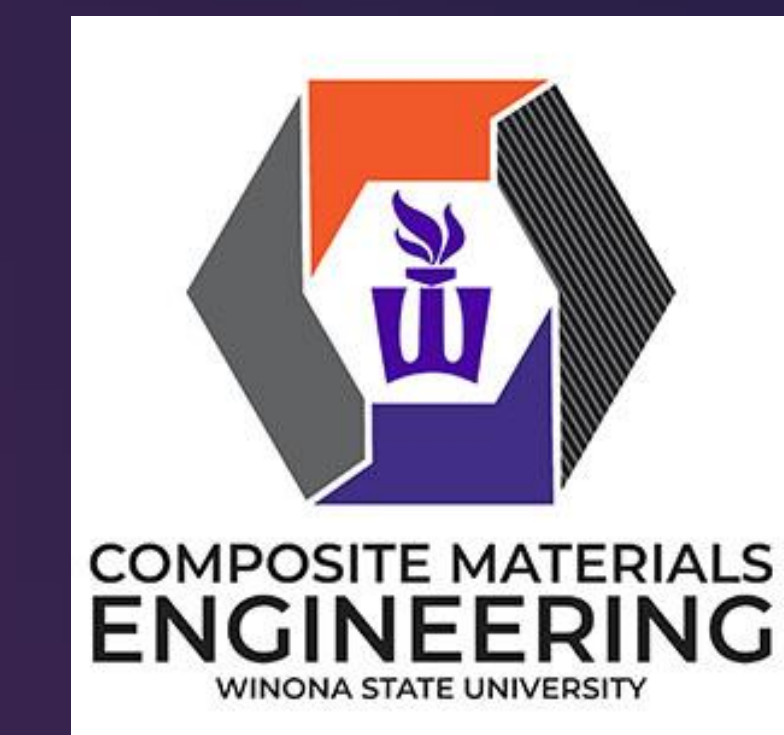




Carbon Cornhole

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Composite Materials Engineering



Abstract

The purpose of this design project is to create a durable lightweight yard game for players of all skill levels. Carbon Cornhole is a composite improvement on the already popular yard game, cornhole, with a new twist. The final product is based on valued feedback from customers. The board is manufactured of carbon fiber/epoxy sandwich panels with a closed cell foam core. The composite design provides a lightweight product. The panels are specifically manufactured to retain their mechanical properties when exposed to outdoor elements such as water and UV radiation. The addition of inlaid LED lights and two new "skill holes" allows for a new playing experience and the ability to play at night. The addition of 3D printed feet allows for the board to be played on multiple different outdoor surfaces such as grass, gravel, or concrete. Testing on the finished product will ensure the customer experiences years of enjoyment from their purchase.

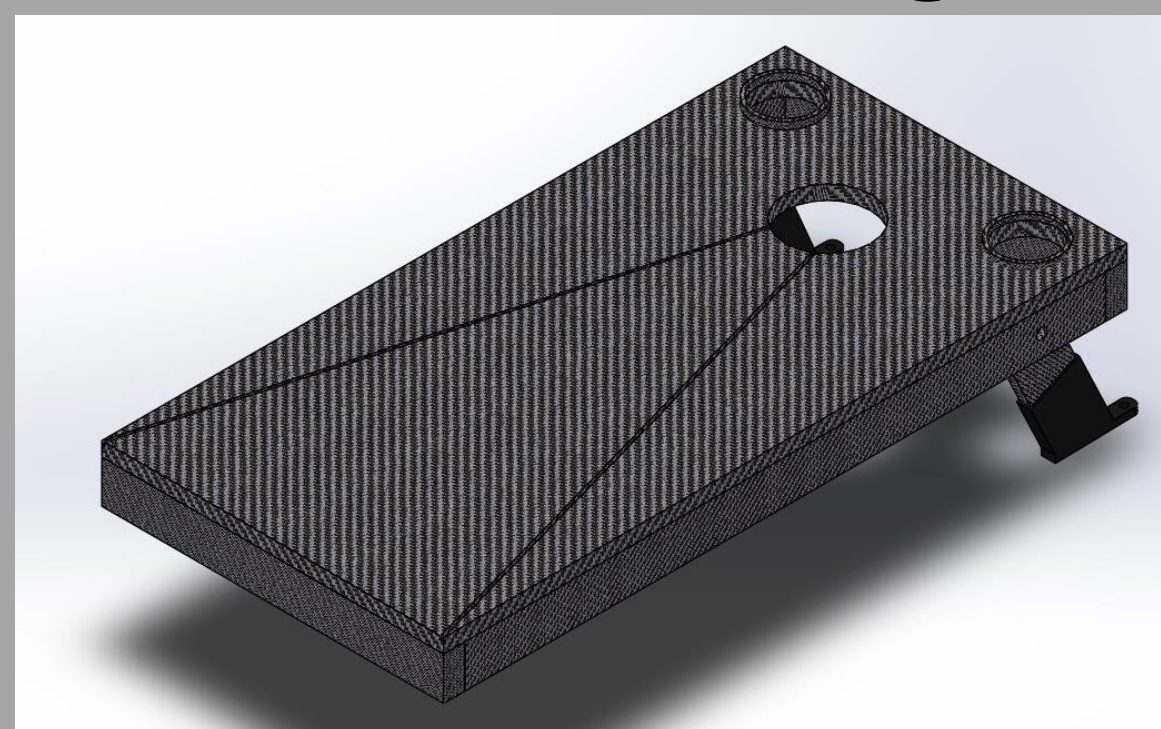
Meet the Team



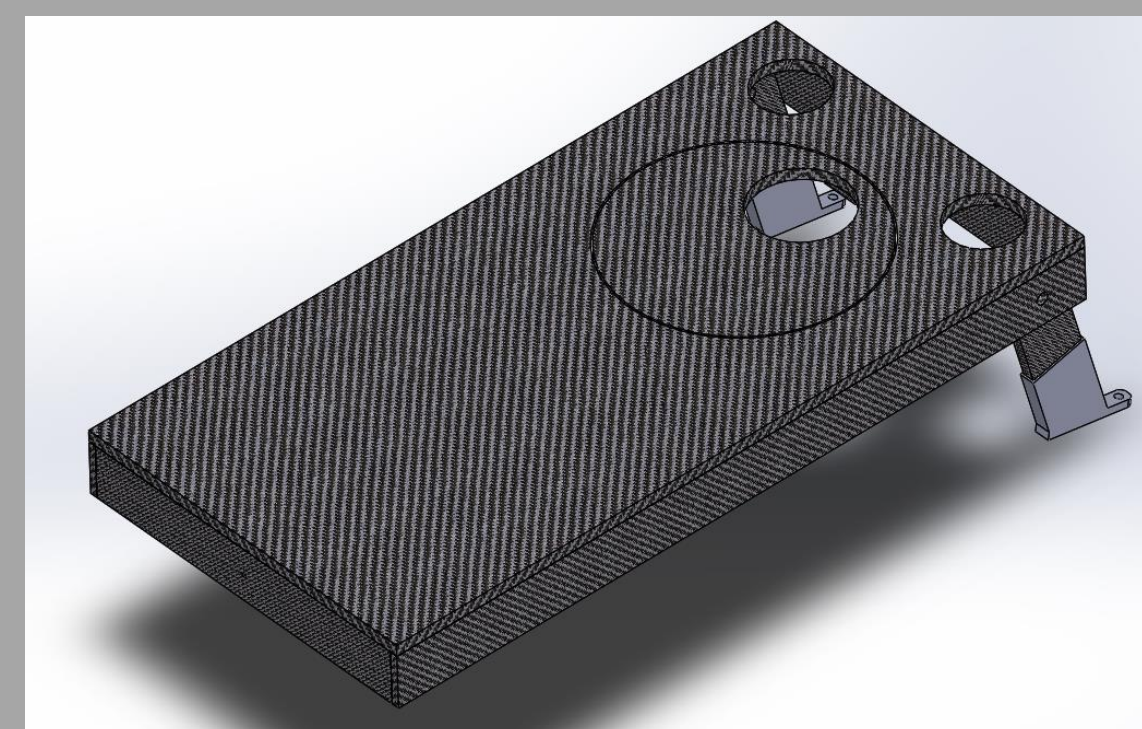
Manufacturing

1. Wet Hand Layout
 1. Three layers of Carbon fabric and four layers of Glass fabric were cut at 53" x 28" for each of the two panels that sandwiched a 0.5" thick foam core.
 2. Silicone strips were used to create the channels for the lights.
2. Braided Sleeve Process
 1. Side pieces, front and back pieces, and legs.
 2. Carbon Fiber woven sleeve was pulled over the 0.5" foam core then wetted out with Epoxy.
3. 3D Printed Parts
 1. Leg attachments and the risers.
4. Assembly
 1. After all the parts were manufactured, the top panel, side pieces and front and back pieces were bonded together using an adhesive.
 2. The legs were attached using a bolt and nut.
 3. The feet attachments were attached using Velcro.
 4. The risers were pressure fitted to allow for easy assembly and removal.

Design Alternatives



- Design 1
- Light Strips
 - Skill holes
 - Skill hole risers



- Design 2
- Rotating center hole
 - Skill holes

Design Concerns

DESIGN CONCERNS CATEGORIES	DESIGN CONCERNS	DEFINITION	ASSESSMENT MEASURES	
			REQUIREMENT	GOAL
Physical	Board Dimensions	Length and Width (in)	Dimensions of playing surface should be 2'x4' ± 0.25"	XXXXXXXX
	Lightweight	Lightweight (lb)	XXXXXXXX	Minimum
	Smooth Surface	Surface Roughness (µm)	55	Minimum
Structural	Impact Resistant	Can withstand impact of items thrown (9-lb)	16	XXXXXXXX
	Flexural Strength	Weight of person stepping on center of board without failure (lb) (80% of 50th percentile weight, assumption is an accidental step backwards onto the board)	150	XXXXXXXX
Environmental	UV Radiation Resistance	Retained strength following an extended period of UV exposure (%) (ASTM G154, Cycle #2, 3 day test length)	95	XXXXXXXX
	Water Resistant	Flexural strength (ASTM D790) retained following exposure to water for 24hr (%)	90	XXXXXXXX
Human Engineering	Cool Design	Portion of visible surface area made with composites (%)	XXXXXXXX	Maximum
	Easy Setup	Setup Steps (#)	XXXXXXXX	Minimum
Life Cycle	Warranty	Warranty Life (yrs)	1	XXXXXXXX
Cost	Affordable Price	Cost plus profit margin of 25%(5)	520	Minimum

Wet Hand Layout

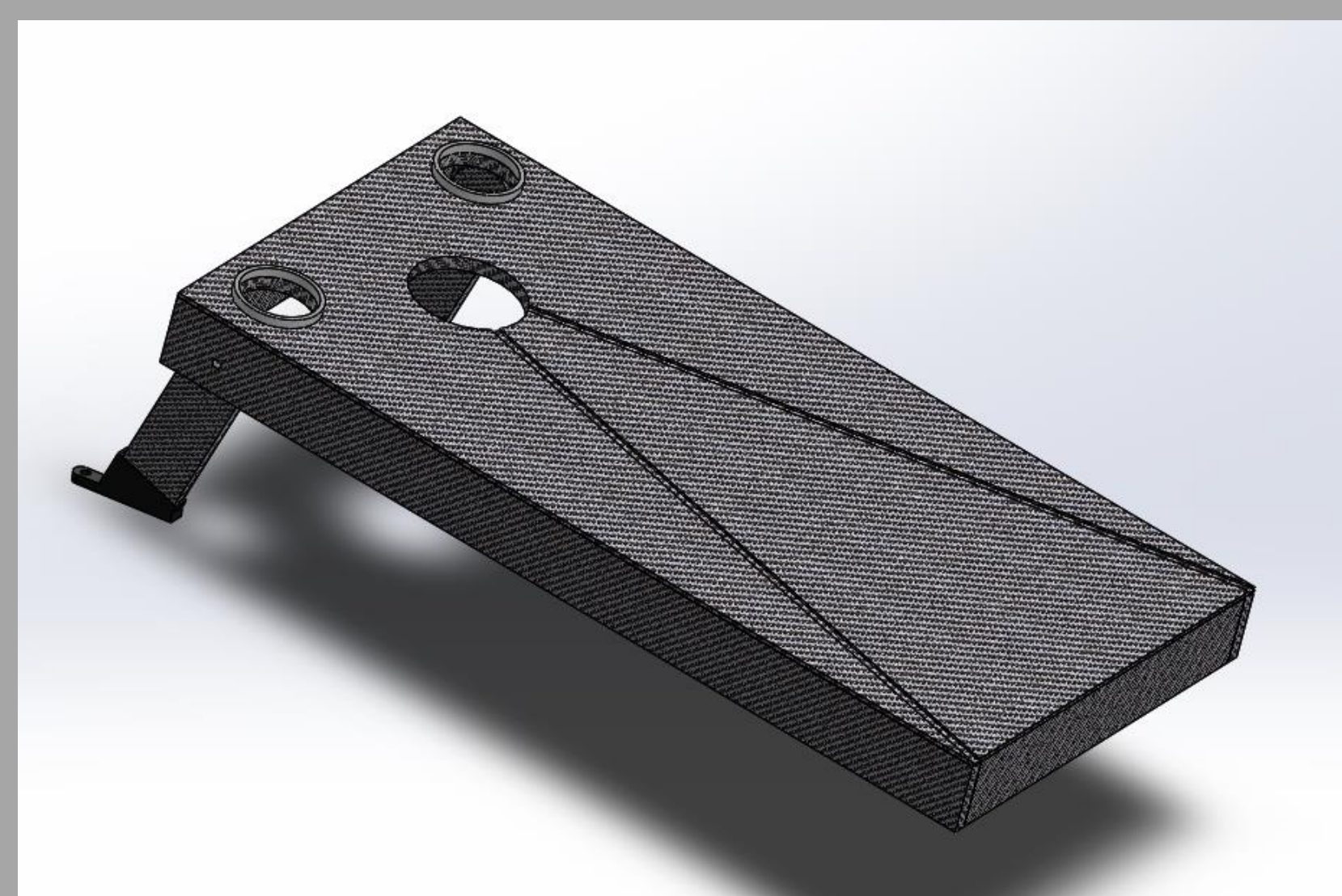
Foam Core

Silicone Strips

Braided Sleeve Process



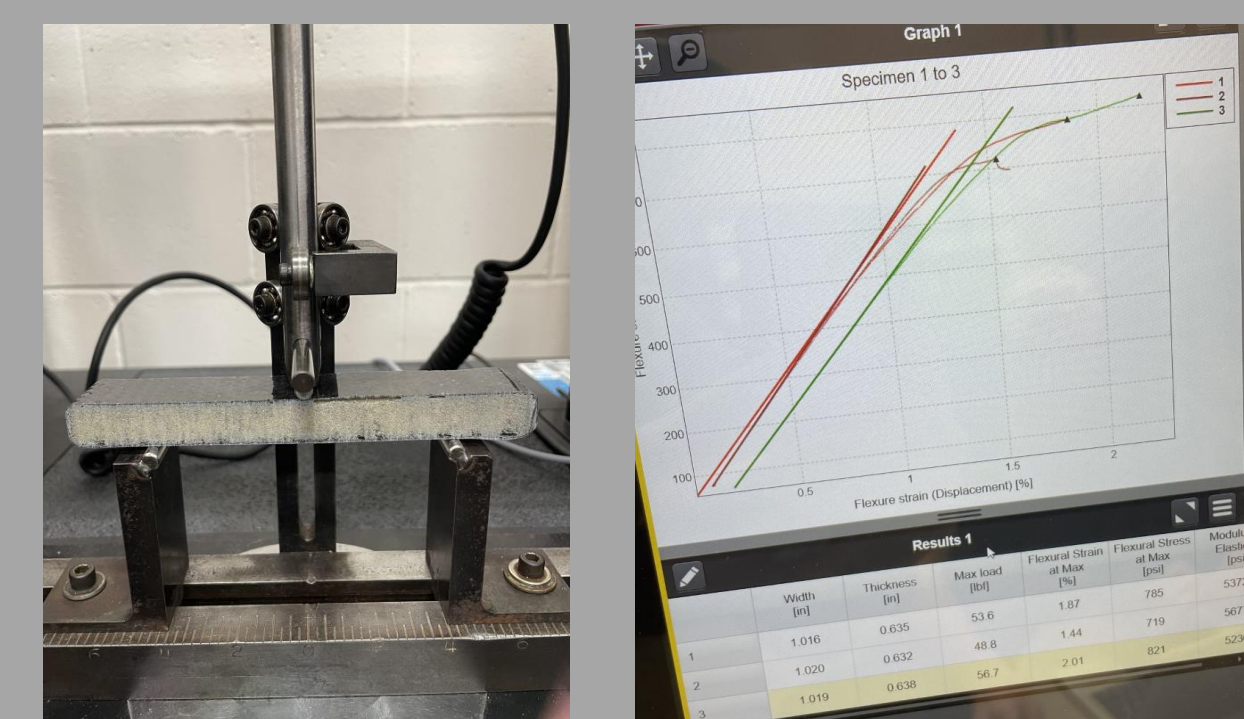
Final Project



Qualification Testing

The following tests were conducted:

- 3 – Point Bend (Max Strength) ASTM D790, 3 specimens each, all at RT.
 - Control
 - 24-hour water exposure
 - UV exposure (ASTM G154)
- Impact/Drop Test
- Dimensional Inspection
- Visual Inspection



Conclusions

The final design will be constructed using a sandwich composite involving a foam core surrounded by layers of fiberglass and carbon fiber. The created design will be ideal for cornhole players looking for a light-weight, and sturdy cornhole set for indoor and outdoor play.