

Microdrone Obstacle Course

A Midterm Project by Thomas Renck
ITGM705, October 2014



Part 1: Proposal

To provide a fun new challenge to owners of remote control microdrone toys and to serve as a platform for increasing pilot skill.



Estes Proto-X Microdrone

A microdrone is a tiny remote controlled quadcopter. The term quadcopter comes from the fact that the device has *four* propellers which work together to fly the device in a very similar way to a helicopter. Quadcopters are a result of recent advancements in digital sensor technology. Even just three years ago, the sensors required for a quadcopter were not sensitive enough to achieve stable flight. I find it particularly fascinating that in just a few years this technology went from non-existent to where we are today, where anyone can buy a tomato-slice sized quadcopter toy for \$29.99.

Design Statement

The purpose of this project is to design a desktop obstacle game to challenge the flight skill of pilots who have achieved a mastery of normal flight. The game consists of a game board and various plastic elements such as rings to fly through and landing pads of varying difficulty. Each element is assigned a point value for completion. Players are challenged to accumulate the most amount of points during each run.

Audience

Owners of microdrone toys who are looking for a new challenge.

Motivation

Flying a microdrone is a blast and I'm always trying to come up with a challenge from the surroundings. With this game, the obstacles are intentionally designed for great fun as well as challenge.



Part 2: Visualization

Inspiration Board

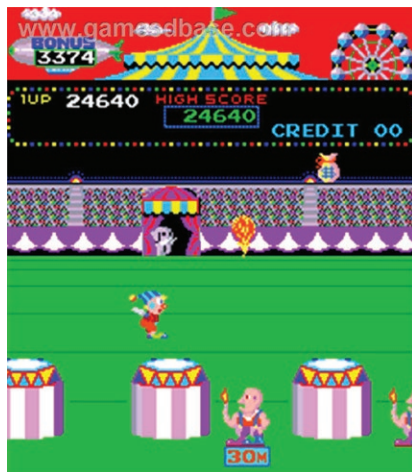
Inspiration for this project was based on classic carnival games and circus elements.



Circus Charlie (1986) NES



Carnival Games (2010) iOS

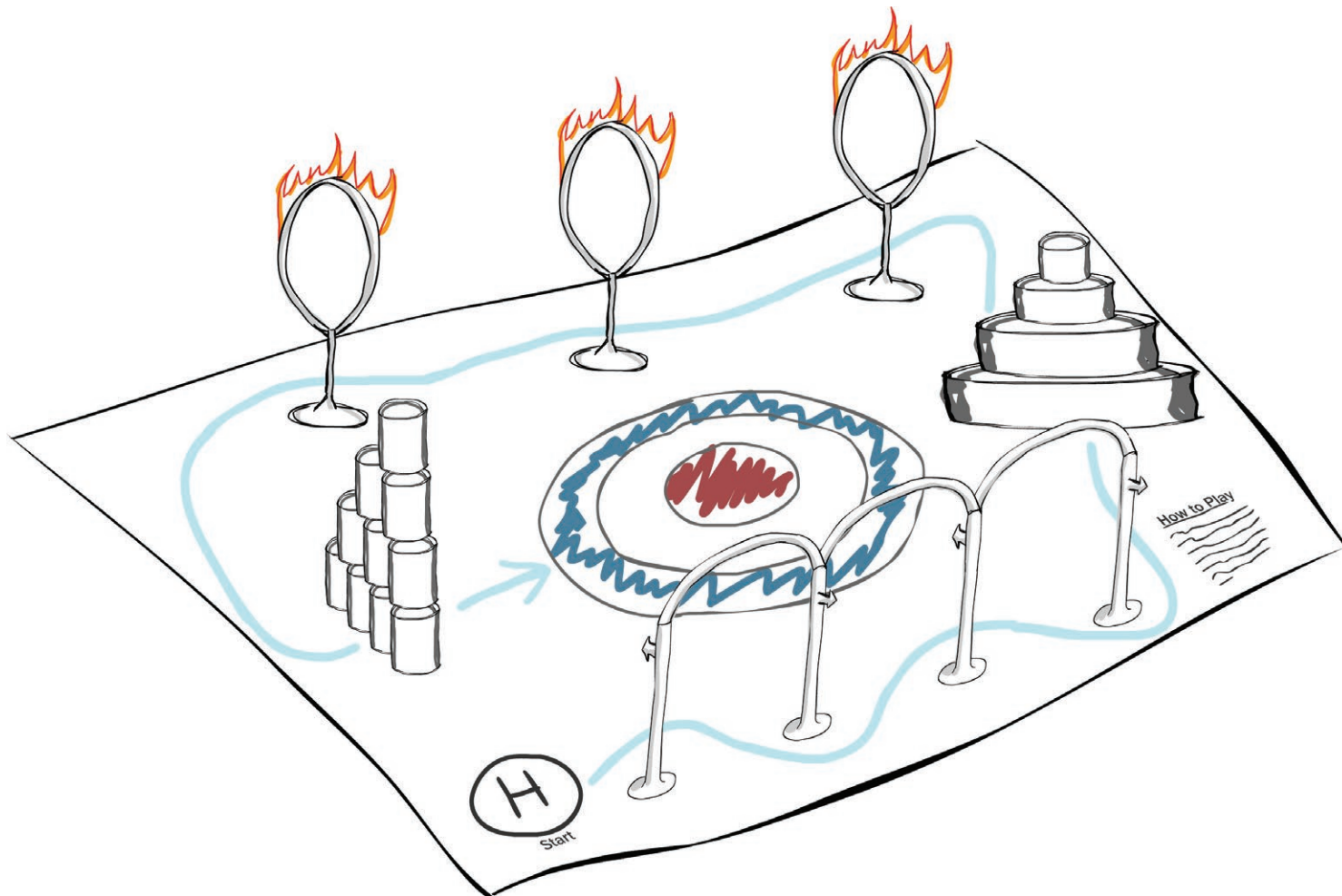


Circus Charlie (1986) NES



Concept Sketches

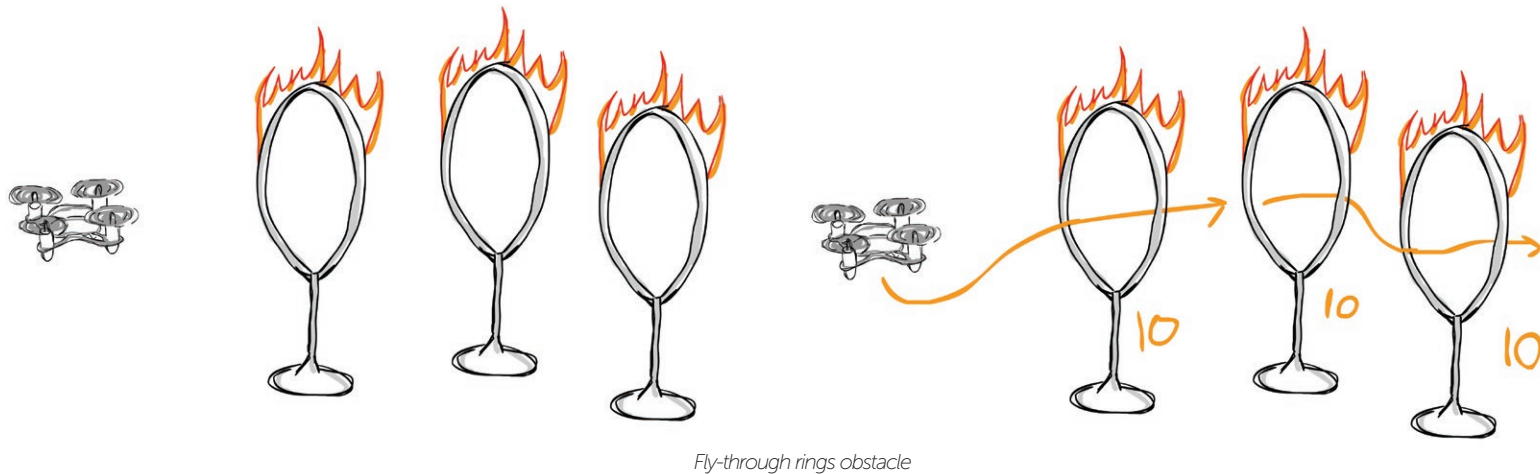
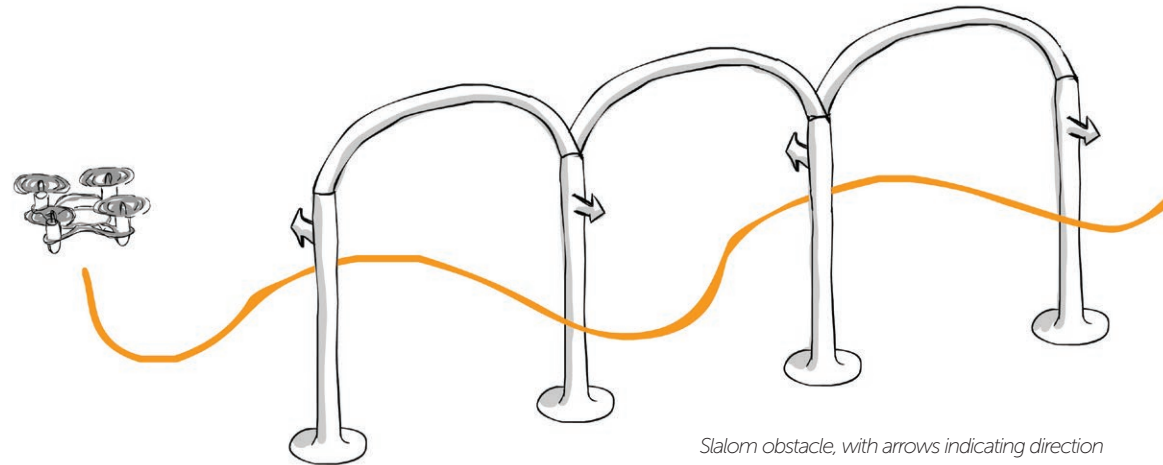
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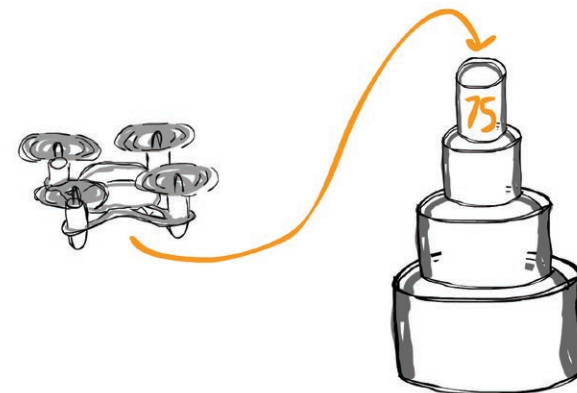
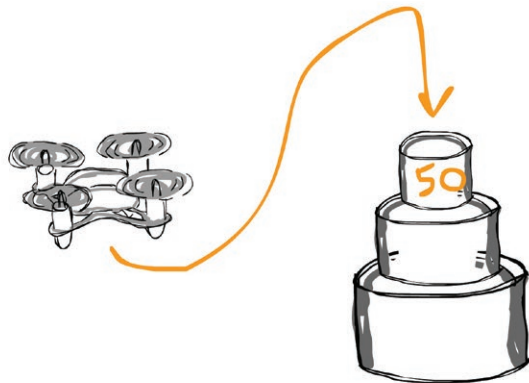
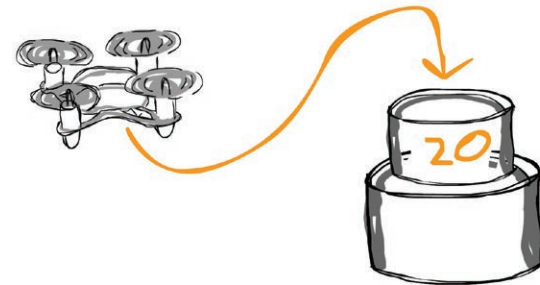
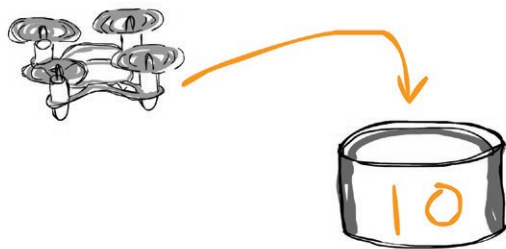


Game board with obstacles in place. Directions printed on lower right corner

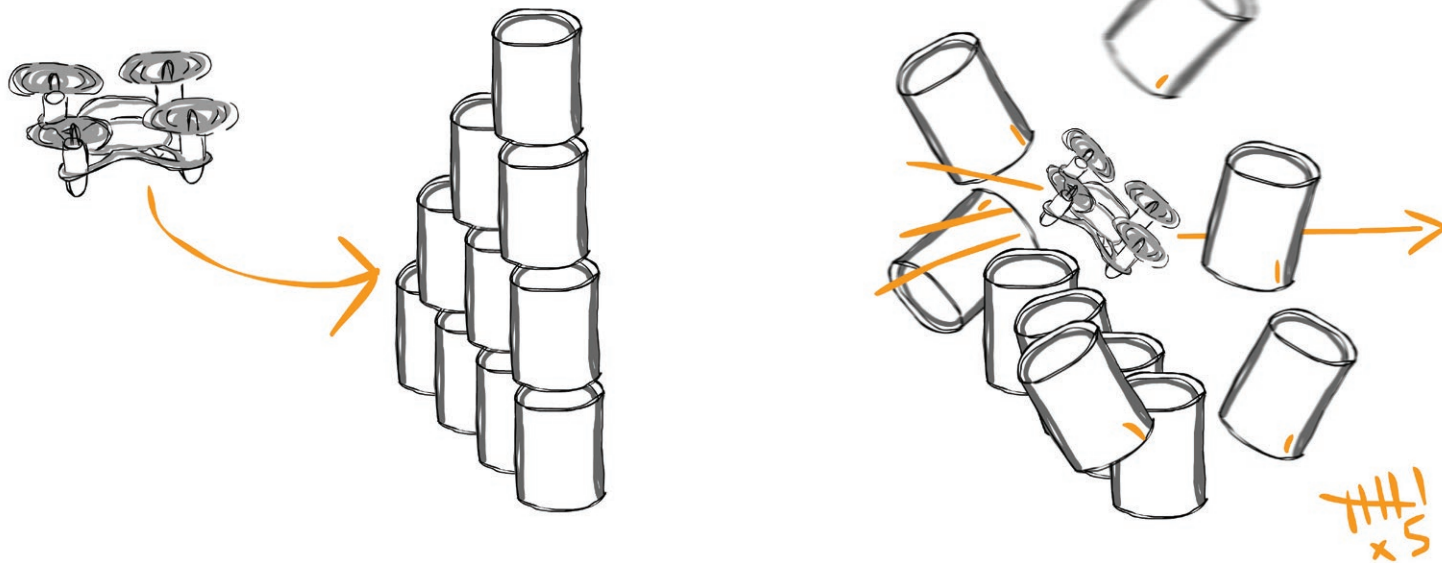
Concept Sketches

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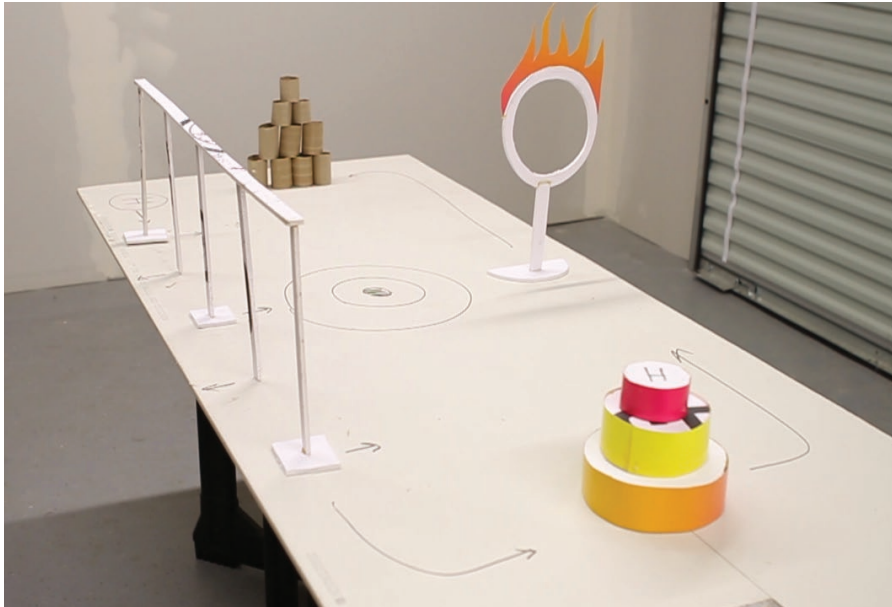


Landing pad tower obstacle



Knockdown tower obstacle. Five points for each can knocked over.

Part 3: Prototype



Foam-board prototype

Prototype

A prototype of the game board and obstacle elements was created using foam-board.

Prototype Notes

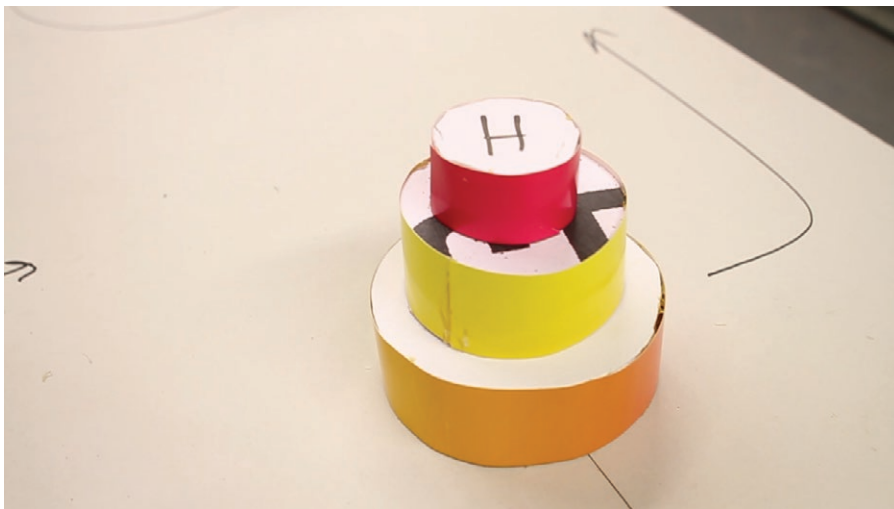
While creating the prototype it became obvious that most of the obstacles would need to be scaled up from their original design. This is due to the relative maneuverability of the microdrone, the original designs would be too small and difficult.

After being scaled up, the obstacles were ready for user testing. See the following pages for photos of the prototype and notes on the testing process.

To see a video of the prototype testing please visit the following URL
https://www.youtube.com/watch?v=vF8mTRTVs_Y

Prototype Photos

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Beginner Play

Start with an empty board. Take turns placing drone at the starting pad and flying to the finish bullseye. When one or more players reach 50 accumulated points, add one obstacle to the course. Now take turns starting at the start pad, attempting the new obstacle, and landing at the bullseye. Continue this, adding one new obstacle each time a course is completed successfully without a crash. Keep track of points accumulated for each obstacle. The game ends when any player completes the full course with all obstacles, the player with the most points wins.

Advanced Play

Start by setting up the full obstacle board. Take turns piloting the course and accumulating the set amount of points for each obstacle. Your turn is over if you crash. The player with the highest score after five rounds of flights is the champion of the obstacles, and the winner.

For an added challenge fly each round simultaneously instead of taking turns!

Point Values

Slalom - 10 points per gate

Landing Pads - As listed

Rings - 20 points per ring

Crash Tower - 5 points per barrel knocked over

Prototype User Testing Results

Prototype used to test obstacle design and game difficulty on five individuals of varying skill level.

Test Subjects

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Name   (YO S Exp)
+ Jason (28 M Low)
+ Ian   (28 M Med)
+ Alex  (28 M High)
+ Megan (28 F Low)
+ Tim   (21 M High)
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Test Notes

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Jason - (Beginner+) Most obstacles were too small to accurately navigate for a beginner pilot. First tier landing zone only. Did knock over most of the tower OK. Slalom was not possible!
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Ian - (Medium pilot skill) Made it through the ring after 5 tries. Gave up on slalom. Made it to second tier landing pad but gave up on third.
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Alex - (High skill) After practicing each element was able to do each element fairly well in a few tries. Noted that slalom was hardest but with the right technique (in and out forwards/backwards, standing to the side of the slalom) it is possible to do in one go.
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Megan - (Beginner) Can fly in open spaces but precision flight has not developed yet, this game does not work for beginners!
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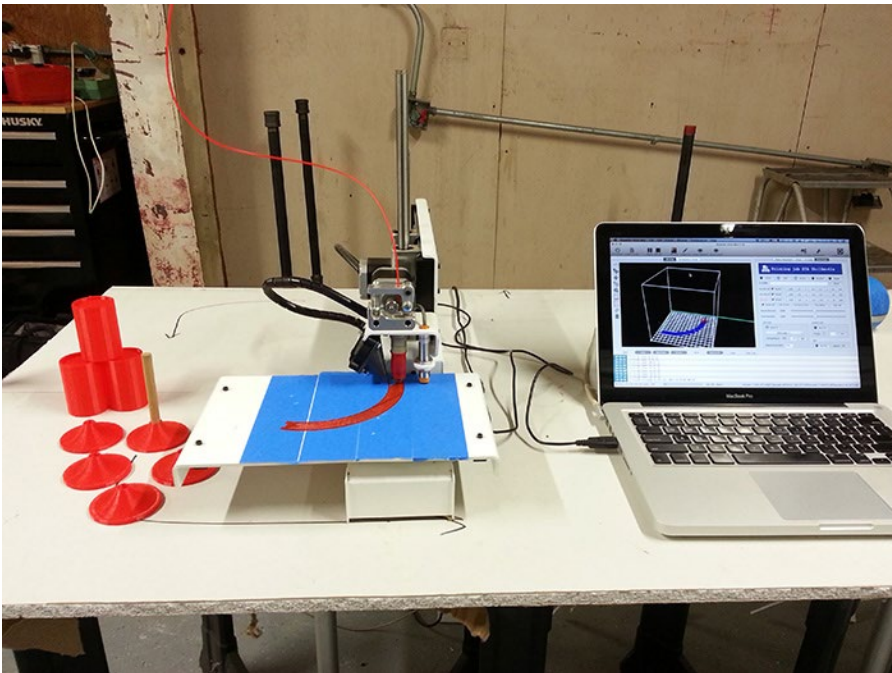
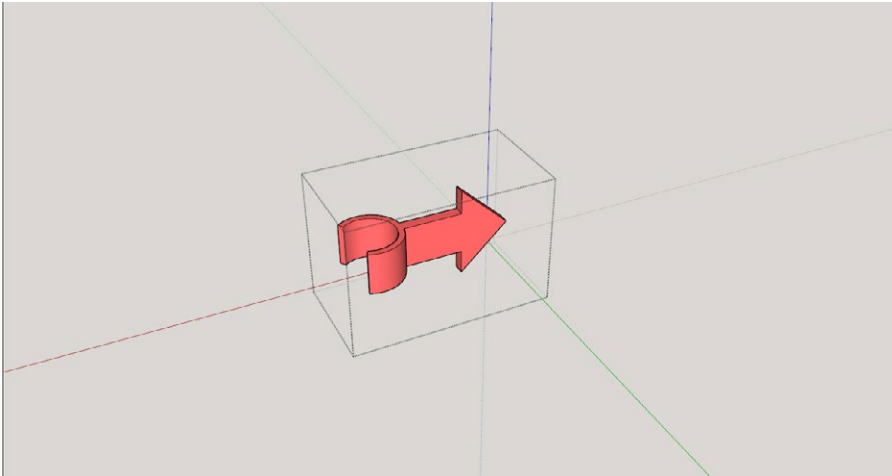
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Tim - (Experienced) Had to warm up and practice, then was able to complete each obstacle. Slalom - crashed a lot, took big swoops in and out (not smooth) but made it through. Landing pads - first and second tier easy, third tier in 5 attempts. Ring - crashed into flames portion twice then made it. Bowling - Hit near the top, all but the bottom row fell, drone crashed near landing target.
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Test Analysis

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I think the biggest takeaway from my testing is that this game is for expert pilots who are looking for a new challenge. Flying feels natural and fluid to these users, the obstacles provide a challenge in precision and maneuverability. This game is not for pilots who are still becoming 'connected' to their craft. It is definitely not for beginners. However, for the target audience, the obstacles seem work well. I do need to tweak the slalom section, many pilots crashed into the horizontal beam connecting the pillars - I think I'll try to arc the connectors so that there's a little more room. Also the ring needs a sturdier bottom - it kept falling over.
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Also to note, all the testing was completed with my personal microdrone and it held up surprisingly well! Once it was obvious that crashing was going to be a big part of this game I was worried that we would ruin the drone or at least damage the propellers. However, there seems to be no damage done to the craft or the props. I'm now wondering if the final build material will be worse for the props, since currently the obstacles are made of foam board which seems pretty soft and forgiving.

Part 4: Production



Production

The final game was designed using 3D printing technology, standard printing, and wooden dowels.

3D Printing

Many of the obstacles were modeled in Google Sketchup. This allowed for 3D printing of the pieces using a Printrbot Simple 3D printer, which added a nice clean look and polish to the final product. The pieces look a lot more professional than if I had created them by hand.

Standard Printing

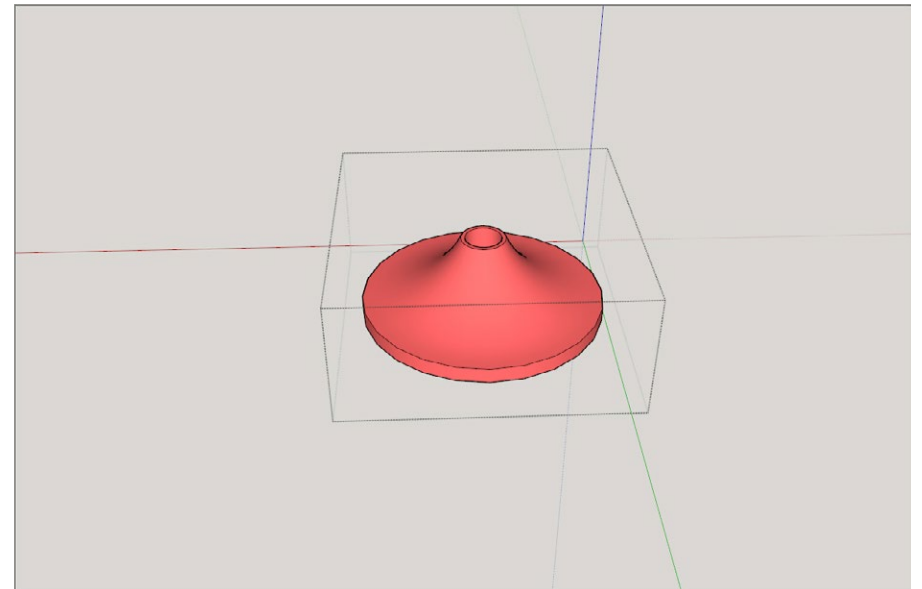
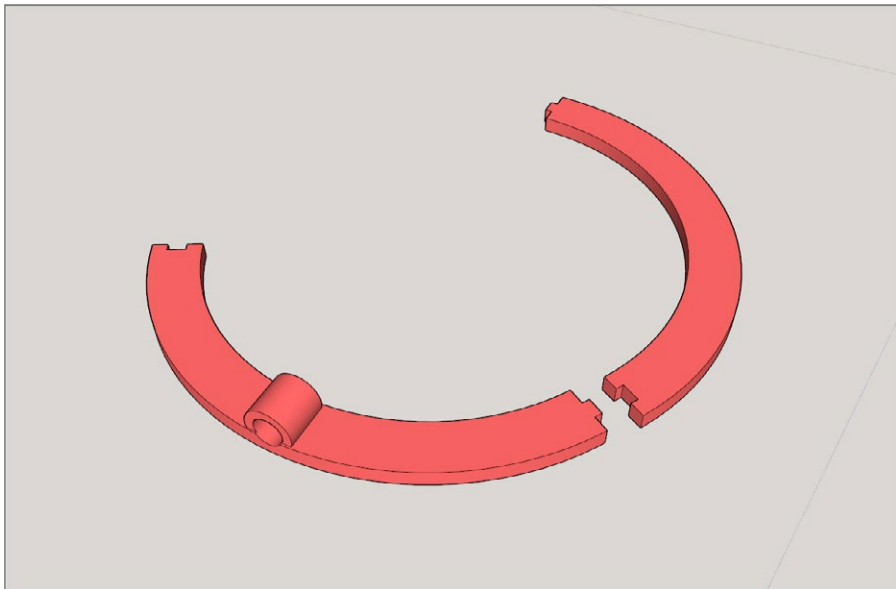
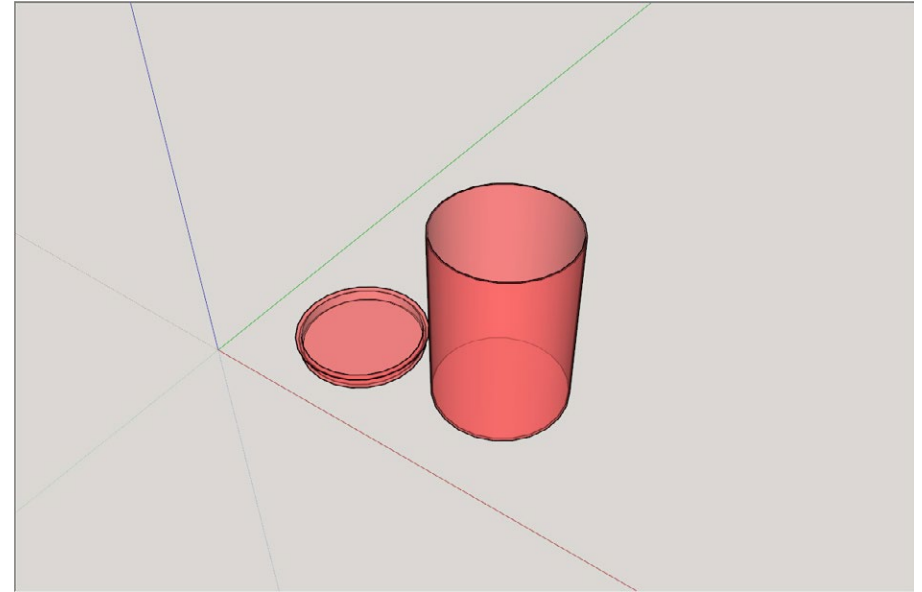
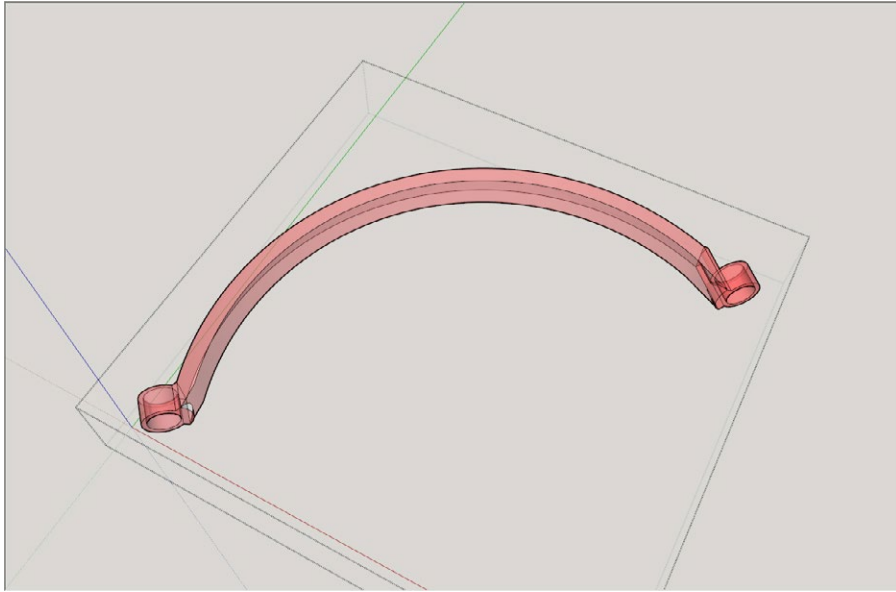
The game board was designed in Illustrator and printed on paper using a large format printer. In production versions of this game the game board could be printed on a fabric material to make it easy to fold and store in a game box without damaging it.

Assembly

The obstacles were assembled with the help of some wooden dowels. This assembly was simple, mostly sliding the dowels into place, this could be left to the consumer on production versions of this game.

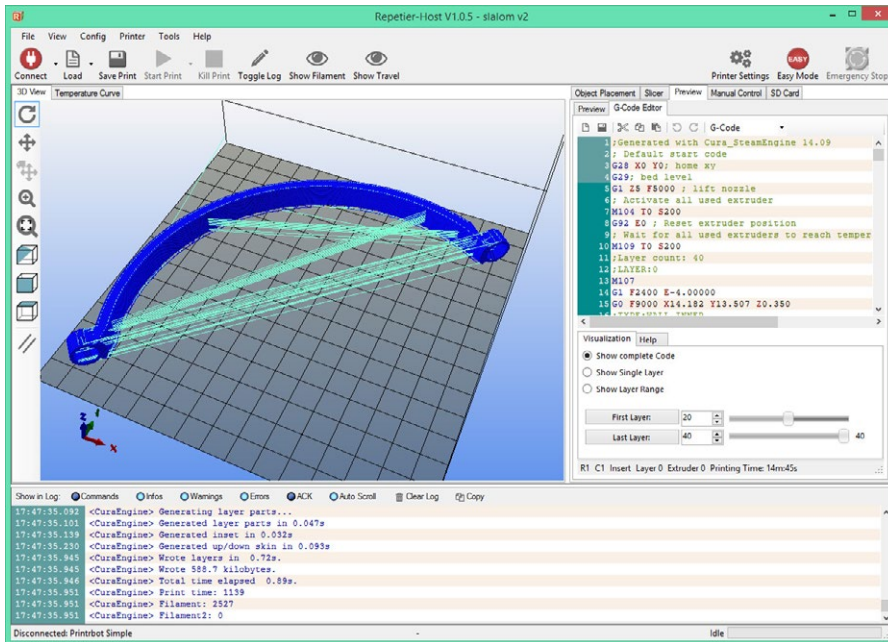
Production 3D Models

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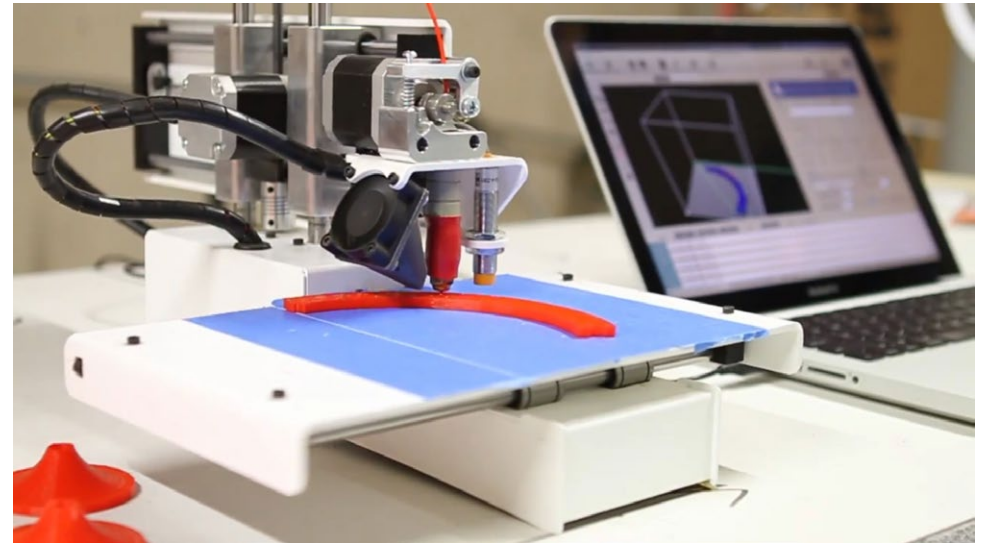


Production 3D Printing

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Preparing 3D model for printing



Printing obstacle part

To see video goto

<https://www.youtube.com/watch?v=JLc9sVyezjw>

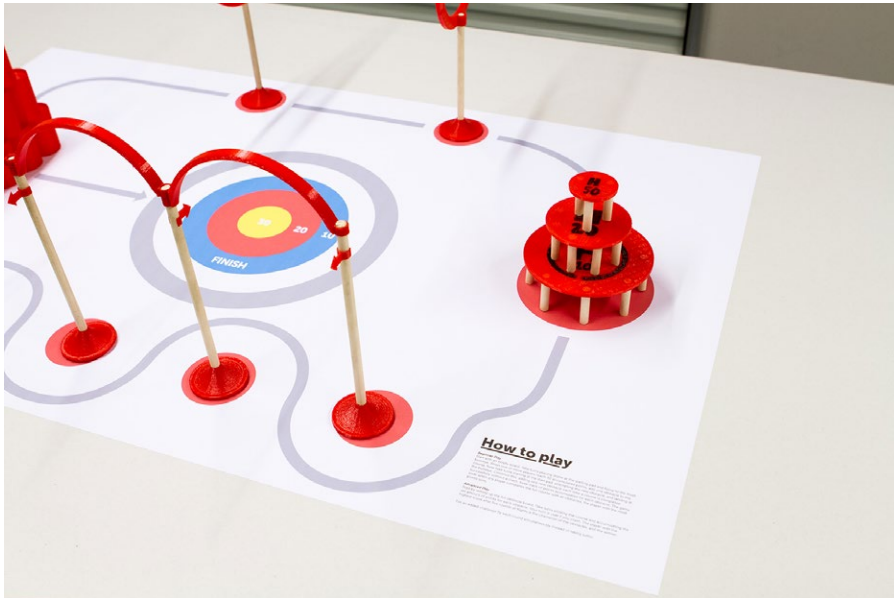
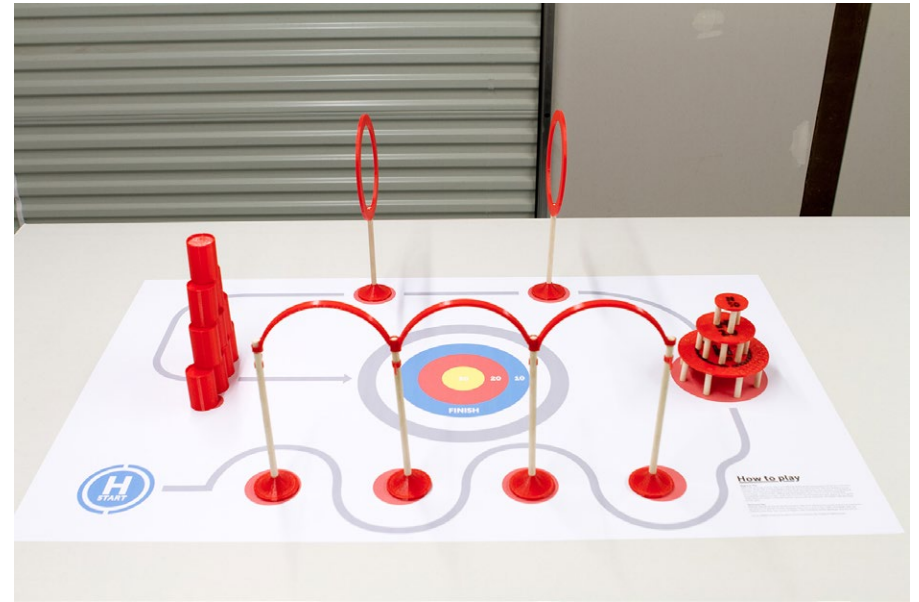


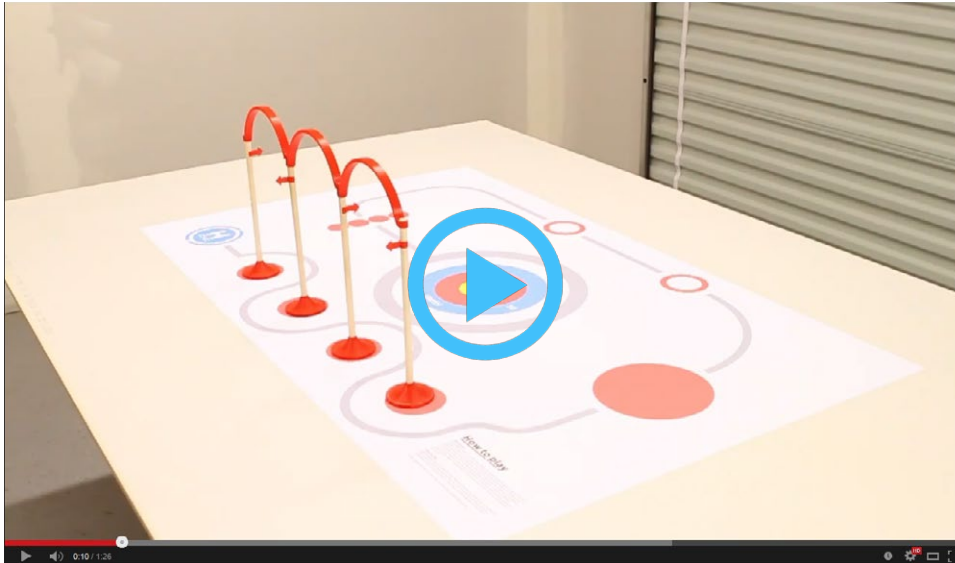


Completed Microdrone Obstacle Course

Production Complete

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Click to view gameplay video

Final Thoughts

Designing and producing this game has been an enjoyable challenge. There have been many revisions and updates along the way from sketch to prototype to test to product, and I think the process has yielded a polished game that is fun to play.

I have created a video of the game being set up and played, please view it at http://youtu.be/MUUtICTZc_4