Department of Mechanical Engineering
THE UNIVERSITY OF UTAH

Fold-A-Ball

Omar Alkhayat, Curtis Casados, Stephen Liljenquist, Matt Mott, and Jordan Munsey
Faculty Advisor: Kenneth d'Entremont

Engineering Challenges

Creating hinges that don't exist

Unable to find pre-existing hinges that fit our needs, we designed some out of 16 Ga. (approx. 1/16" thick) stainless steel (Figure 2). We ran FEA simulations (Figure 1) to test the the strength of the hinges at their most vulnerable points. These tests resulted in a safety factor of 5.24.

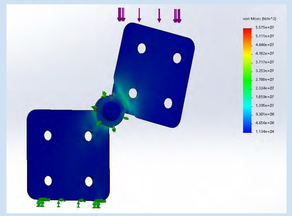


Figure 1. FEA Hinge Analysis

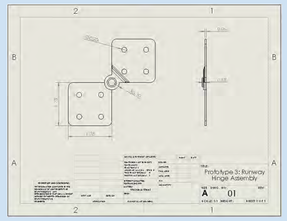
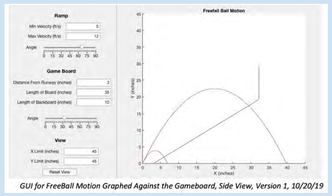


Figure 2. Hinge Design Drawing

Modeling game play physics to maximize fun

In order to design the ramp, we created a GUI (Figure 3) to model the physics of the ball motion and track the ball speed. Subsequently, we were able to design the ramp (Figure 4) to align the balls with the pockets in the game board.



GUI for FreeBall Motion Graphed Against the Gameboard, Side View, Version 1, 10/20/19

Figure 3. GUI Model

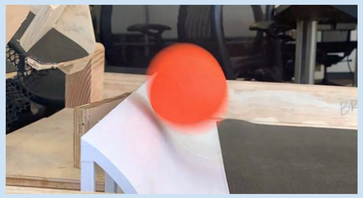


Figure 4. Prototype Ramp

Making it light *and* sturdy

The runway is one of the weakest parts of our product. Consequently, we did both an FEA simulation (Figure 5) and a displacement test to analyze the strength of the runway. We then compared the displacement results produced by the FEA simulation to the actual displacement of the runway (Figure 6).

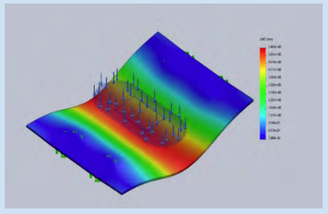


Figure 5. FEA Runway Analysis

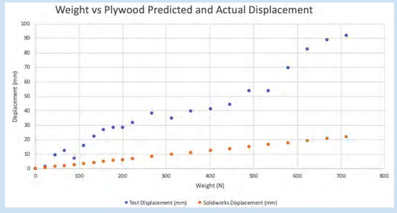
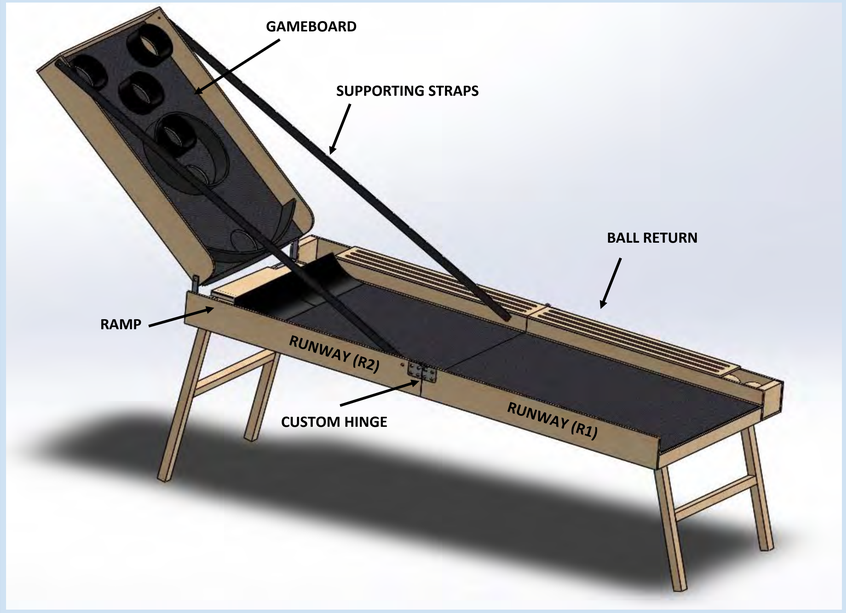


Figure 6. Displacement Comparison



CAD Model of Prototype 3

INTRODUCTION:

Many iconic arcade games are confined to the building in which they are originally placed, destined for seldom use. Our goal was to maximize portability and playability while minimizing costs. Employing engineering design to remove barriers such as size, weight, and cost, allowed us to create an accessible game for our targeted age group that can easily fit in the backseat of a car or any room.

OBJECTIVE: Take a popular arcade game, *but:*

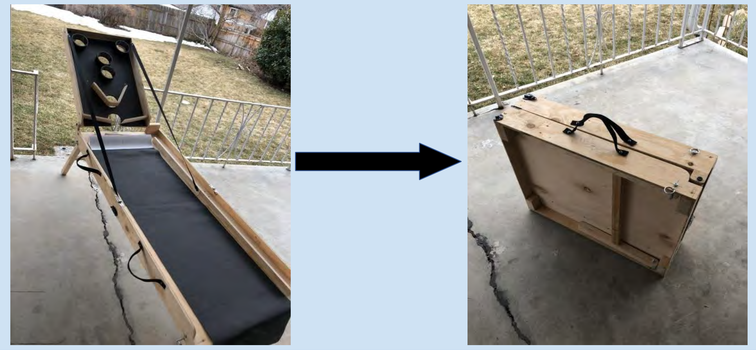
- Undercut current $700 - $5,000 price point to < $200
- Portable size allows for game to easily fit in the average car
- Decreased overall weight to allow long distance carrying
- Increased height to meet targeted audience average height

Engineering Metrics

Metric	Specs	Goal	Pass / Fail
Total Weight	27 lbs	< 30 lbs	Pass
Dimensions	25" x 30" x 8"	6 x 30 x 23	Fail
Max Holding Weight	50lbs	> 30 lbs	Pass
Noise Level	72 dBs	< 75 dBs	Pass

Yes, this giant folds!

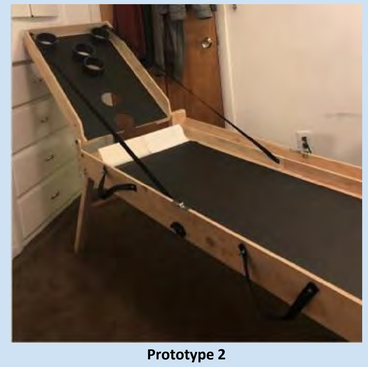
(Full size game to the size of a large suitcase)



Many functional prototypes:

Preliminary Design

Prototype 1



Prototype 2

Prototype 3

Corona Virus and its DASTARDLY PLANS

We were unable to finish a third physical prototype as progress was interrupted due to the COVID-19 pandemic. **Rest assured!** We'll be moving forward and finishing it this year!