For the manufacturing review:

To be presented/discussed at the beginning of Week 10 labs (3 points, individual scoring) :

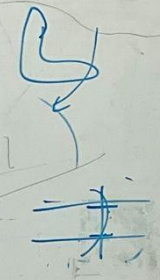
(I expect this to only take your team 1 *productive* hour)

As a team, go through the "sandstill" design and answer the following bullet points:

- Understand how it works
- Identify and fix weaknesses, failure points, premature wear components, possible safety issues
- Brainstorm top improvement ideas
- Redesign components to be mass-manufactured

Assign a slide for each person to present at the beginning of lab. Each person on your yoyo team will present one slide, and only one slide, at the beginning of lab (include your name on your slide, you will be graded on your slide). Divide bullet point topics among yourselves as you see fit, corresponding to the detail needed for that bullet.

- Captive nuts / tapped holes would be nice for assembly
- Sheet metal housing – hard to trim
  – not protective for internals / user
- Wiring not secured in specific location (no home)
- can't take whole lid off.
- Inertial Plate is rusted
  (many waterjet plates are rusted)
- Rivet-threads were frustrating
  - didn't go in straight
  - inside clearance needed is a lot
- gold parts were spray-painted
- Stack of washers add to crossbeam assembly
- heat generated during braking
- "Drum" of the band brake was, at first, aluminum, but was wearing too quickly
  (–drum had to be made lighter bc everything forward of torque coupling has to be low inertia
  – ↑ machine time

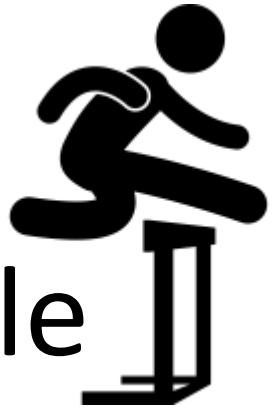


- only bought parts are:
  - electric motor
  - Sander table
  - torque coupling
- Major issues
  - 8020 Frame
    - infinite fasteners that were hard to align/assemble
  - fasteners are subject to vibration (they loosen)
  - if fasteners loosen, axial components move, which causes Sander to (the team saw this actually happen, they had to temporarily not work save for this)
  - several short keyed shafts – if keys fail, repair requires significant disassembly
- everything is built around "trigger reset" assembly
  – position of trigger assembly is Key
  – trigger assembly made from the two steel plates to constrain + protect but now impossible to replace the part that is currently broken.
  ↳ to reset the machine, a pin pushes a lever that gets caught by solenoid. When you trigger the solenoid, the lever impacts that pin. – the team thought about using a harder pin, but feared that failure in fracture would be worse.
  – team considered thicker pin but didn't have time

https://2022.2009.mit.edu/teams/gold

Team A

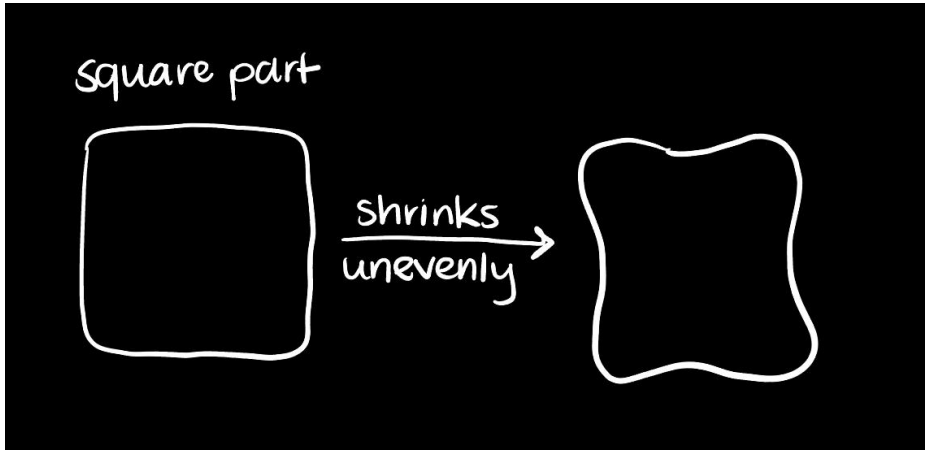
Most Difficult Hurdle

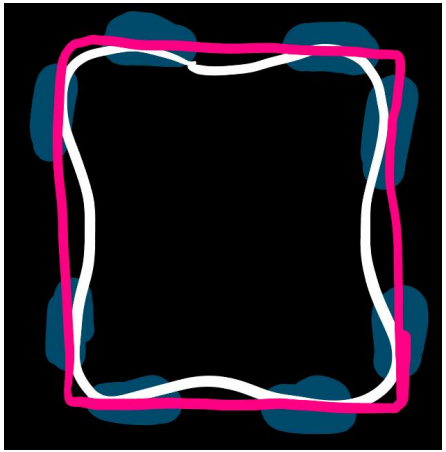


Lab Deliverable #1 – 11/06

Square Press-Fit Challenges

- The geometry of our yo-yo created some unique challenges when it came to the press-fit

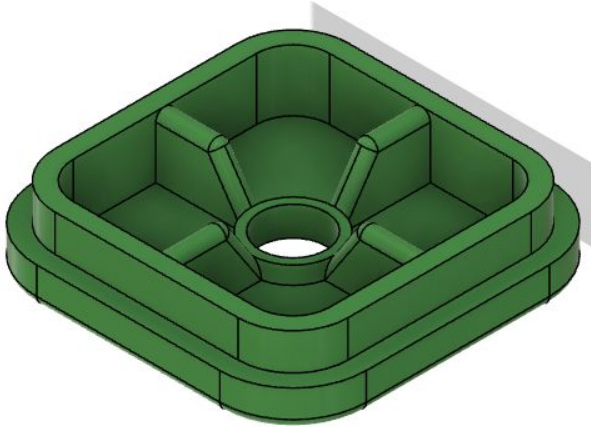




Non-uniform deformation significantly decreases engagement during press fit.

Resolution

Ribs on in the inner shell greatly increased the strength of the part, and keep the outer shell walls in tension



Our press fit not only passes a drop test, but it can also be thrown against a wall.

Team A

Manufacturing Review: SandStill

Lab Deliverable #2 - 11/06

Weaknesses and Failure Points

- Non-inspectable mechanical parts lead to failure in normal use condition over time
- Electronics are complex and unserviceable
- Mechanism is difficult to reset and also fails over time
- Capacitive sensing is unreliable and may not detect all dangerous conditions

Max Burns

Problems and Resolutions

Problem	Possible Solution
Pin and inner linkages not accessible	Rearrange assembly so that only accessible fasteners are for maintenance, add maintenance door
Mechanism liable to misalignment due to vibration or assembly variance	Move to solid parts for any structural parts, add shock collars/damping to isolate high impact
High impact braking causes heat generation and wear	Add shock collars/damping, add more structural support to brake system, user serviceability

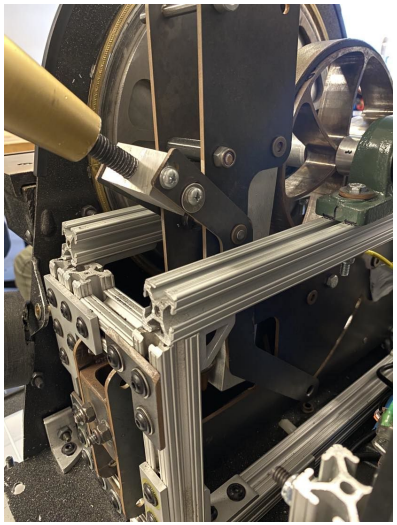
Internals Accessibility

Problem:

- Fasteners were hard to assemble, and reset pin was hard to access.

Proposed Solution:

- **Rearrange the assembly** for ease of access to fasteners. (Cast frame could help with this)
- **Fasteners single and common type** wherever possible (they are currently mixed types & lengths)
- Rearrangement would also need to **make pin easier to access** for replacement in case of failure. (Redesigning of the frame done with this in mind)



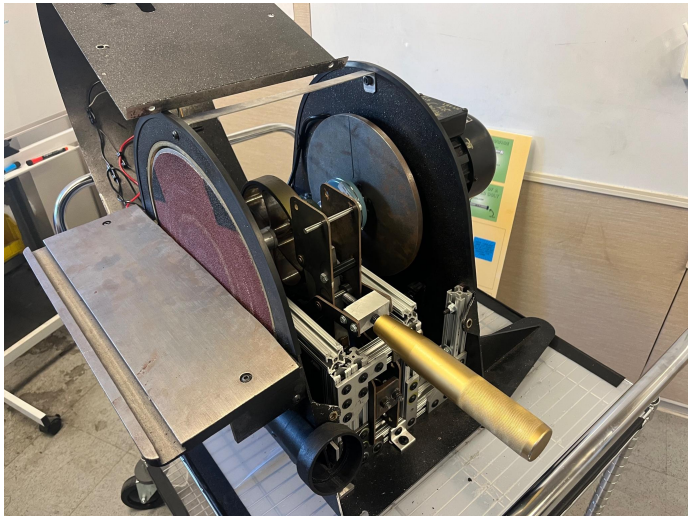
Heat and Wear from Braking

Problem:

- Brake pads wear down over time from multiple uses
- May cause product to stop working without any external, noticeable change, a dangerous failure mode

Proposed Solution:

- Model for life of brake and number of uses before expected failure
- Create indicator when needs replacement
- User-serviceable and replaceable

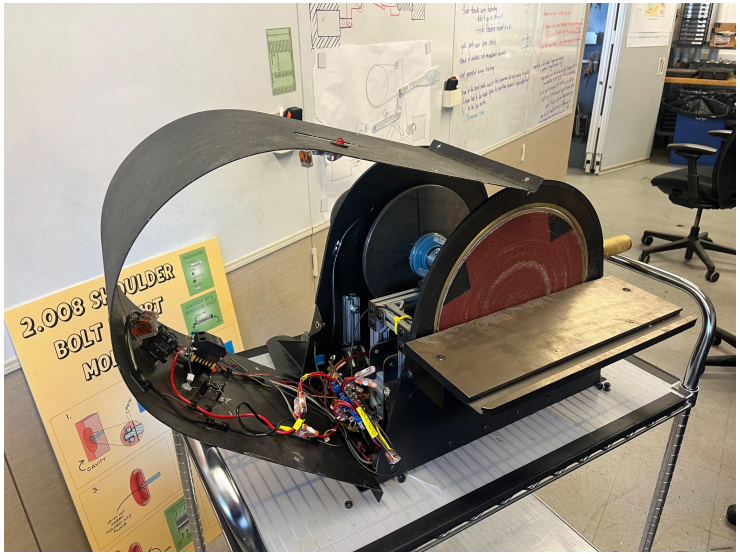


Sydney Kim

Vibration Vulnerability

Problem:

- Vibration over time may cause electrical connections to loosen, or a mechanical failure
- This impacts the safety of the device in a non-inspectable way



Proposed Solution:

- Regular test of device and maintenance
- More reliable electronics solution (PCB)
- User-serviceable parts

Gerardo Berlanga Molina

Improved Design for Manufacturing at Scale

- Less individual machined parts → cast and post machined assemblies
  - No aluminum extrusion ($/kg)
- Electronics integrated into PCB
- Capacitive assembly integrated into sanding disk
- Replaceable /serviceable parts - sander, brake, etc.