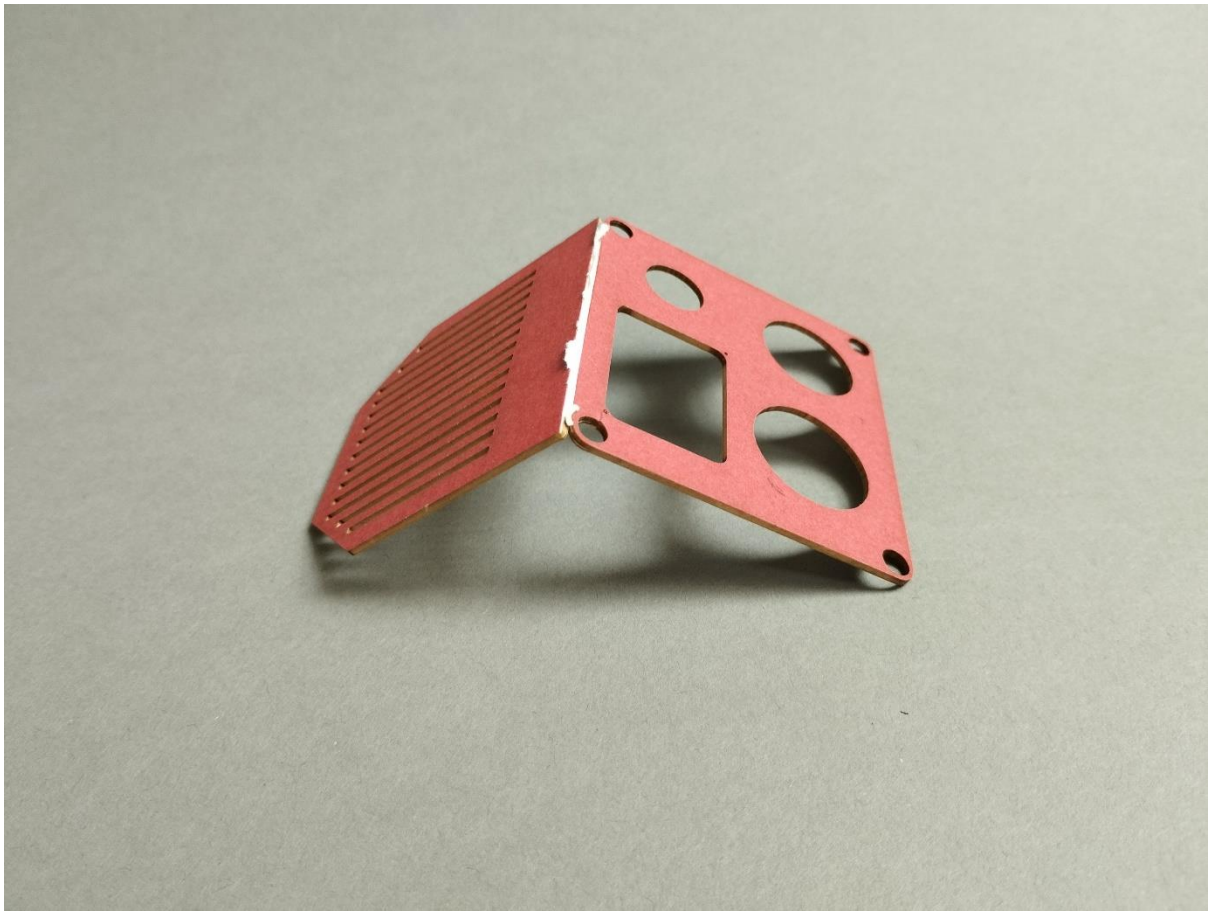

Figure 13 the paper prototype used as a first test

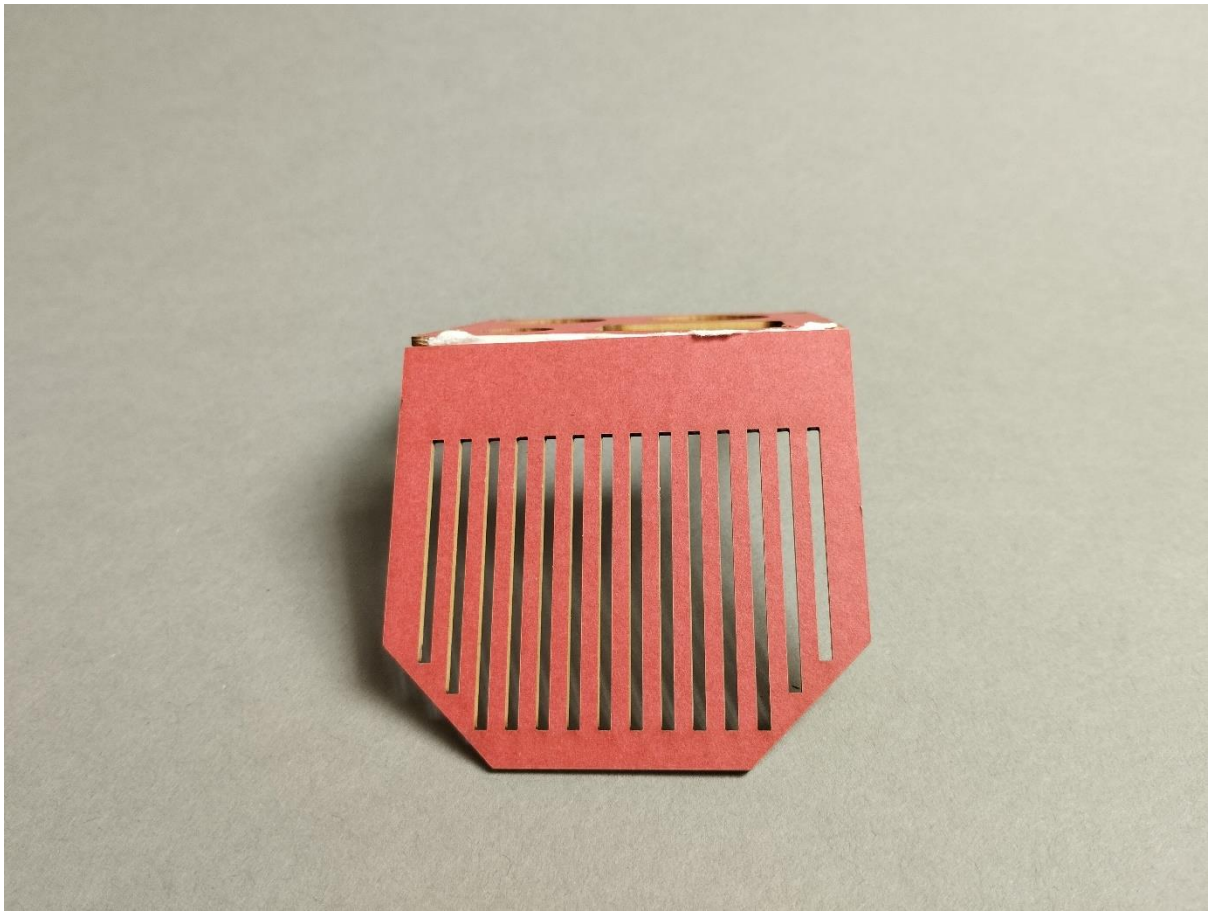

Figure 14 the measures from the 3d model are perfectly matching the mock up

We then moved to a 3 mm aluminium sheet that provides both strength and light weight.

The result works but it would need more attention in the folding procedures. It could be more efficient if milled from an aluminium cube rather than from a sheet.

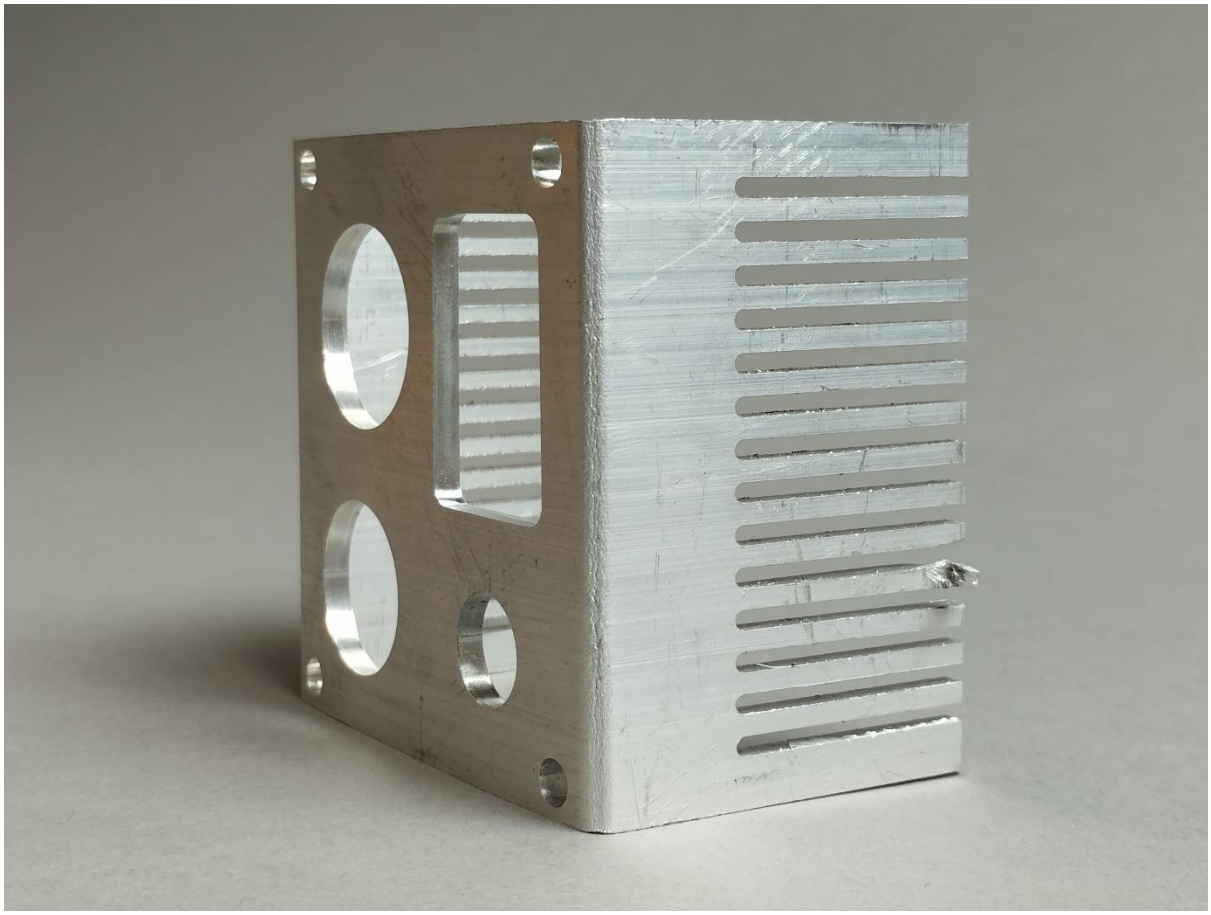

Figure 15 The aluminium prototype

The next prototype is a fully 3d holder, printed in resin. This model could be revised and reused for aluminium milling.

Fully 3d – resin holder

Figure 16 a selection of different prototypes

Managing the balance of the Gimbal

Flying tests

Figure 17 mounting the filter at Blaise park

Figure 18 filter on, with 28 grams counterbalance

Figure 19 the flying drone