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About Me

I am a recent graduate with a Bachelor's of Science in Mechanical Engineering (minor in Economics) from the University of Delaware. I am currently working in the Consumer Products industry. My greatest attribute as a design engineer is understanding customer needs; this is ultimately what drives the design process. I would never argue that I have made the most robust product – I excel at identifying key constraints within a project and creating the most viable solution. Throughout my completed projects, whether they relate to consumer products or medical devices, there is a common theme of cost-benefit analysis and working within industry standards to produce the optimal result.

Projects

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Speakman Company

April 2018 - Present

Figure 1: Speakman Reaction showerhead

At Speakman, I was the primary engineer on a NPD showerhead project. My role was to design a new water efficient engine to maintain performance while adhering to EPA WaterSense standards. This was largely an R&D effort to create a unique product. I frequently took inspiration from the Aerospace industry to bring new technology into my designs. I cannot go into further details due to an NDA agreement.

- Evaluated existing showerhead engines (such as the Reaction in Figure 1) using Solidworks CFD and Excel-based calculations to establish a baseline efficiency and performance
- Designed potential showerhead models in Solidworks
    - Multi-functional ability
    - Unique nozzle concepts
- Prototyped concepts utilizing 3D printer and basic machine shop tools
    - Designs needed to be modular and watertight
- Tested prototypes with EPA protocol; iterated designs based on tests and qualitative feedback
- Altered successful showerhead prototypes to improve manufacturability for injection molding

The showerhead models I have worked on are on track to finalize in November 2018 and hit the US market in May 2019.

Gore Hernia Patch Manufacturing

Senior Design Project (Fall 2017)
Team Lead

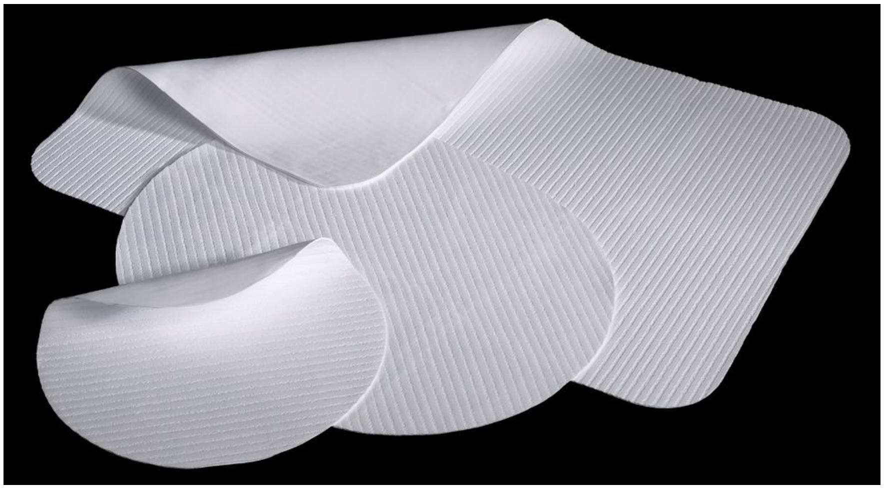

Figure 2: Gore Dual-Mesh Soft Tissue Patch

For my Senior Capstone Project at UD, I worked with two Biomedical Engineering students and one fellow Mechanical Engineer to optimize the manufacturing process for Gore hernia patches. The main design constraint was the strict absence of imperfections in each patch. This was difficult given the resilient properties of the patch material. Addressing QA and process time concerns, our scope was to:

- Alter current manufacturing methods
    - Used basic laser and hydraulic press equipment at University to prove concepts
    - Constructed process test protocol and created experiment (DOE) to be run at Gore facility by machine operators
    - Analyzed test results in JMP and made recommendation based on output quality and process time/financial savings
- Explore alternative manufacturing methods
    - Constructed small hobby CNC with stock plans and stepper motors
        - Final design attached to industrial CNC router
    - Designed and 3D printed rotary cutting attachment for CNC to cut hernia patch patterns
    - Prototype served as a proof of concept to invest in a large scale rotary-cutter CNC

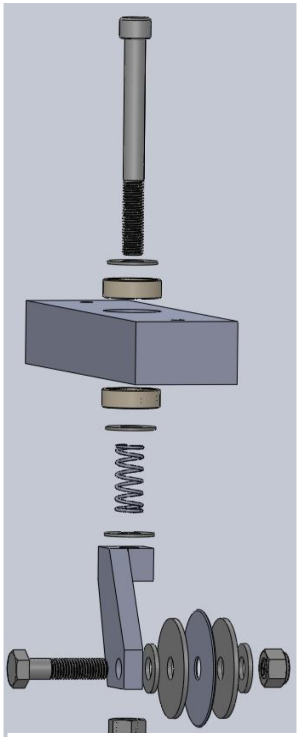

Figure 3: Exploded assembly of CNC cutting attachment

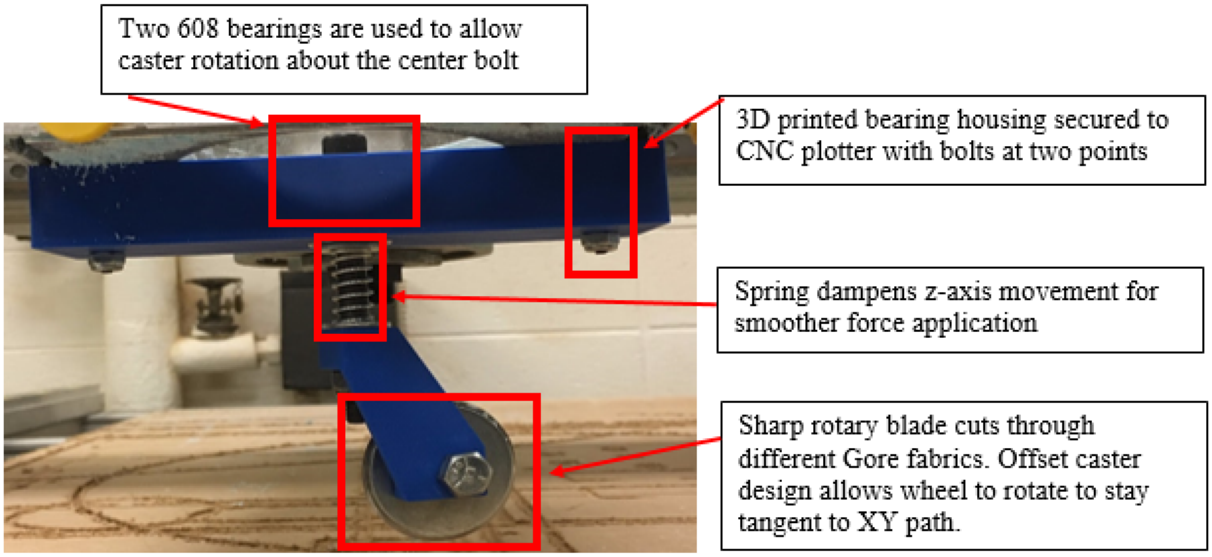

Figure 4: Final prototype attached to industrial CNC plotter

My biggest personal contributions were:

- Organization and timeline (Gantt) planning as team lead
- Academic experience with DOE and constrained optimization
- CNC & Laser expertise
- Solidworks design and assembly
- Load calculations
    - Solidworks FEA
    - Hand calculations

3D Printing

FabNewport Internship (Summer 2017)

Figure 5: Prusa i3 "print farm"

During my internship at FabNewport, a community Makerspace, I led the 3D printing and design programs. This entailed teaching CAD (Autodesk Fusion 360) to students ranging from Middle School to working professionals (generally teachers looking to incorporate tech into classroom). My other main role was maintaining 3D printers. FabNewport had limited experience with 3D printers when I arrived, so I utilized a combination of documentation and online resources to become proficient at maintain, and also training others, to use the 3D printers.

- Disassembled and assembled when needed to repair broken machines
- Calibrated and managed machines to ensure successful prints
- Improved machines with modifications
  - Printed extra machine supports to reduce vibrations
  - Added PID temperature control
- Used Octoprint with Raspberry Pi to standardize settings and enable wireless print queue

Siemens Healthcare Test Equipment

Junior Design Project (Spring 2017)

The client (Siemens) used plastic screws to connect fluid tubing to fluid test machines. These screws needed to be tightened to an exact torque to provide a perfect seal while avoiding overtightening. Prior to the project, these screws were tightened by hand using a torque-reading wrench, providing room for user error. The scope of the project was to provide a foolproof method of applying the necessary torque. The design pictured below was the final proof-of-concept.

- DC motor was chosen to apply torque (as opposed to a mechanical solution) due to the predictable relationship between torque and input current
    - 3D printed coupler delivered torque to unique test screw using rubber-lined driver head
    - Arduino measured voltage drop across a resistor in series in order to record current
    - Power was cut when desired torque was reached
        - Accurate to deviation of 6%

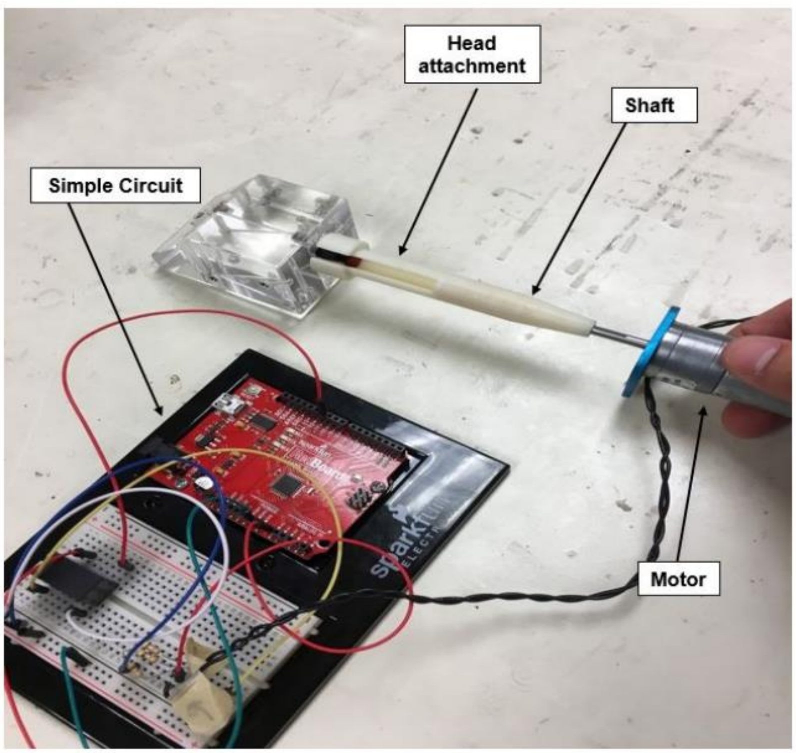

Figure 6: Full prototype applying torque to medical test screw

Melissa & Doug Toy Design

Sophomore Design Project (Spring 2016)

The requirements for this design project were to construct an engineering themed toy intended to stimulate interest in STEM fields. Working with an Early Childhood Education major, my team was assigned the target age group of 2-3 years old. The low target age required designs to be simple yet engaging. In addition, products intended for children have many safety standards that must be taken into consideration, such as minimum part size and structural integrity. The final toy design was the “Excavation Station” pictured below.

Figure 7: Final toy prototype, the "Excavation Station"

In the box, there were three different weights of metal (shavings, I-beam and pipes) sealed in by Plexiglass. Three different toy vehicles had varying-strength magnets in them which correlated to the magnetic strength necessary to move their respective metal. Children using the toy were able to see the cause and effect from different magnetic forces; this was contrary to other toys on the market, which simply utilize magnetic forces. My team received second place for Best Design in peer voting.

- Considerable number of design constraints
    - ASTM standards (toxicity, part size)
    - Early Childhood Education benchmarks for stimulation and ability to sterilize
    - Market factors (price, production time, production methods)
- Box constructed using aesthetically pleasing woodworking techniques
    - Myself and another team member fixed abandoned CNC router to engrave logo on box side
- Toy cars constructed by slicing 3D models, laser-cutting each layer, and laminating
    - Design consideration on thickness of slices

Custom Skateboards

2011 – 2015

As a hobby, I used to design and build longboard skateboards because it was cheaper and allowed for full customization. This was the process:

1. Design board shape in Google SketchUp
2. Use homemade hot-wire foam cutter to shape insulation foam into desired board cross section
   - This was very important – the concave shape was based on personal preference of feel, but also provided stiffness
   - Playing with different concave shapes, such as a "w-concave" (where the concave follows the foot arch), was new to the market at the time and exciting to design

Figure 8: W-concave board blank curing in vacuum bag

3. Glue sheets of veneer together against foam mold in homemade vacuum bag, and let set for 24 hours
   - Vacuum bag was vinyl and had a one-way valve, similar to those used in VARTM
   - Add composite weaves (fiberglass, carbon fiber) if desired
4. Print out board shape and trace onto skateboard blank. Cut out with jigsaw. Drill mounting holes for trucks. Sand out "wheel wells" to avoid interference between board and wheels

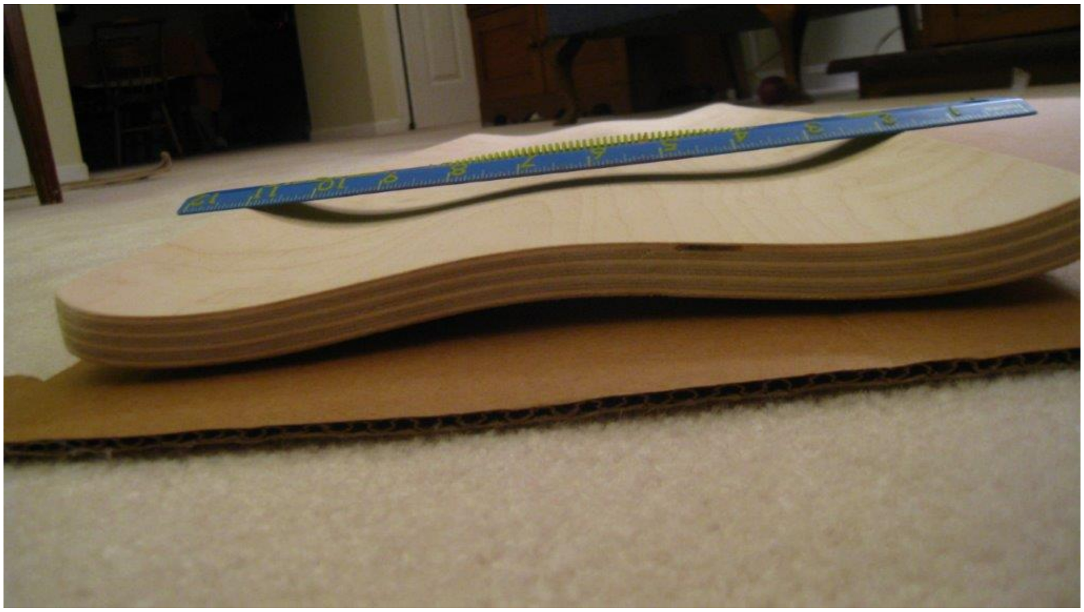

Figure 9: Shaped and sanded board with w-concave

5. Sand board smooth and seal with polyurethane

Figure 10: Completed board with trucks and wheels mounted (same board with w-concave)

I designed and built numerous boards over those years and learned a great deal about the process and myself at this time. This is where I pushed my self-starting ability by learning beam theory, optimal composite placement, and composites manufacturing before I knew I would be an engineer. I also failed quite a bit: my first board snapped in half the first time I stood on it. This only encouraged me to improve and deduce why the designs were failing. The experience made me interested in consumer products, because when I would sell boards, designs had to respond to peoples' wants. This drove me to try unorthodox designs that large companies were experimenting with.