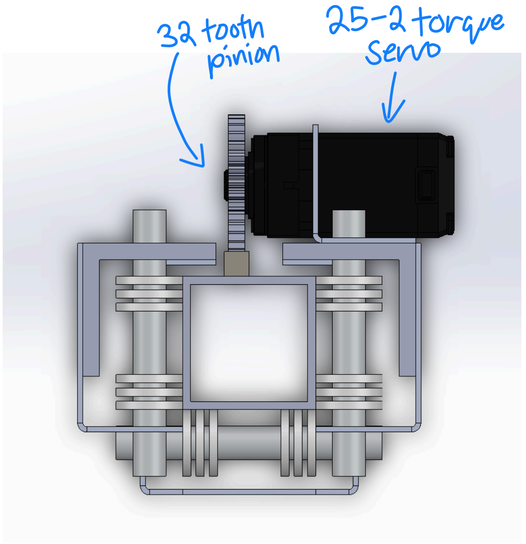
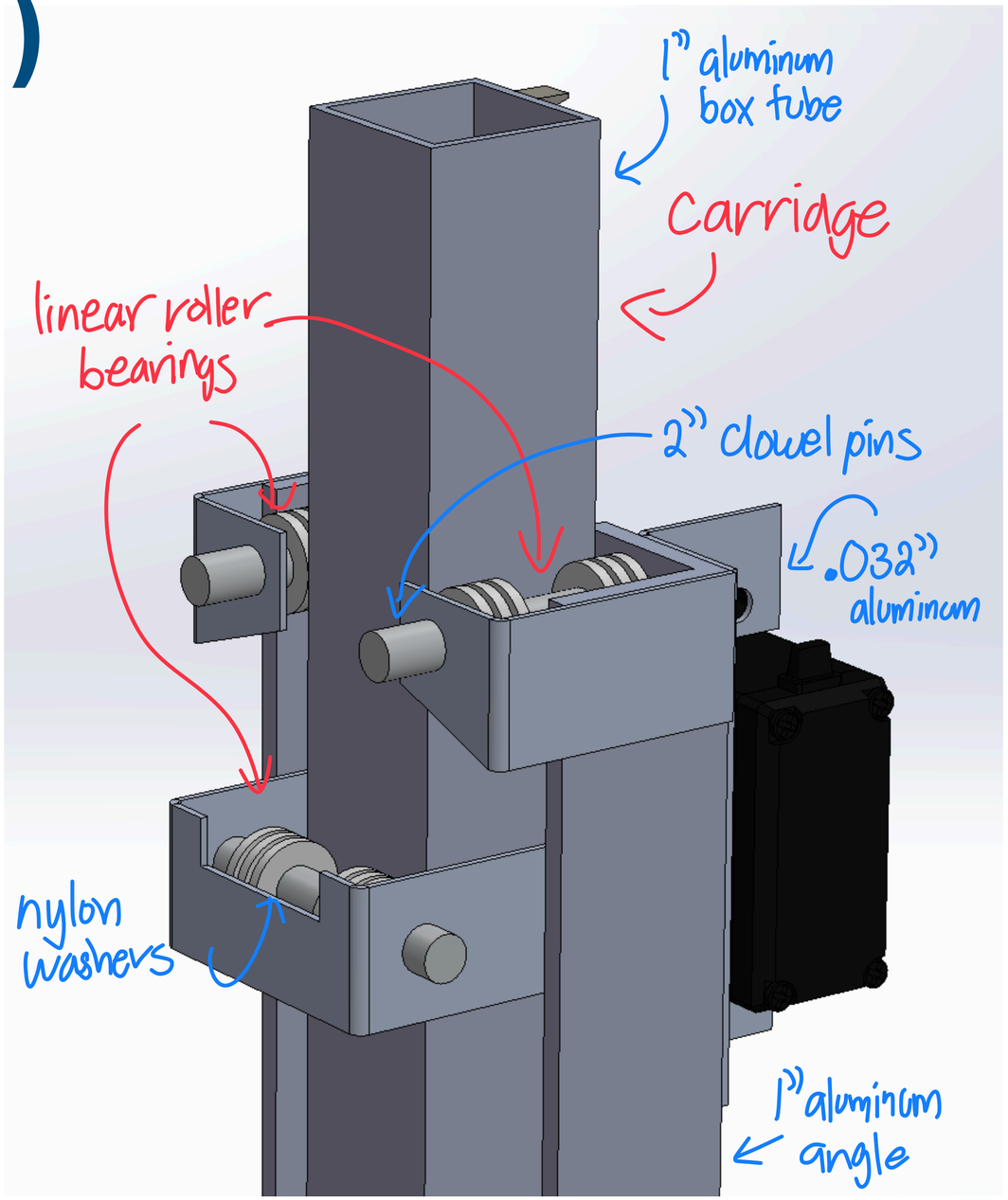
Most Critical Module (pt. 1)

Rack-and-Pinion Elevator

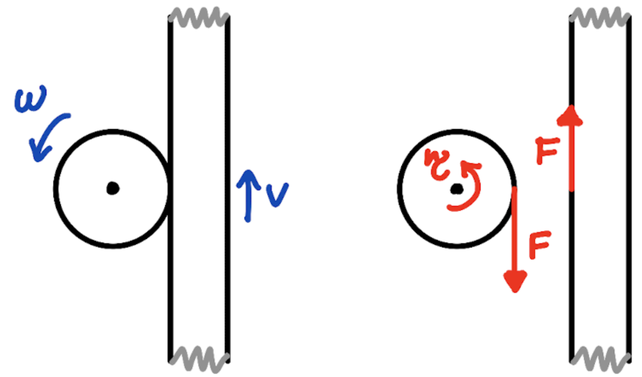
- Design Requirements:
  - Exert 4 pounds of down force when fully extended
  - Exert 8 pounds of up force when fully extended
  - Start match with all attached parts within 8 inches of the ground plane
  - Extend such that the top of the carriage is 13 inches above the ground





Technical Calculation

Rack-and-Pinion Elevator



We obviously choose the 25-2 torque servo.

(6V) $\omega_{no\,load} = 50$ RPM, $\tau_{stall} = 300$ oz·in → (5V) $\omega_{no\,load} = 41.67$ RPM, $\tau_{stall} = 250$ oz·in

max power output @ $\omega_{pp} = \frac{1}{2}\omega_{no\,load} = 20.83$ RPM, $\tau_{pp} = \frac{1}{2}\tau_{stall} = 125$ oz·in

At constant speed, $0 = \tau - Fr \rightarrow r = \frac{\tau}{F}$

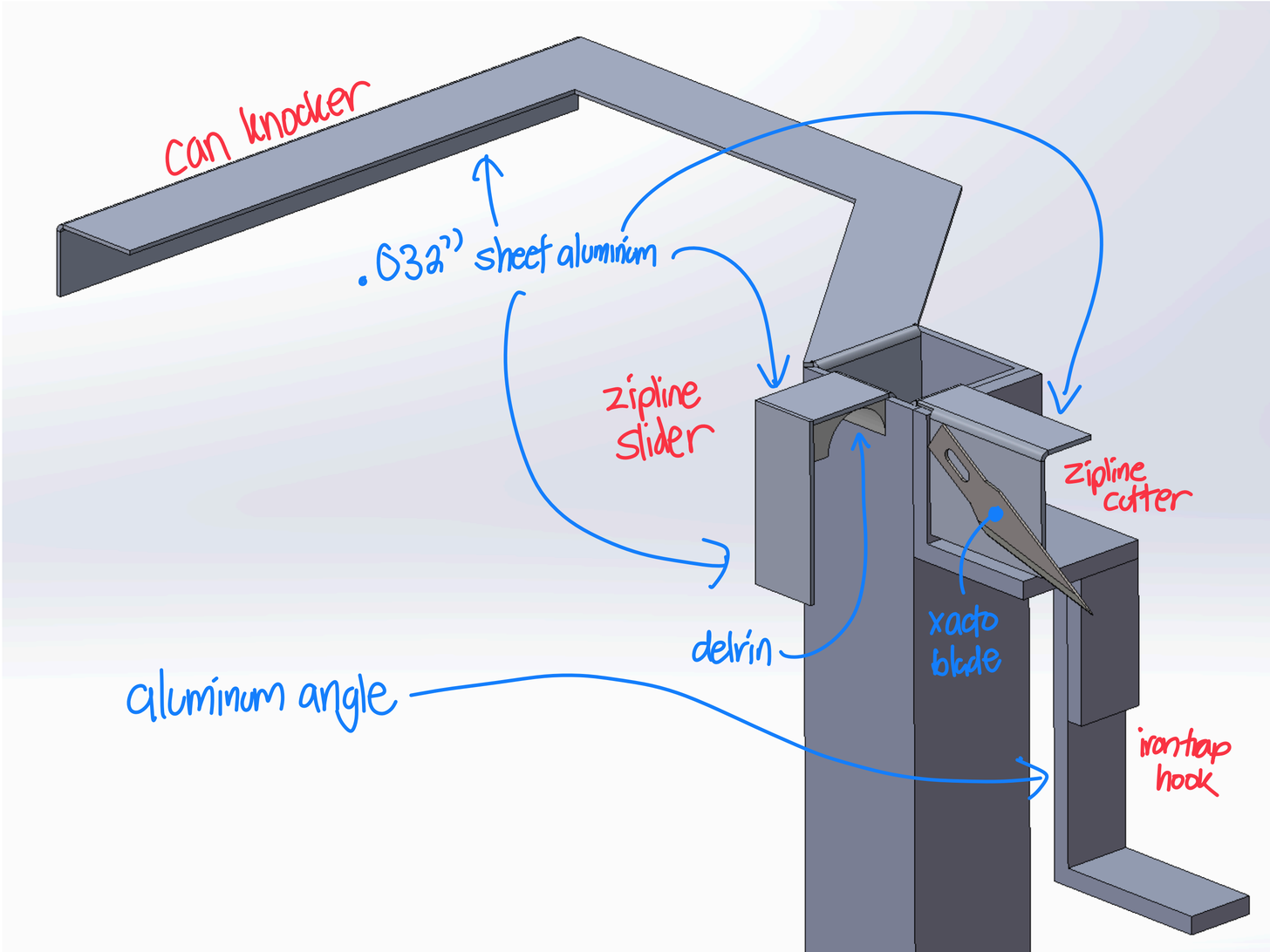
Therefore, applying a peak-power torque for a $F = -4$ lbs requires $r = \frac{-\tau_{pp}}{F} = \frac{-125\,oz\cdot in}{-4lbs \times 16\,oz/in} = 1.95"$

Applying a peak-power torque for a $F = +8$ lbs requires $r = \frac{+\tau_{pp}}{F} = \frac{125\,oz\cdot in}{8lbs \times 16\,oz/in} = 0.95"$

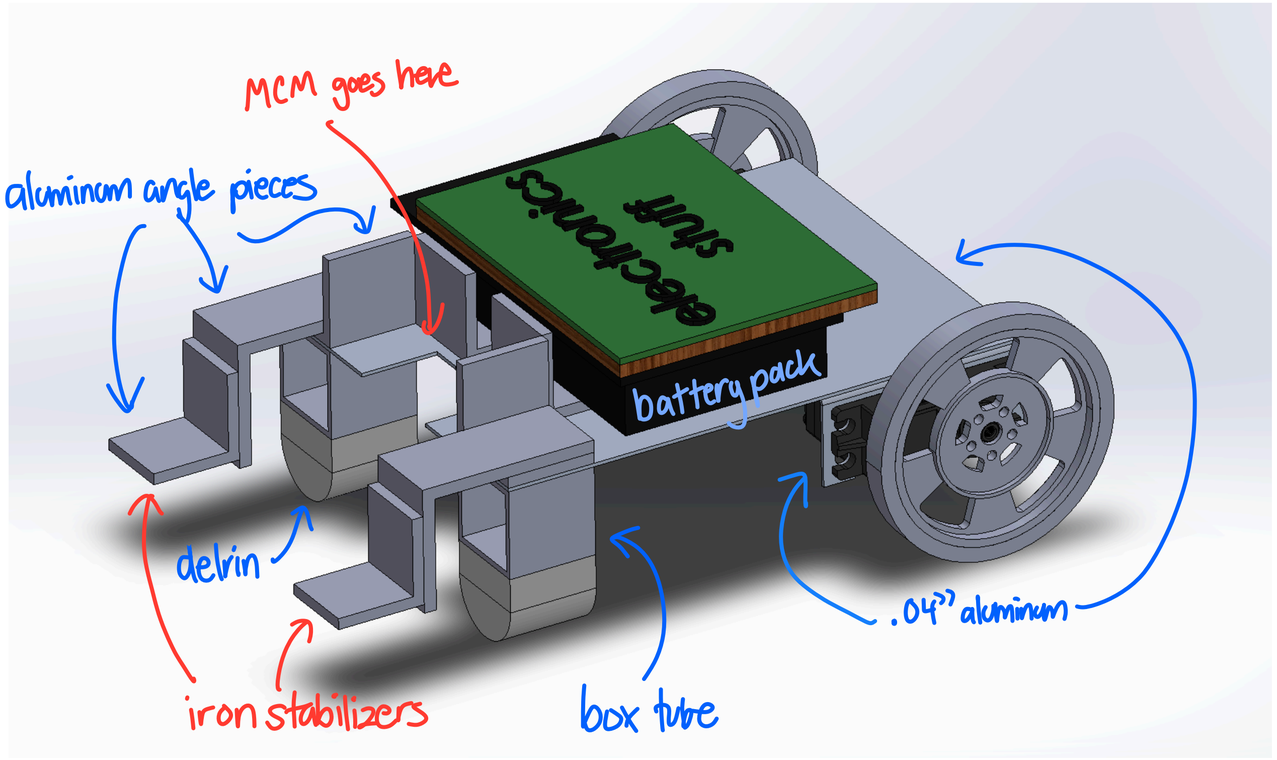
Most Critical Module (pt. 2)

“Up-High” End Effector Suite

- Design Requirements:
  - Cut the zipline at height B
  - Latch on to and slide down the zipline at height C
  - Knock the paint cans off of the platform (when coupled with a linear motion of the drivebase)
  - Hook the iron trap multiplier ring



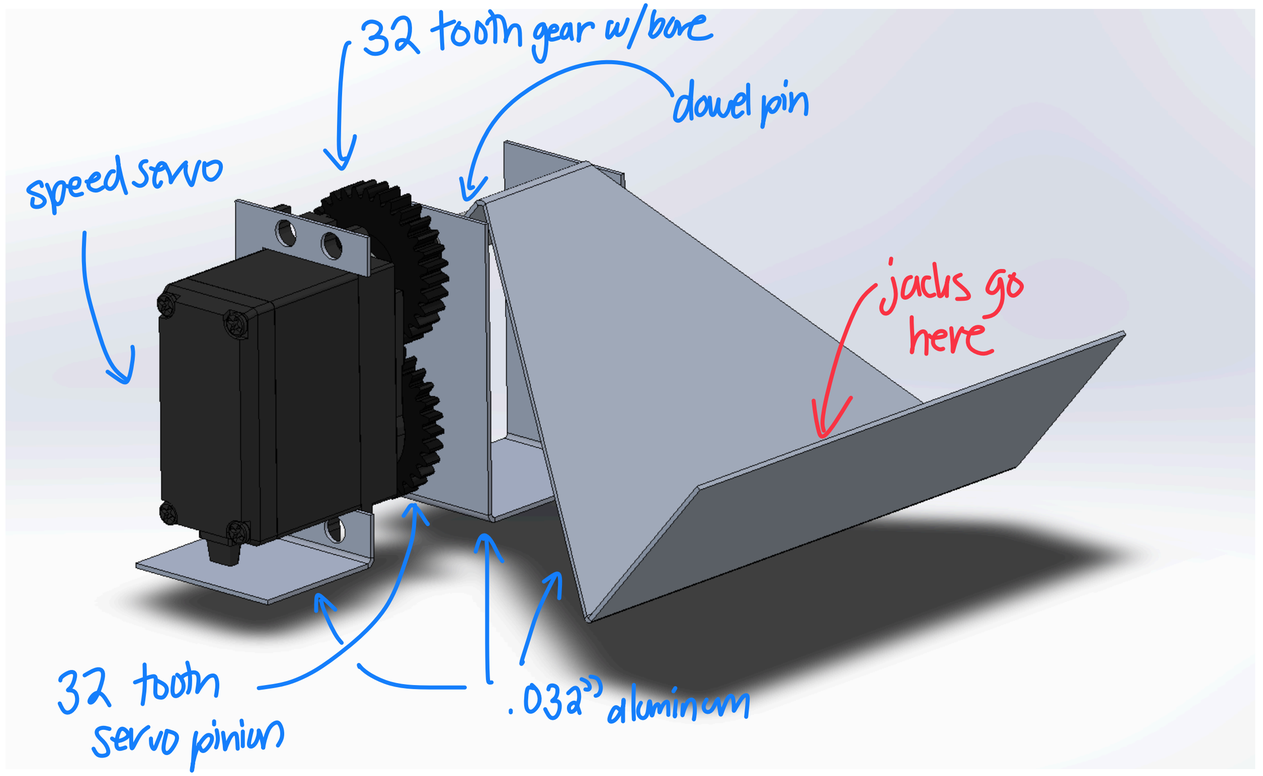
Drivebase



- Design Requirements:
  - Securely hold the MCM, Battery Pack, and Arduino Carrier Board
  - Securely hold two servos in the back with drive wheels
  - Smoothly drive on the flat parts of the gameboard
  - Drive up the ramps without tipping
  - Prevent tipping when setting the iron trap

Jack Scoop

- Design Requirements:
  - Fold to be completely within the 8”x8” starting box
  - Pick up as many jacks as possible when driven into them
  - Lift the jacks and itself over the ledge on the third floor
  - Dump the jacks off of the ledge into the scoring box



Final Design