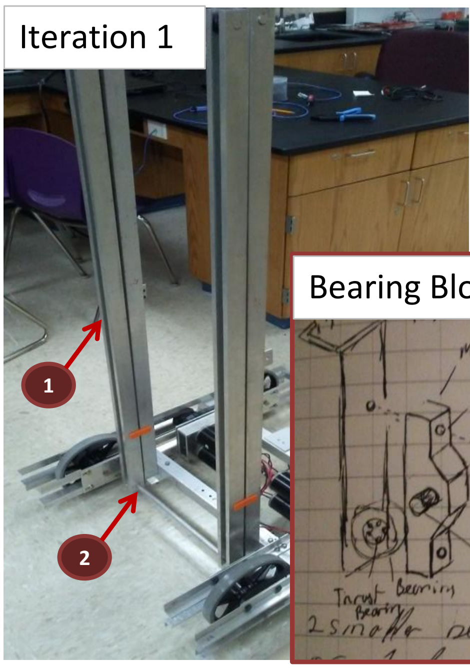
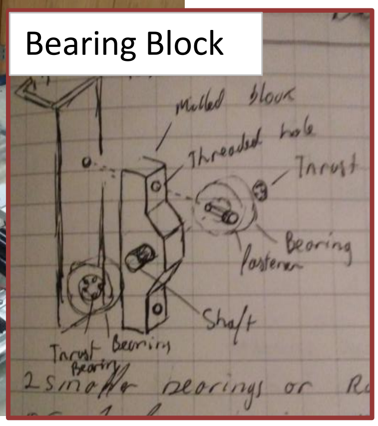
# FIRST Robotics Team STEMpunk #4531
# Lift Iterations - 2018 Power Up

## Iteration 1




**Description:**
Our first run at a linear lift. We developed a bearing system that fits inside of the square tubing that makes up the lift sections. The lift is designed to reach about 8 ft in 2 seconds, using a winch system with a 8:1 gearbox ratio and a 1-inch diameter spool. The lift sections (1) are slotted to accommodate the bearing blocks, and the blocks pass in front of the bolts that mount to the next section. The sections are braced together using aluminum roundstock (2) and

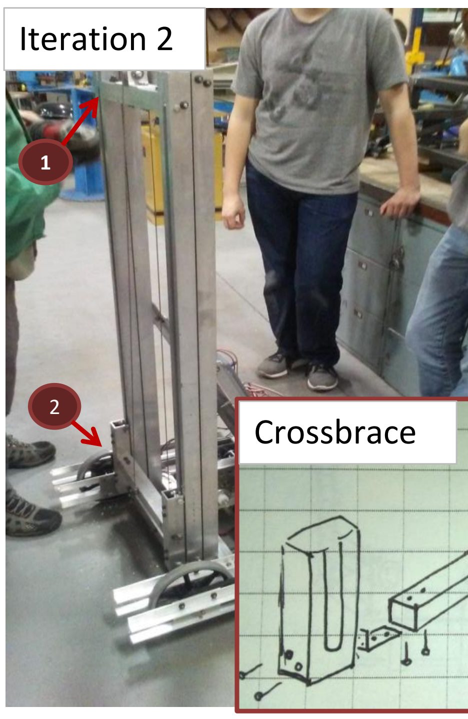
### Bearing Block




**Testing:**
Before we hooked up the winch and cable system, we tested the motion of the assembled lift by sliding it manually.

**Problems:**
We found issues with the bearing blocks pinching on the inside of the lift, causing the lift to jam. The collar clamp setup did not provide the rigidity necessary to keep the lift sections parallel, which allowed the system to torque to the side. The bearing blocks did not initially have enough clearance within the slots, and our machining wasn't in tolerance. The bearing blocks got caught on the mounting bolts.

## Iteration 2



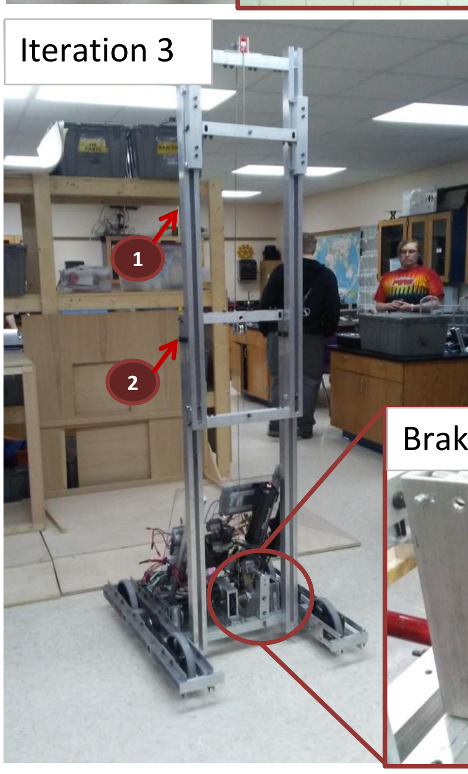

**Description:**
We modified the crossbraces (1) to provide rigidity, while maintaining the clean profile necessary for the lifts to slide next to each other. Right angle brackets were machined to exactly the size of the interior of the crossbraces, and they fit inside the crossbraces keeping them from twisting and separating. We remachined the bearing blocks within tolerance and switched out the mounting bolts for smaller profile heads.
We then developed the section of the lift (2) that will support the intake

**Testing:**
We hooked up the winch system with steel cable and aluminum pulleys, then powered up the system to test the action and speed of the lift.

### Crossbrace

**Problems:**
Bearing blocks still pinch inside the structure when it sways side to side. The weight of the structure pushes it forward at its max height, which causes the lower corner of the secondary section to bind against the top of the primary section. The gearbox friction is not enough to hold the lift position in place. Speed is slower than expected, with a loaded lift speed of 2.7 seconds to max height. The intake structure maxes out before lift reaches max height, which limits us to 7.5 feet.

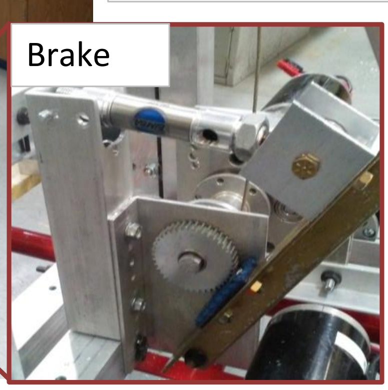
## Iteration 3




**Description:**
We remachined the lift sections using wider tubing (1) in order to fit thrust bearings and washers on between the bearings and the inside face of the tubing. We introduced bearings on the inside face of the lift sections to prevent binding. To keep the lift sections from swaying back and forth, we 3-D printed some H-shaped clips (2) that guide the secondary lift section to stay parallell with the primary section.

One of our younger students developed a pneumatic brake system to be able to control our lift position as we wished. We introduced an encoder to read our lift position and create a failsafe to keep an operator from accidentally maxing out the lift to past its full safe extension.

### Brake



**Summary:**

We are very satisfied with our lift going into our first competition. We expect it to perform robustly and consistantly. We modified our intake system to be able to compensate for the maximum height of our lift, and will be able to place a cube on top of another cube when the lift is in the uncontrolled position. This design project has proved to be one of the most challenging we've ever faced, but has not been without reward.