

# AEV Project



Team P

# Team Introductions

- Sam - Lead Documenter/Anything asst.
- Caleb - Designer/Testing mechanic
- Matt - Designer/Testing asst.
- Kenny - Lead Coder/Testing asst.

# Brainstorming

- Nosepiece
- Double push
- Long "L" arm

Title AEV Design  
Name Matt Heffinger

Instructor Dr. Phil  
Seat 61 Hour 9:35

Scale 1:3  
Date 2-1-17

Weight - 1.6 lbs.  
Cost - \$163.84

Arduino - \$100.00  
Motors - \$19.98  
Count Sensors - \$4.00  
Count Sen. Conn. - \$4.00  
Propellers - \$1.80  
25x25 Rec. - \$4.00  
L-shaped Arm - \$3.00  
Wheels - \$15.00  
Battery Support - \$2.00  
Brackets - \$4.00  
Motor Clamps - \$1.18  
Screws + Nuts - \$2.85  
Trapezoids - \$2.00

① Arduino  
② Battery  
③ Motor

# Brainstorming

- Single Motor
- Unique Wing Design

**Title** Kenny's AEV Lab 3  
**Name** Kenny Redback  
**Instructor** Dr. Phil  
**Seat** G2  
**Hour** 9:35  
**Scale** 1/2  
**Date** 2-1-17

Est. Weight: 1.45 lb

Materials  
Arduino: \$100  
Motor: \$9.99  
Count Sensor: \$4  
Count Sensor Connector: \$2  
Propeller: \$0.45  
2" x 6" Rect: \$4  
L Shape Arm: \$3  
Wheels: \$15  
Battery supports: \$2  
30 Printed Nasci: \$15  
Total: \$140.59

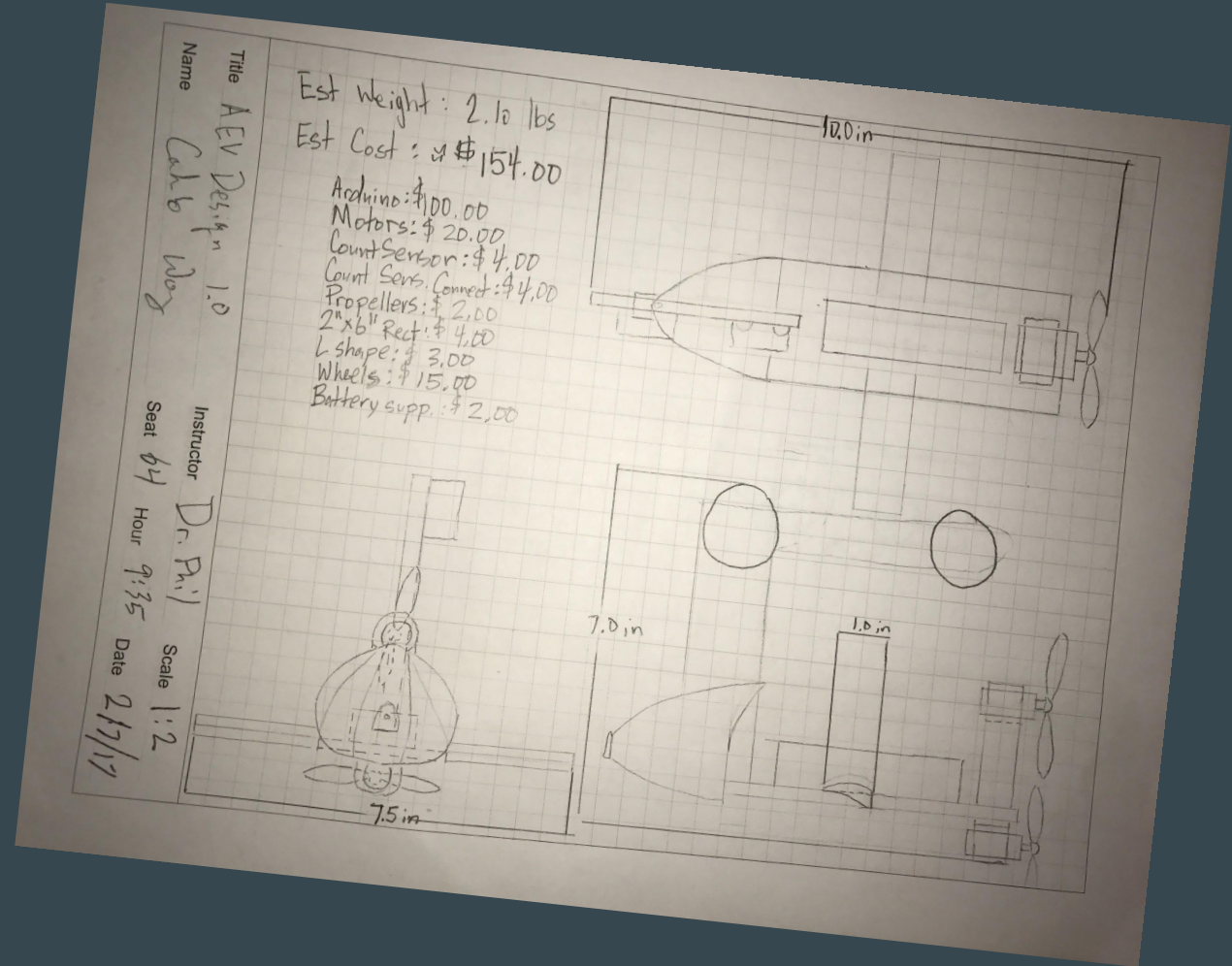
1 Battery  
2 Arduino  
3 Motor

Scale:  $\frac{1}{3}$

10.8 in  
5.8 in  
9.5 in  
3 in  
5.8 in

# Brainstorming

- Wing
- Nosepiece
- Double Push/Pull



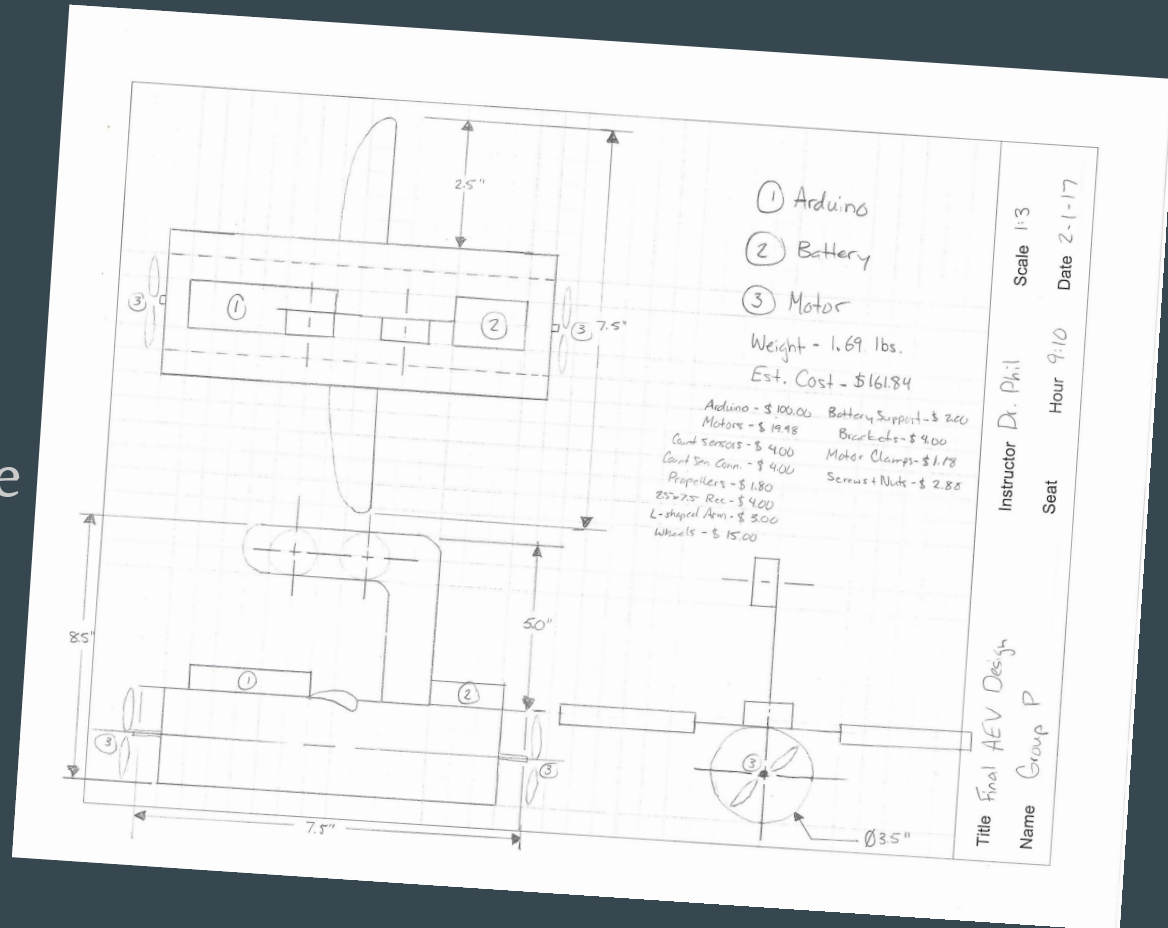
# Brainstorming

- Push/pull combo
- Minimal weight
- Long "L" arm

Name Sam Stegman	Instructor Pahvi	Scale 1:2
Title Mikrotron direction robot	Seat 63	Hour 9:35
<p>Cost: 194.06          Arduino: 100          Motors: 20          Count sensor: 4          Count sensor connectors: 4          Protoboard: 2          2" X 6" Reel: 4          L-Shelf: 3          wheels: 15          Battery Supp: 2          Motor Clamps: 1,18          Bulk screws/nuts: 2,88</p>		
<p>① Arduino          ② Motor          ③ L-rod</p>		

# Initial Prototype

- Decided to use push/pull motor and wing design but 3D-Printed parts were needed.
- Wind tunnel



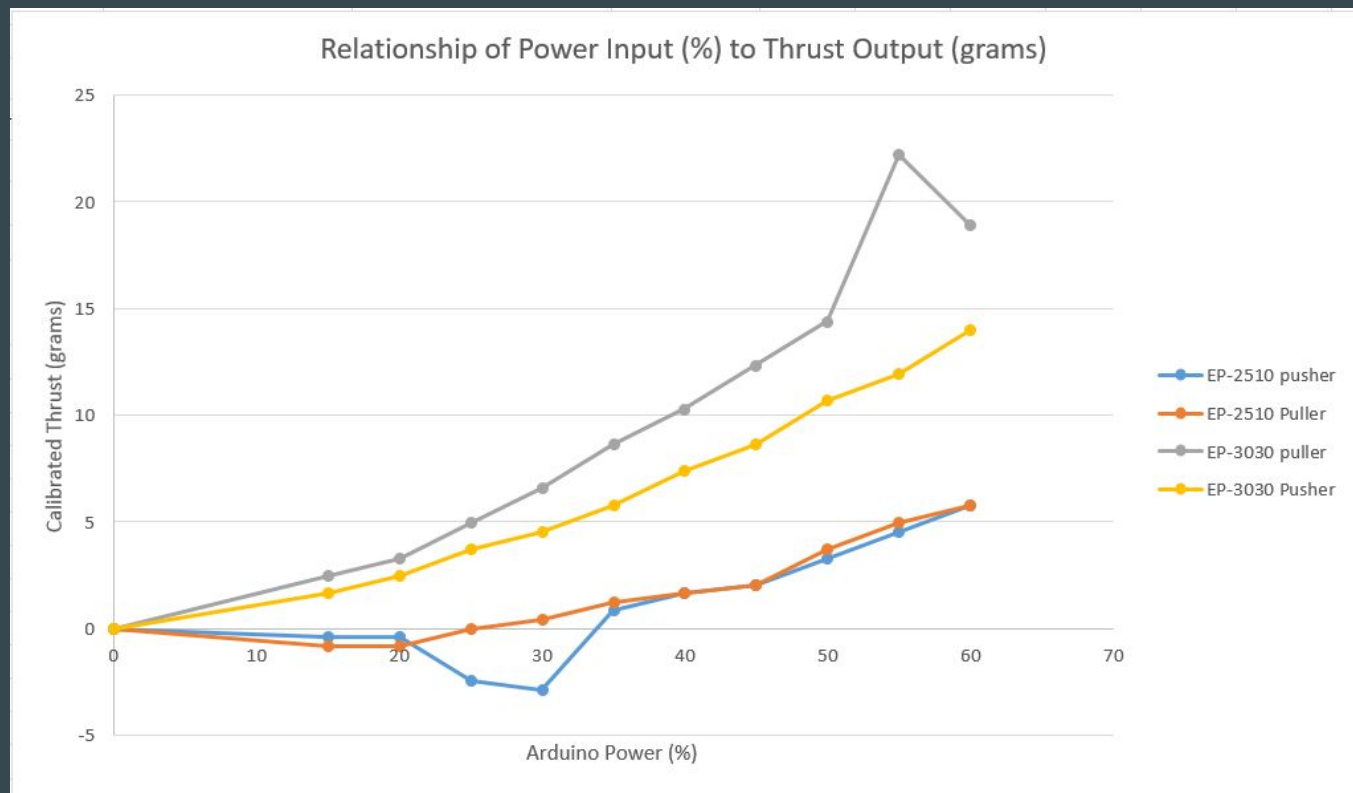
# Thoughts on the Prototype

- Motors in the pull configuration are most efficient
- AEV will have to travel two directions so it can't always be pull
- Wings would be used to decrease friction
- Wind tunnel should help increase wind velocity and therefore thrust



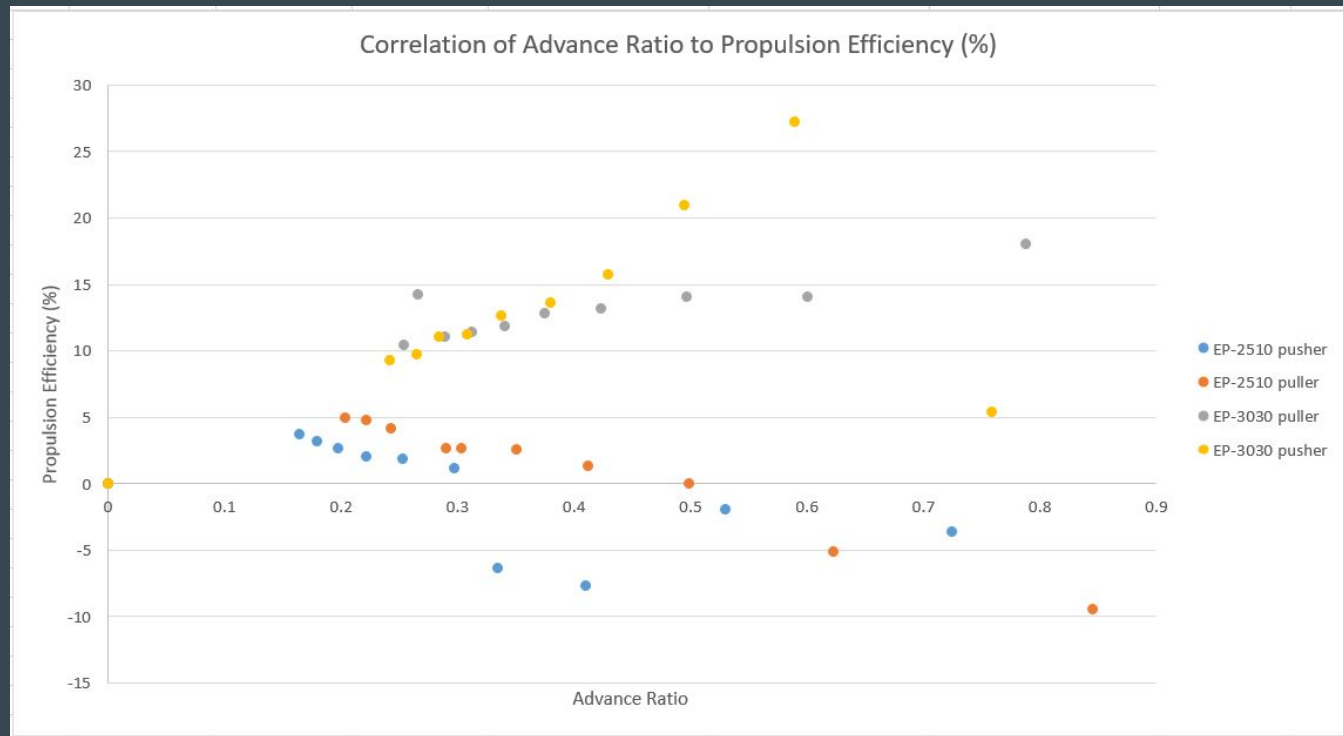
# Thoughts on the Prototype

- 3030 puller has best thrust output

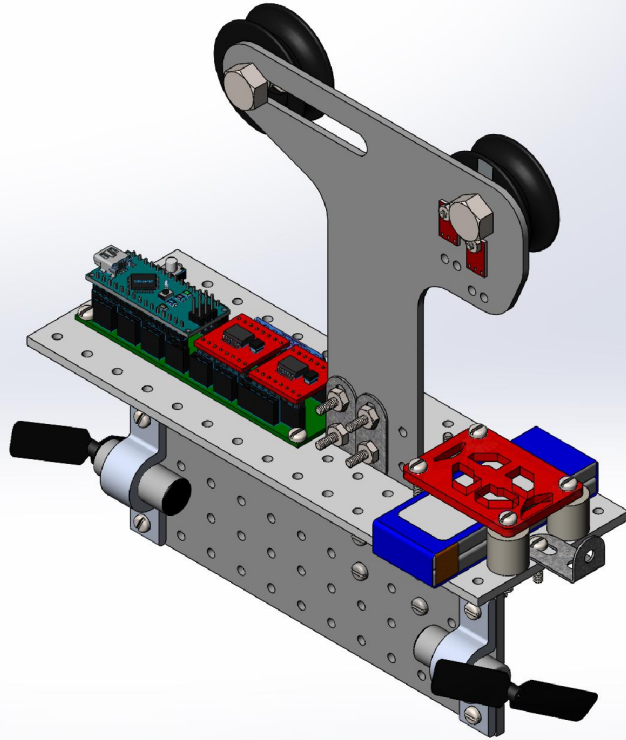


# Thoughts on the Prototype

- 3030 pusher has better efficiency at greater advance ratios



# Push/Pull Prototype

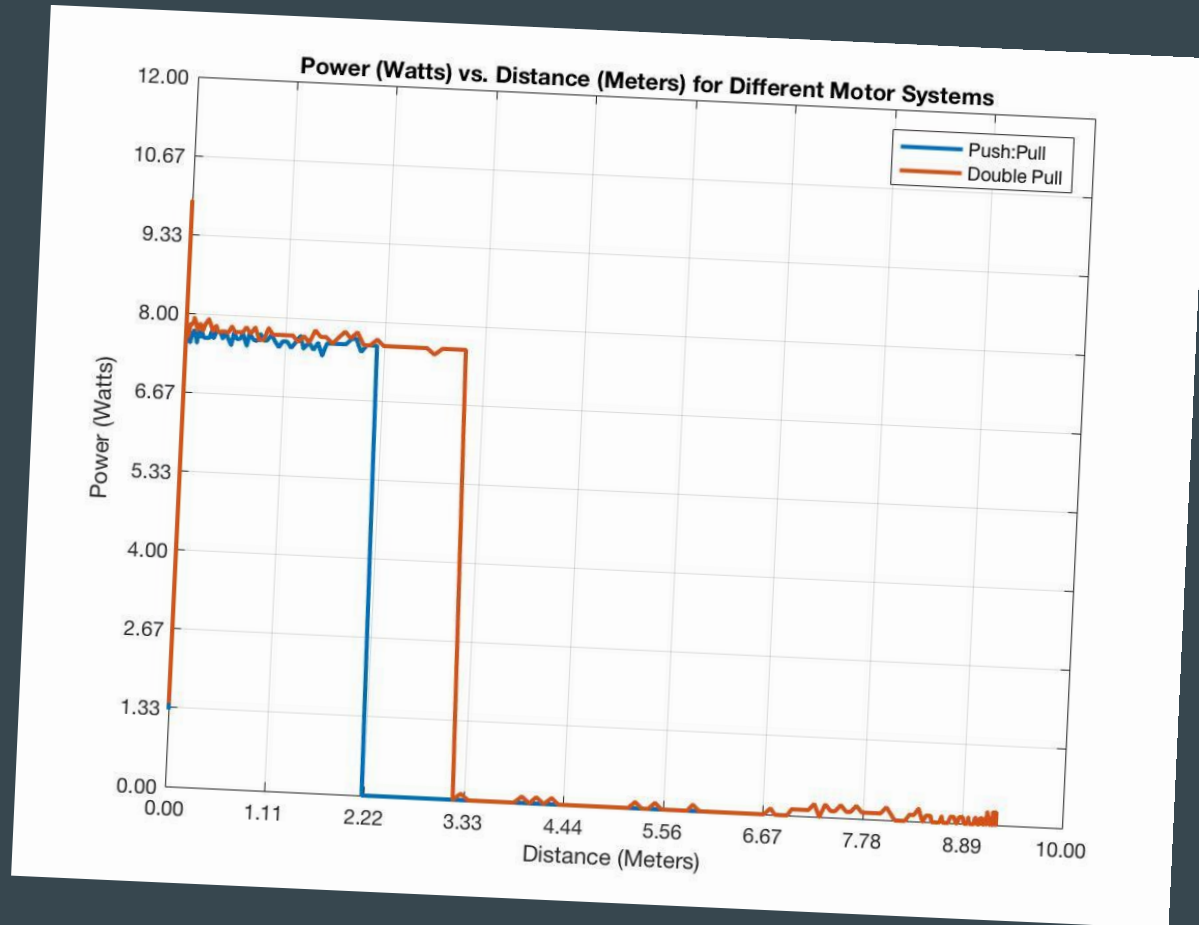


# Initial Testing

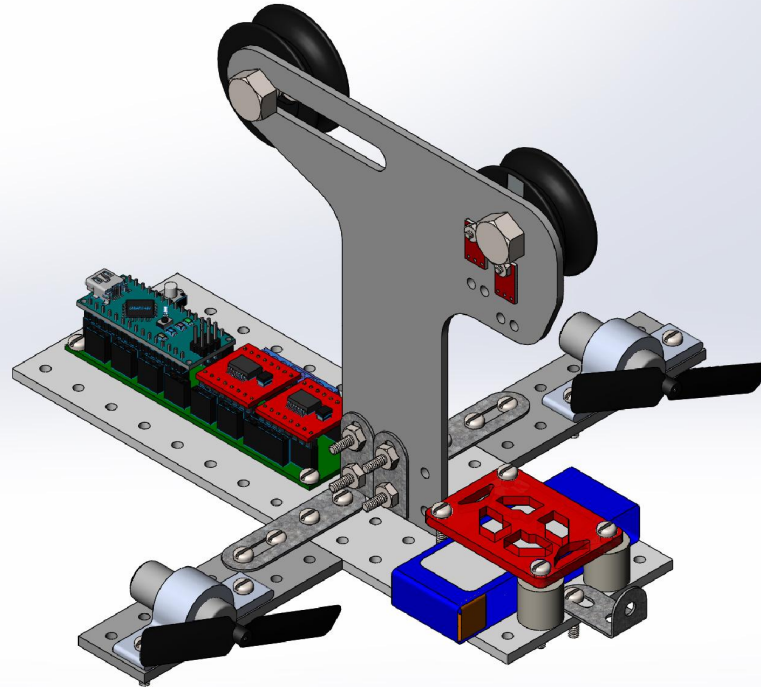
- Weren't happy with distances travel by Push/Pull compared to input power
- The attachment for the Push/Pull motors added a lot of weight
- Decided to look into other designs

# Double Pull System

- Why we leaned away from Push/pull and towards double pull
- More distance for barely more power input

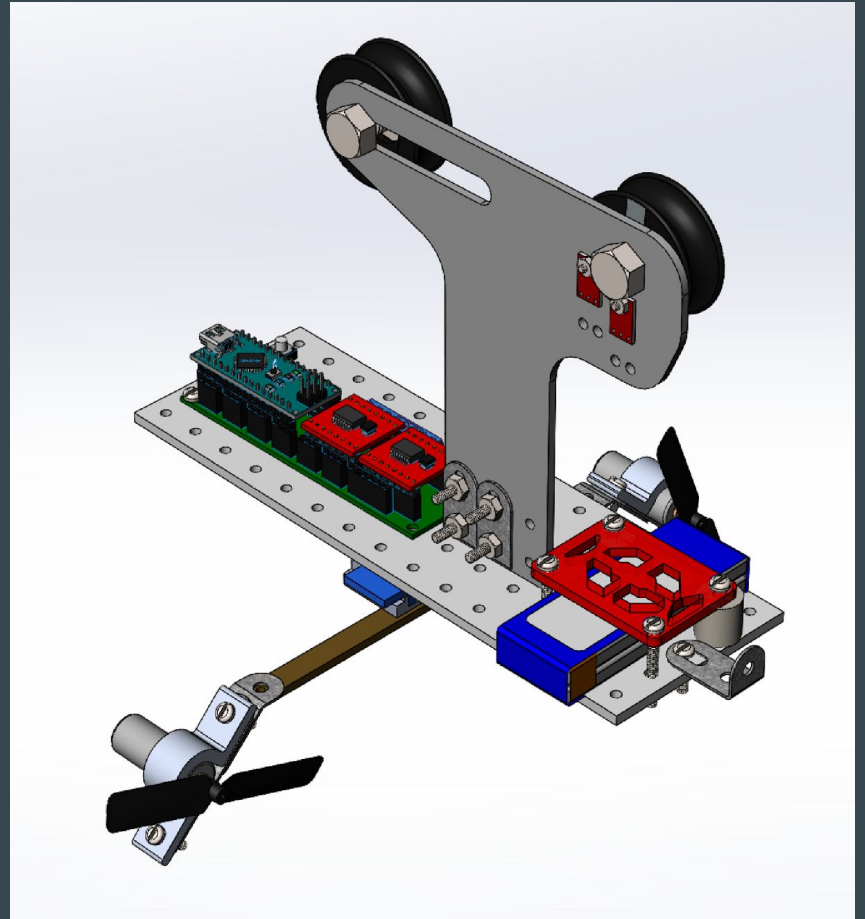


# Double Pull Prototype



# Improvements

- Team wanted pull system in both directions (servo)
- 3D-Printed Parts delayed
- Improvised
- Some parts taped together



# Arduino Code

- Four sections
- Short burst of speed
- Longer period of lower speed
- Coast, rotate servo, low-power brake
- Perform backup check, rotate servo back and proceed to next stage



# Code - Stopping

```
boolean isStopped() {
    boolean stopped = false;
    int pos1 = getVehiclePosition();
    goFor(.2);
    int pos2 = getVehiclePosition();
    if (pos2 - pos1 <= 0) {
        stopped = true;
    }
    return stopped;
}
```

```
void stopAEV() {
    int mSpeed = 20;
    while (!isStopped()) {
        motorSpeed(4, mSpeed);
        goFor(.1);
        mSpeed += 5;
    }
    brake(4);
}
```

# Code - Check Mechanism

```
while (!isStopped()) {  
    if (getVehiclePosition() > 476) {  
        stopAEV();  
    }  
}
```

```
if (getVehiclePosition() < 473) {  
    reverse(4);  
    motorSpeed(4, 28);  
    goToAbsolutePosition(473);  
    brake(4);  
    reverse(4);  
    stopAEV();  
}
```

- After planned brake
- While moving, ensures it doesn't pass destination
- After stopping, checks if it is short

# Final Test Results

- The team ended up having to stop the AEV manually
- The code didn't work because isStopped() used absolute position
  - Wasn't calibrated for reverse travel
- Used 178 Joules of energy
- Ended up with an energy ratio of 635 J/kg

# Results - Power vs. Time

File :

File :

File :

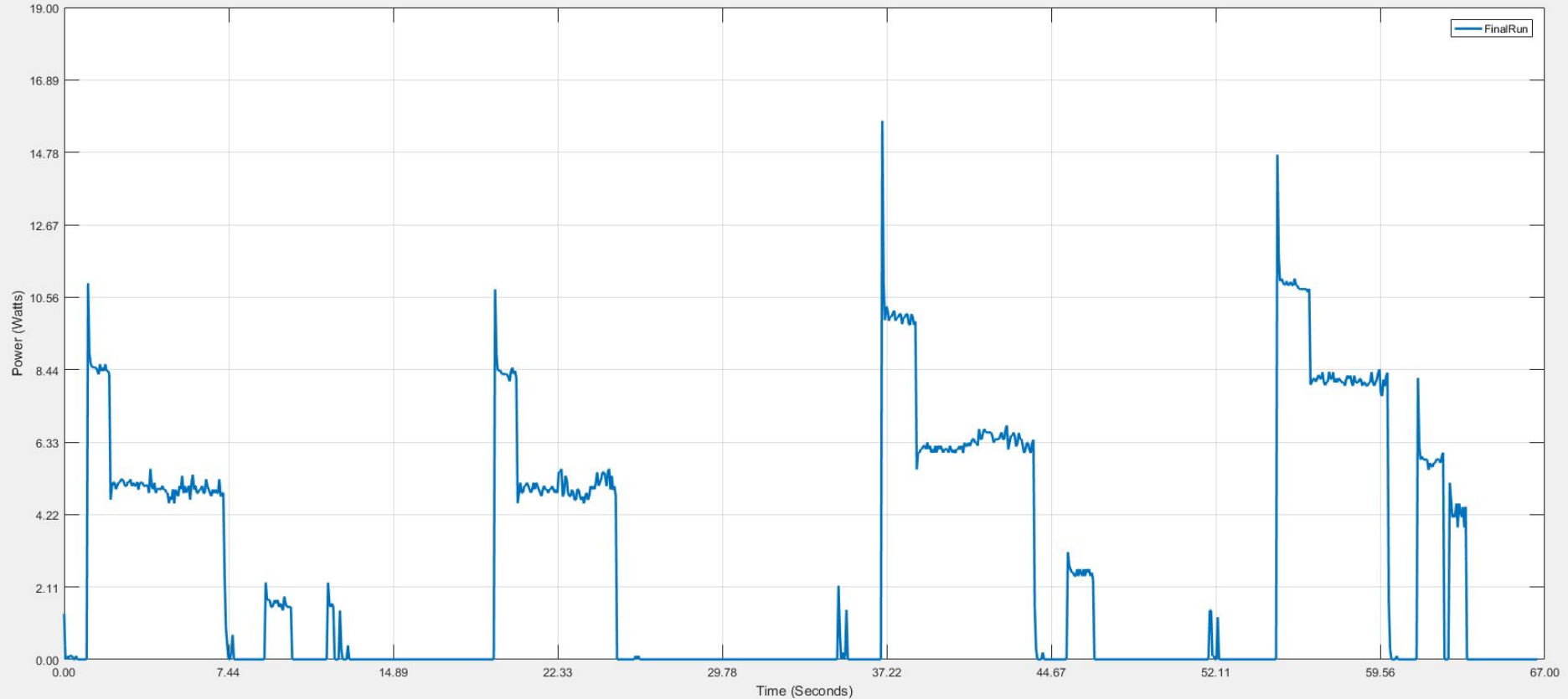
File :

Energy (J)

Energy (J)

Energy (J)

Energy (J)



# Video

