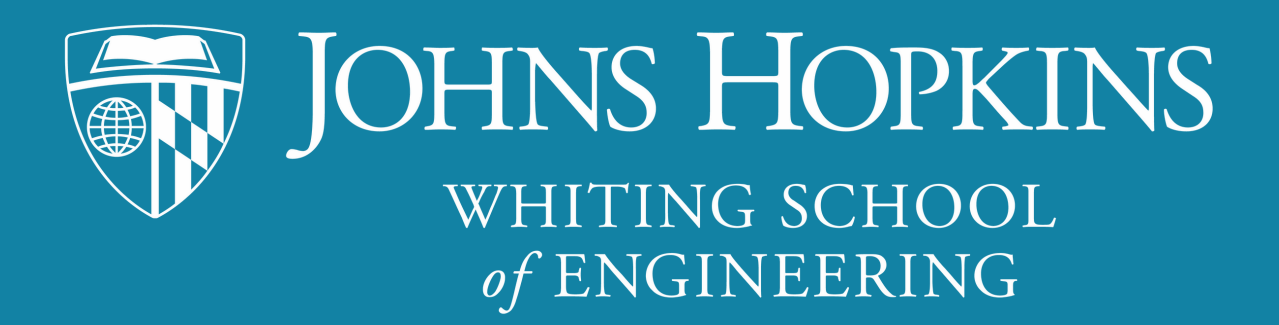


Sustainable Shoes: Utilizing Innovative Technology To Eliminate Chemical Adhesives

CENTER FOR LEADERSHIP EDUCATION



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Faculty Mentor: Jenna Frye
Project Partner: Under Armour



Introduction

300 million shoes are thrown away annually. 90% of these shoes end up in landfills. They take 40 years to decompose. This is unacceptable.

In order to recycle the upper and soles of Under Armour™ shoes, the materials must first be efficiently separated from each other, which is where the difficulty emerges..



Under Armour™ is a global athletic wear giant based in Baltimore. For the past decade Under Armour™ has been pursuing solutions to make their products and their business more environmentally sustainable. Their goal is to design, manufacture and sell fully recyclable shoes.

Defining the Need

Under Armour™ seeks to utilize innovative designs that align with their sustainability goals and improve the component *assembly and disassembly* of their shoes in order to improve reusability.

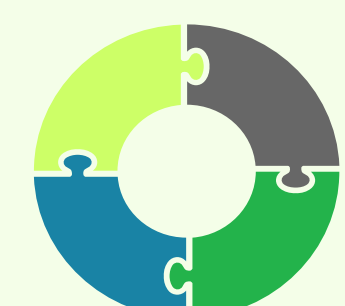
They have come to our team in hopes that our technical backgrounds and detailed research will produce a sneaker design that is aligned with their sustainability goals. Through our partnership we designed a shoe for Under Armour™ so that the recyclable components can be quickly and easily disassembled in order to be reused or recycled to improve sustainability and lower UA's carbon footprint.

Criteria

We conducted a plethora of interviews to collect firsthand technical research and expertise on the textiles, footwear, and sustainable consumer goods market. We interviewed different groups of people including UA employees, university professors, and textile experts. The design criteria below summarizes our most crucial technical findings through research and interviews.



Level of Sustainability



Ease of Assembly



Ease of Disassembly



Athletic Performance



Timeline to Feasibility



Consumer Perception

Meet the Team



Anya, BME '23



Claire, ChemBE '23



Callie, ChemBE '23



Victor, MechE '23



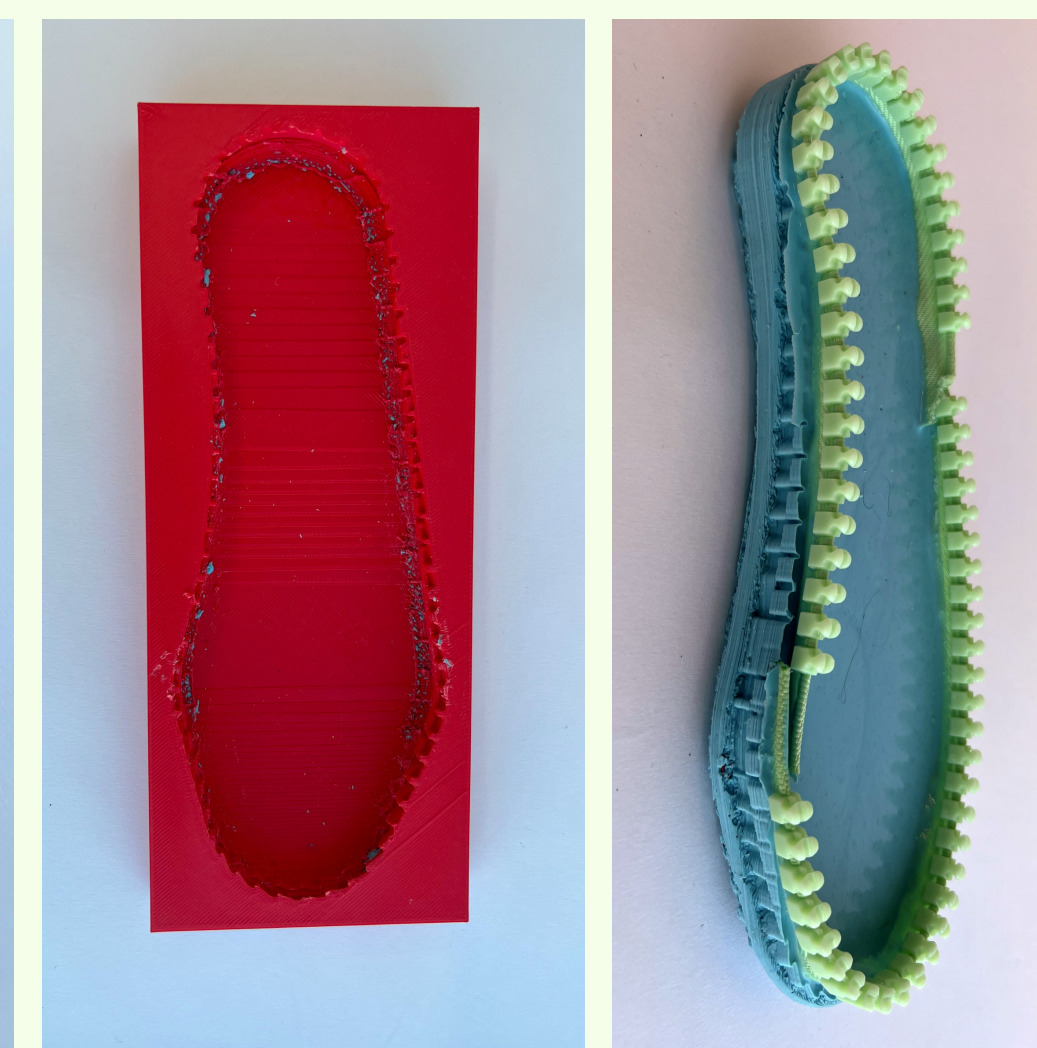
Watch our video!

Solution 1: Zipper Shoe

This solution mechanically zips the upper to the sole by incorporating zipper teeth into the sole of the shoe.



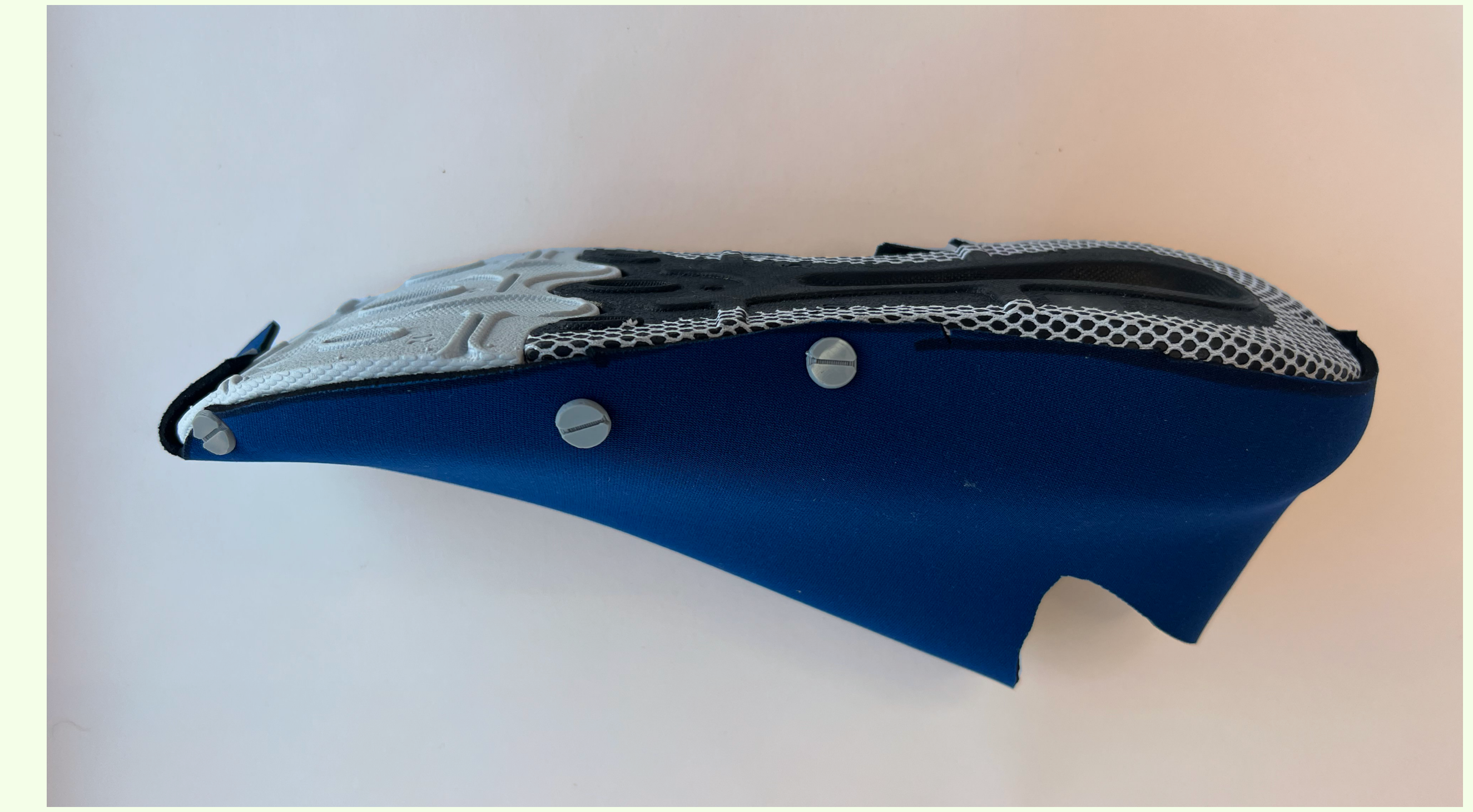
Existing Under Armour™ upper sewn to top half of zipper



Prototype of an industrial mold concept of sole with zipper teeth & external attached solution

Solution 1: Zipper Shoe

This solution connects the upper and sole with a screw-like rivet aligned to the edge of the sole.



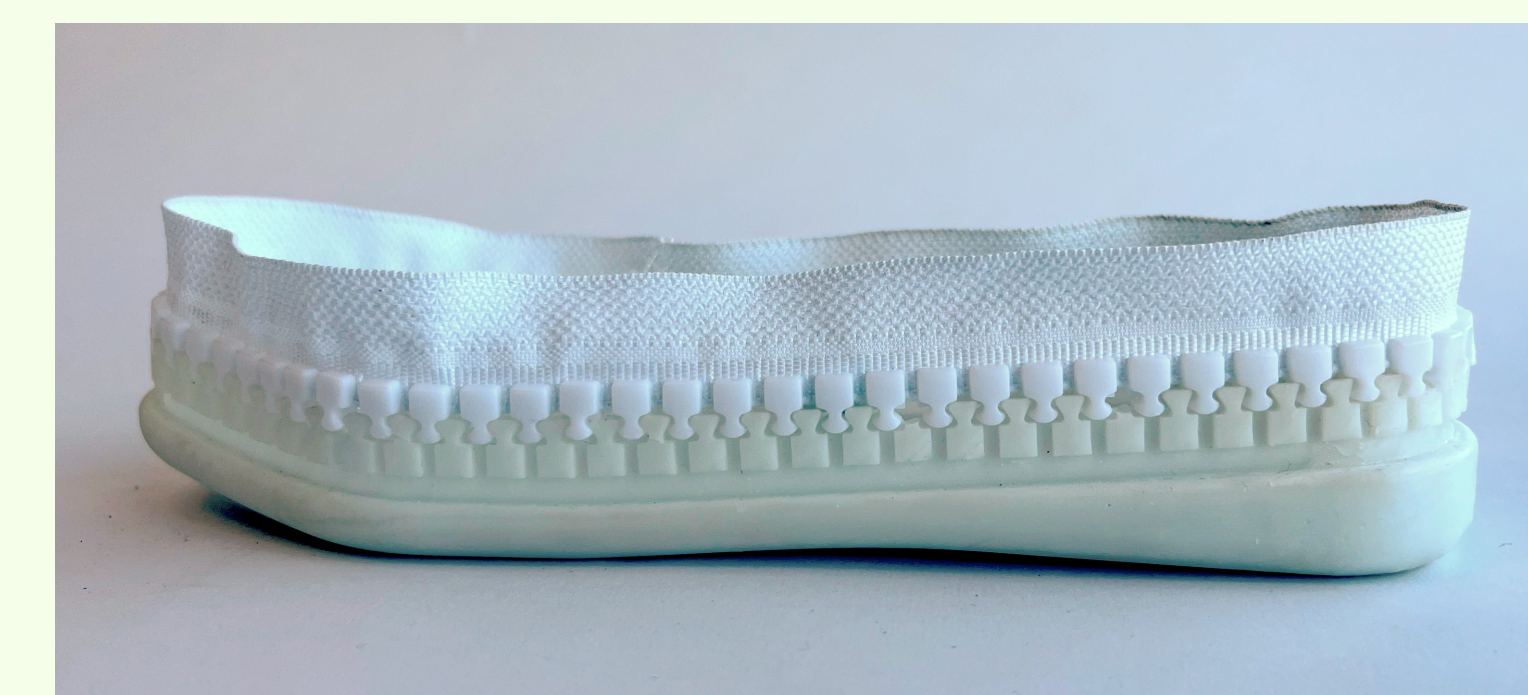
Existing Under Armour™ sole with holes drilled into lateral edges



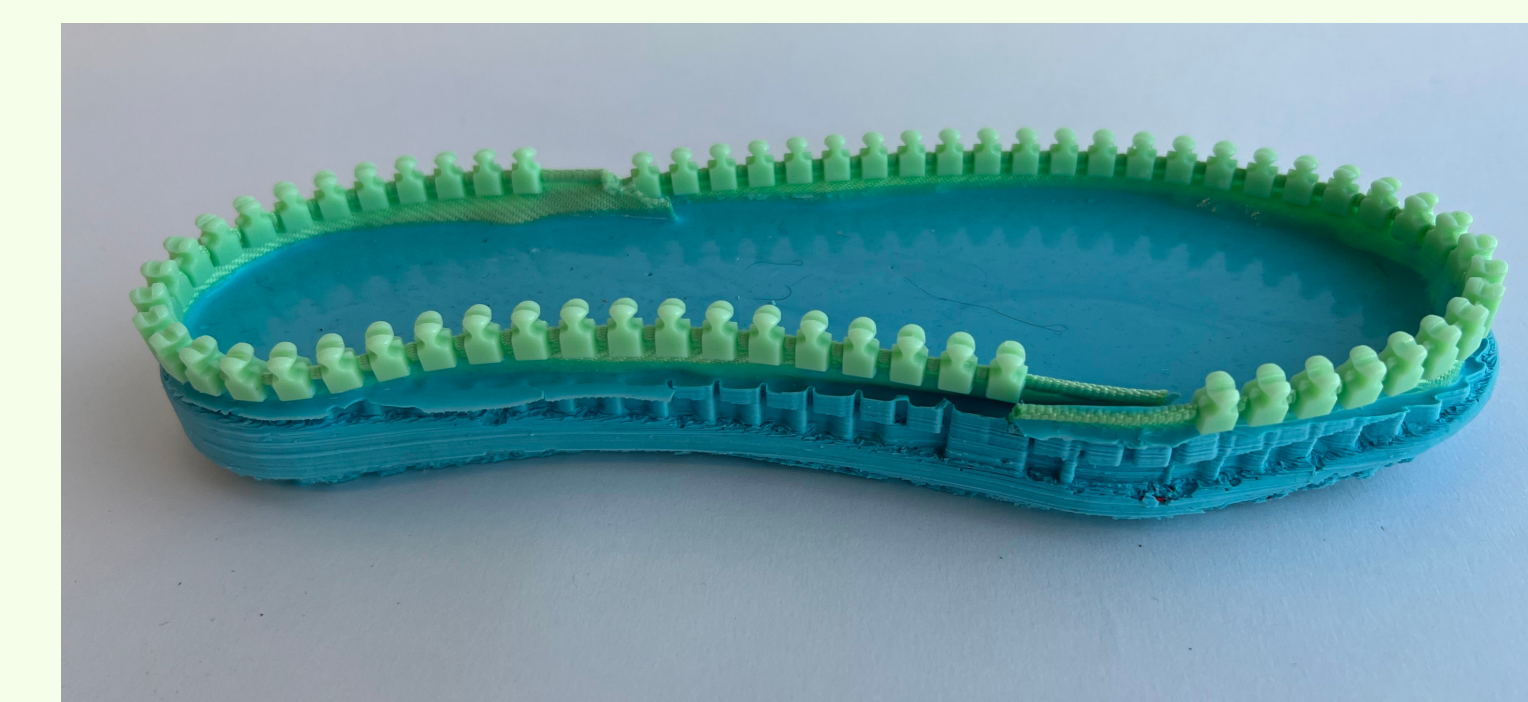
Knit upper fastened to sole with plastic rivets spanning sole length for secure attachment

Testing: Zipper Shoe

Ease of Assembly & Disassembly



Sole assembly takes ~5 minutes via clamp tool



Attaching bottom half of zipper to industrial sole mold cures for ~2 hours

Disassembly via manual unzipping takes ~5 seconds

Integration to UA Manufacturing

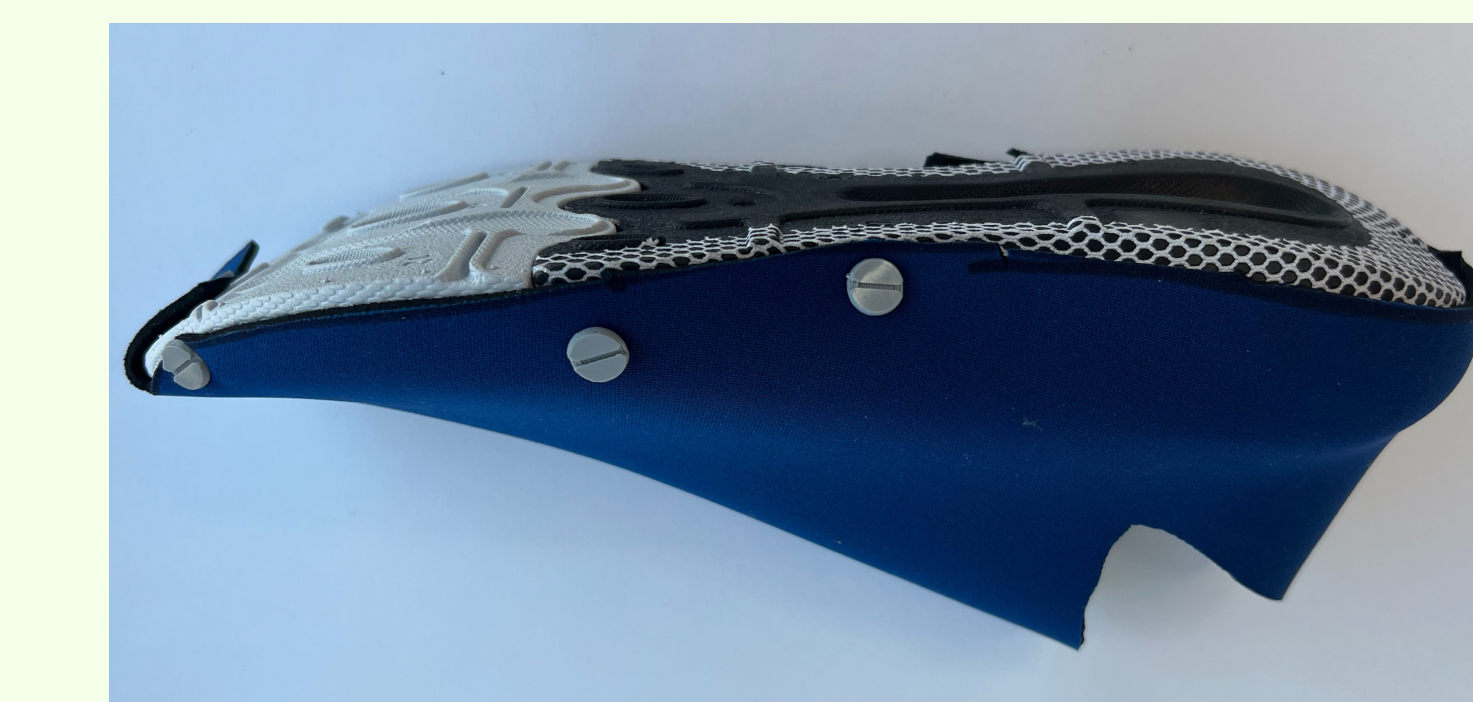
Create Mold	Industrial Molding	Sewing Zipper	Assembly	Recycle
Manufacture a thermoplastic mold of the sole in various shoe sizes (singular investment)	Using an industrial molding process, a recyclable zipper will be added into the cast of the sole mold. (manufacture or external vendor)	Sew zipper to upper using sewing machinery already in UA manufacturing	Manually zip upper to sole (~10 sec per pair)	Manually unzip top upper from sole (~10 sec per pair) leaving all components recyclable

Testing: Zipper Shoe

Ease of Assembly & Disassembly



Drilling matching holes in sole & upper take ~3 minutes per shoe



Rivets manually secured using hammer/clamp in ~55 seconds

Integration to UA Manufacturing

Manufacture Sole & Upper	Manufacture Rivet	Drill Holes	Assembly	Recycle
Manufacture sole & upper with existing processes	In-house production or external supply of recycled plastic screw-like rivets	Drill holes in upper & sole (~3 min per shoe with industrial drill)	Fasten upper over sole with rivets secured with hammer or clamp tool (~55 sec/shoe)	Manually disassemble with pliers (~2 min per shoe); all components recyclable