# Bicycle Handlebar Attachment for Upper-limb Amputees

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## Introduction

Being in a ‘standing’ position at the start of cycling races gives cyclists a big advantage as they can use their body weight as an extra force to pedal harder and faster. However, upper-limb amputees cannot properly pull off this ‘standing-start’ because they cannot grip on to the handlebars to hoist themselves up. This project is largely based on an existing prototype to help cyclists get into this ‘standing-start’ position, modified according to suggestions made by Mr Jon-Allan Butterworth.

**Figure 1** Standing position (left) and aerodynamic position (right).

## Old prototype

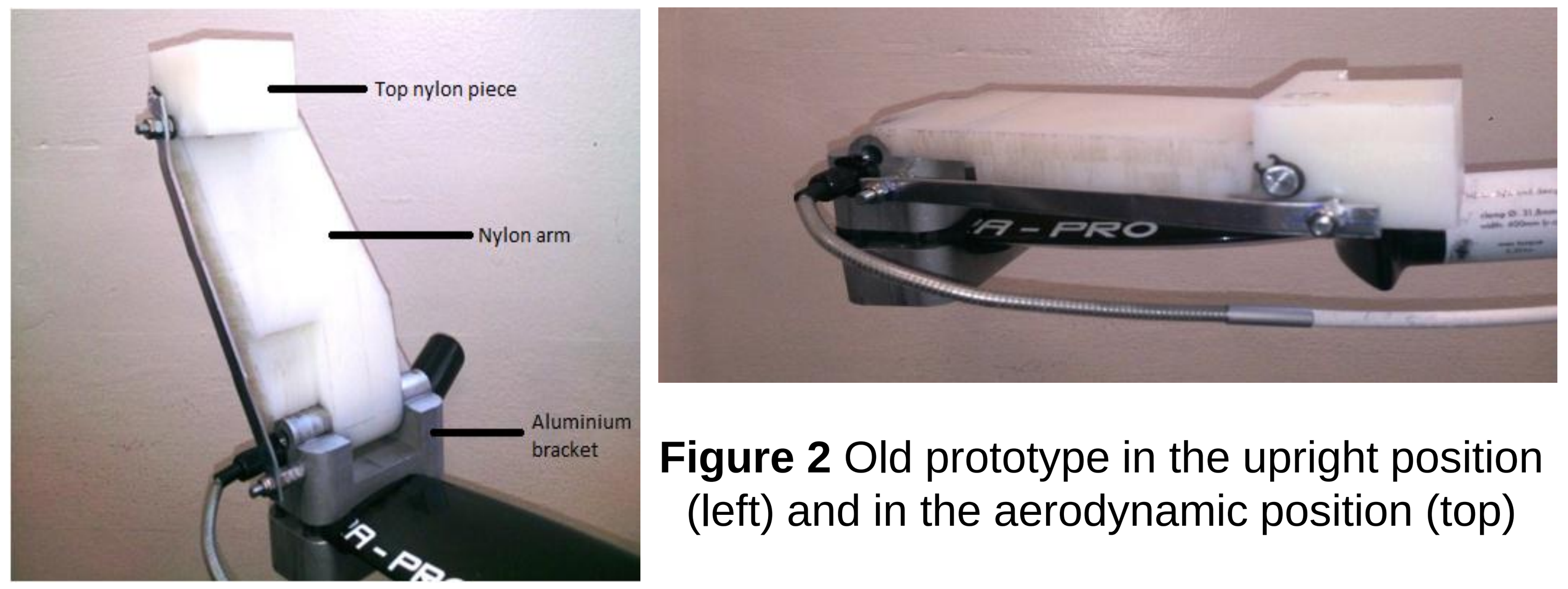
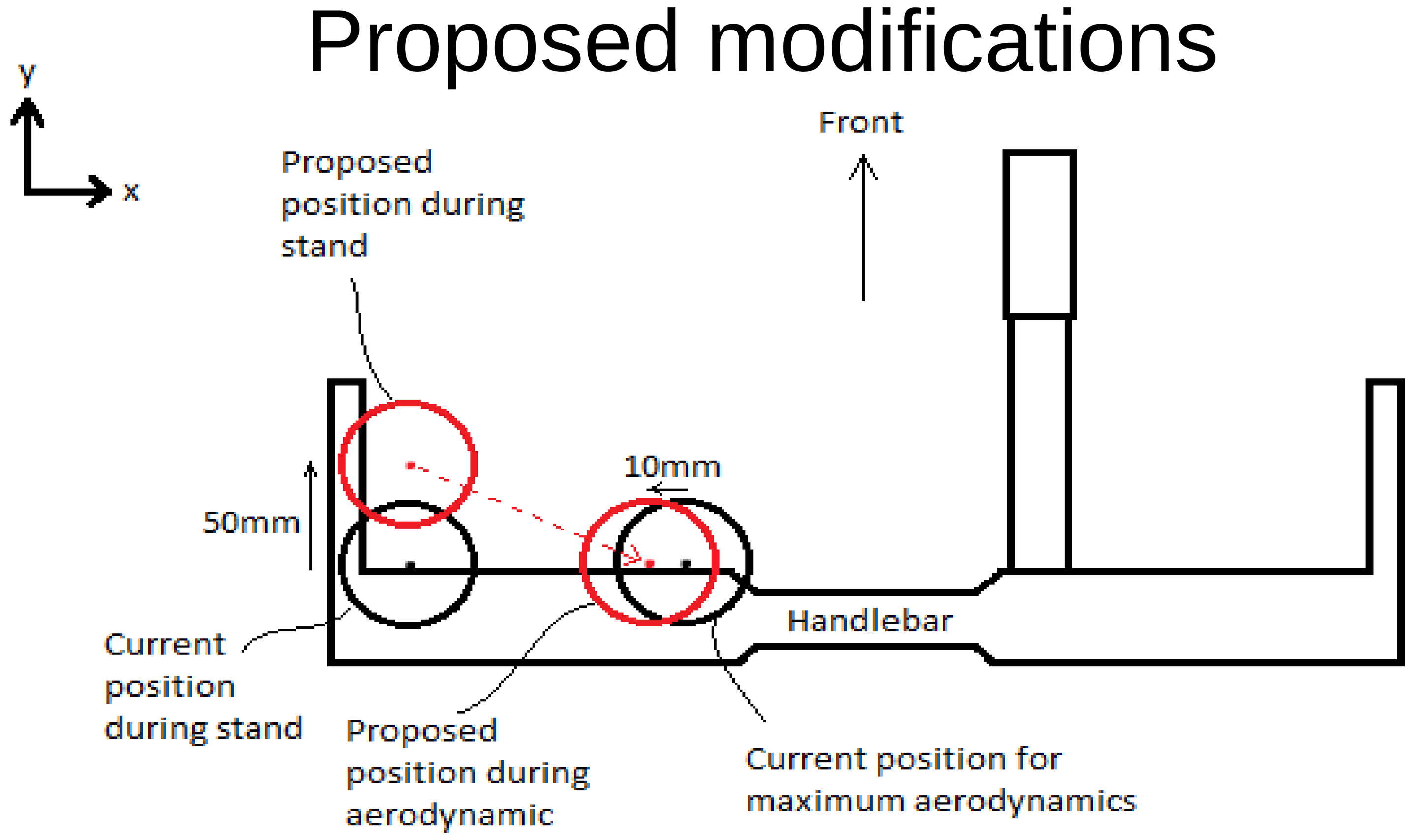



**Figure 2** Old prototype in the upright position (left) and in the aerodynamic position (top)

## Proposed modifications




## New Design

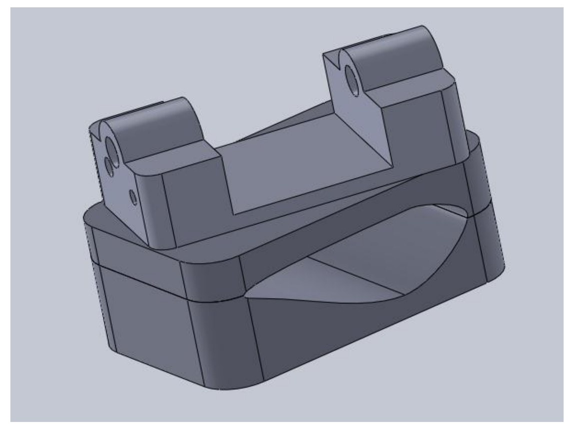


**Figure 3** The new aluminium clamp design (left) incorporates the change in angle (16º). It consists of the old aluminium bracket which was modified bolted on to the top of a newly manufactured almunium clamp.

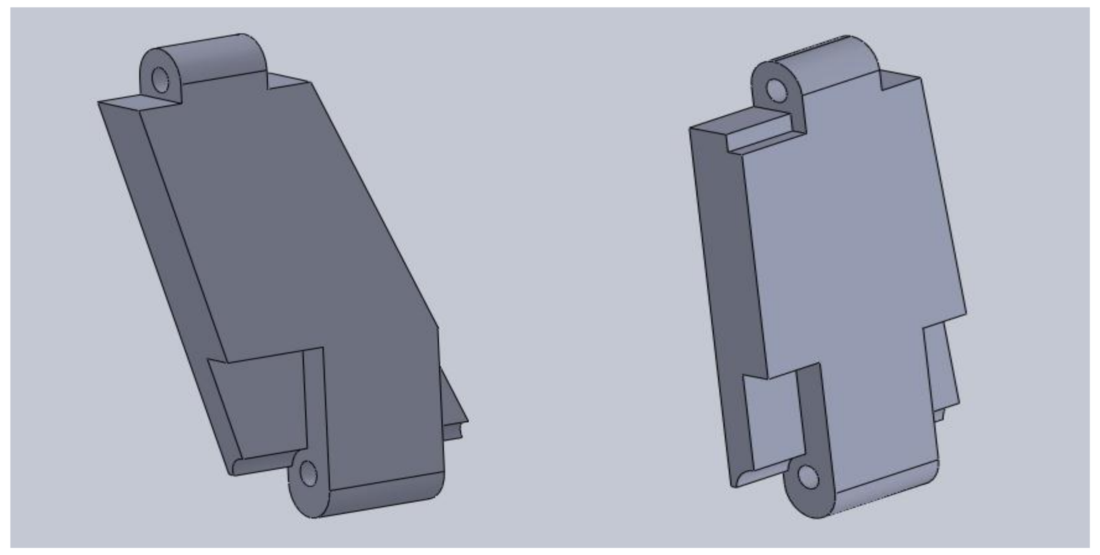


**Figure 4** The old nylon arm (left) and the new nylon arm (right). The new one is not slanted to the back anymore.

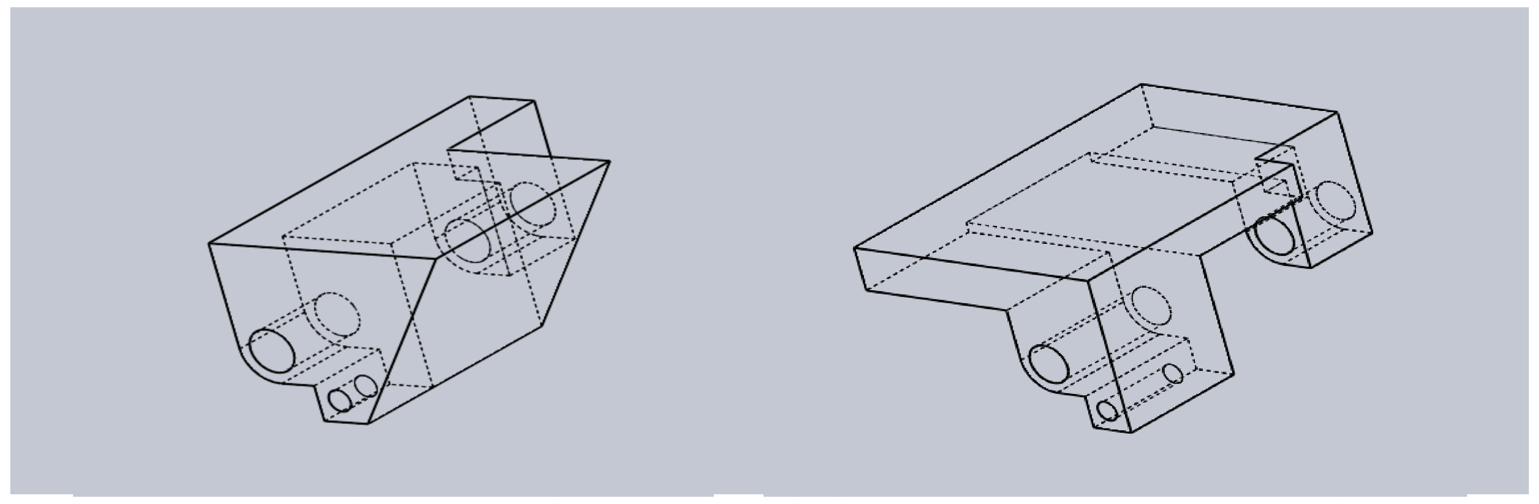


**Figure 5** The old top nylon piece (left) and the new top nylon piece (right). The shell (Figure 6) is supposed to be bolted on the top at the flat surface. The shell (and hence force) is now shifted to the left, unlike the old one which was on the right. This is attached at the top of the nylon arm using a 78mm long, 8mm diameter aluminium rod and circlips.

**Figure 6** The new attachment method of the prosthesis to the prototype. The core (right) is supposed to be embedded in the prosthesis and the shell (left) is bolted with a countersunk screw at the top of the top nylon piece. The sphere of the core has indents around it for the spring plungers in the shell to hold it in place.

## Mechanism of attachment

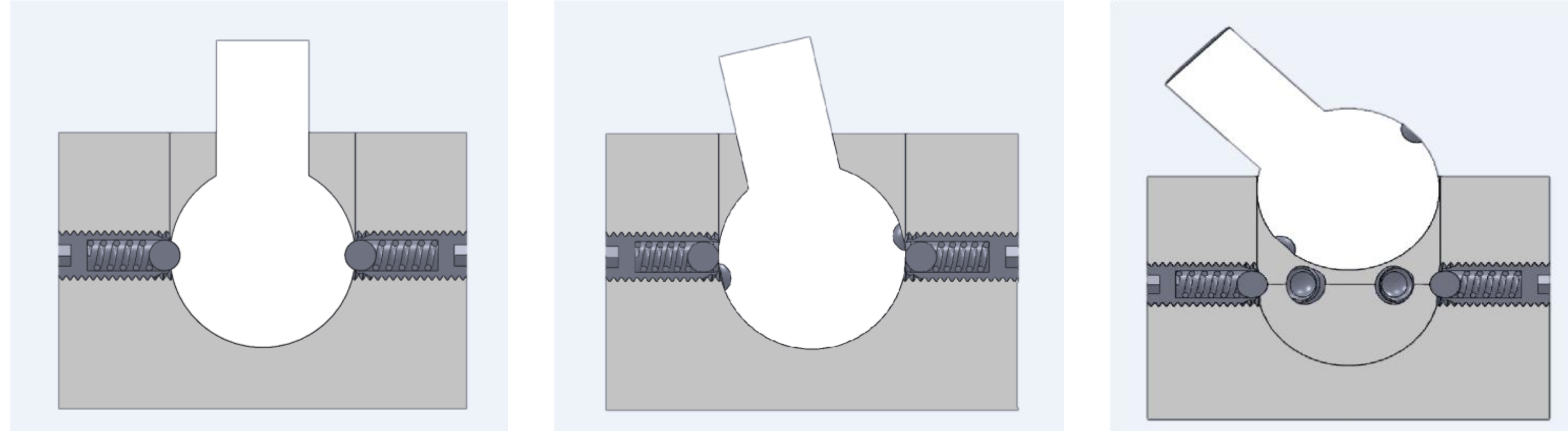


**Figure 7** The core fitted into the socket (left). It is held together by spring plungers with ball bearings, which fits into the indents of the core. When forced sideways (middle), the ball bearings leave the indents. The core is then free to leave the shell (right). This is important as it detaches easily, safely and immediately in cases of collisions.

## New prototype

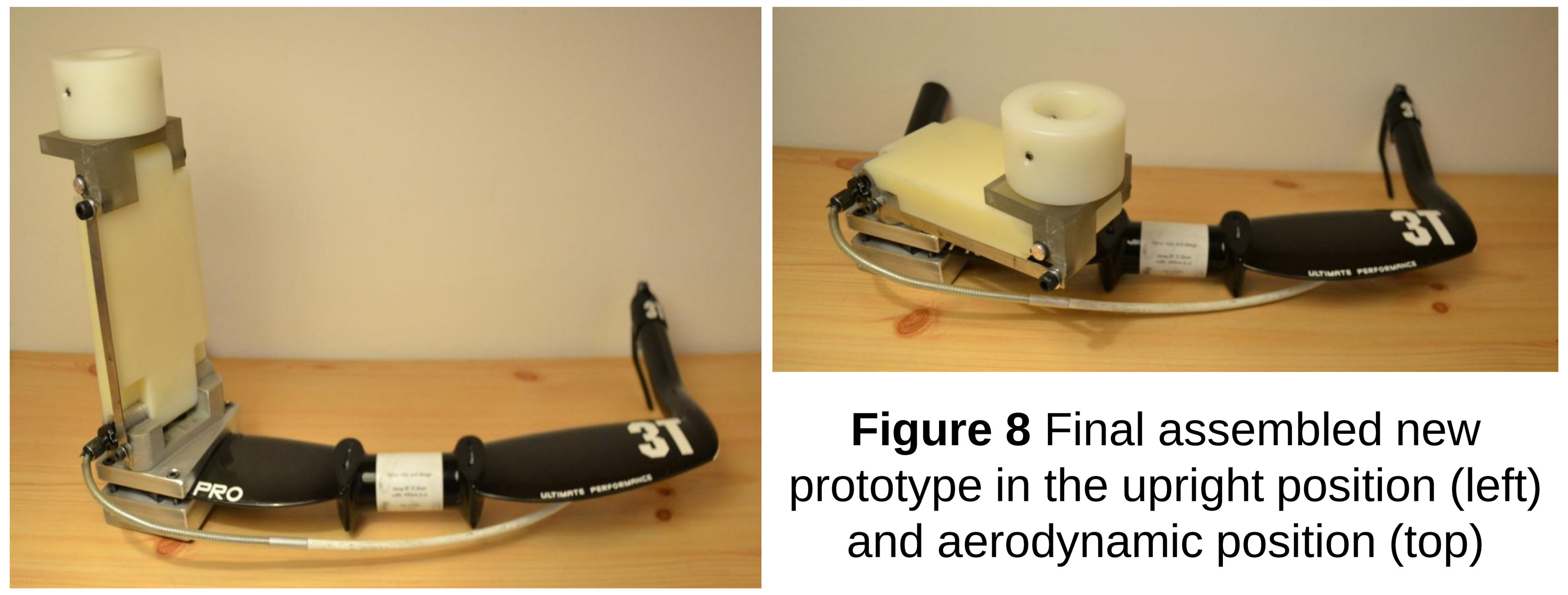


**Figure 8** Final assembled new prototype in the upright position (left) and aerodynamic position (top)

## Conclusion

This new prototype satisfies Mr Butterworth’s suggestions regarding the final socket positions. The attachment of his prosthesis to the prototype is also safe as the mechanism allows his prosthesis to safely and immediately break away from the prototype in cases of a collision.

## Acknowledgement

I would like to thank my supervisors, Dr Dominic Southgate and Dr Ian Radcliffe for their constant advices and guidances which made this project a lot easier for me. Thanks to Mr Gary Jones for manufacturing the newly designed parts. Also thanks to Henrik, Gabrielle and Jed for their work on the previous design, which this current design is largely based upon, and Group 5 from 2012/2013 Year 2 Bioengineering for their work on ‘OssGuard’, which the attachment device is modified from.