TEAM A – BAKER INTERNATIONAL GROUP

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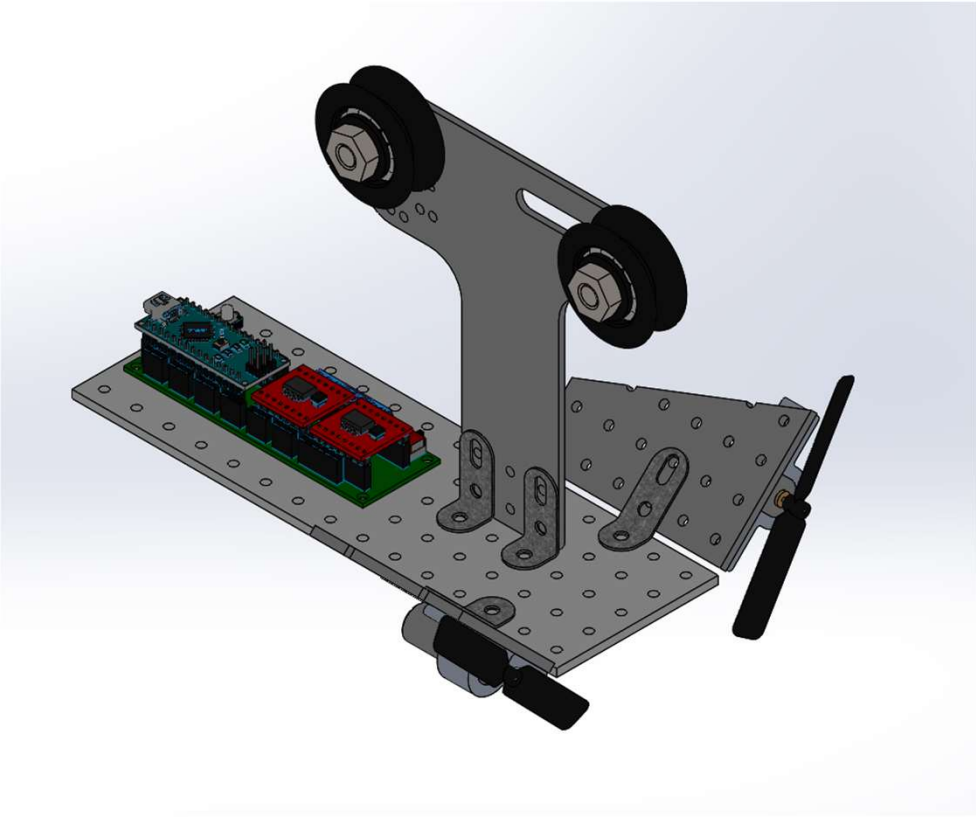
OUR AEV

- Approach to MCR: Focusing on Enhancing Mobility
  - Wing Shape and Angle
  - Balanced Weight
- Research and Development
  - Focusing on speed to lower cost
  - Testing braking to increase efficiency



R&D 1: MOTOR PROPULSION

Why?

- To determine which method is more efficient based on power usage and speed of travel

How?

- Two "puller" motors
- Two "pusher" motors
- One "puller", one "pusher"

R&D 1: MOTOR PROPULSION

Arduino Code

- Accelerate from 0% to 25% power in 2 seconds
- Run motors at 25% power for 99 marks
- Brake

TWO PULLER

```
// Accelerate all motors from 0% to 25% power in 2 seconds
celerate(4, 0, 25, 2);
// Run both motors at 25% power for 4ft (99 marks)
motorSpeed(4, 25);
goToRelativePosition(99);
// Brake both motors
brake(4);
```

TWO PUSHER

```
// Reverse the motors
reverse(4);
// Accelerate all motors from 0% to 25% power in 2 seconds
celerate(4, 0, 25, 2);
// Run both motors at 25% power for 4ft (99 marks)
motorSpeed(4, 25);
goToRelativePosition(-99);
// Brake both motors
brake(4);
```

ONE PULLER, ONE PUSHER

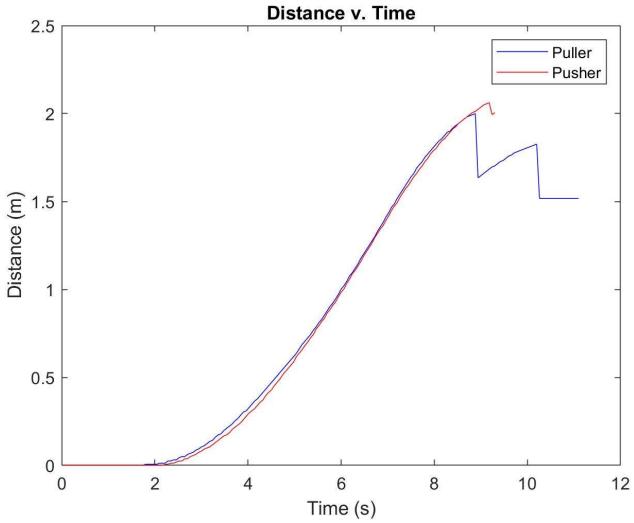
```
// Reverse motor 1
reverse(1);
// Accelerate all motors from 0% to 25% power in 2 seconds
celerate(4, 0, 25, 2);
// Run both motors at 25% power for 4ft (99 marks)
motorSpeed(4, 25);
goToAbsolutePosition(99);
// Brake both motors
brake(4);
```

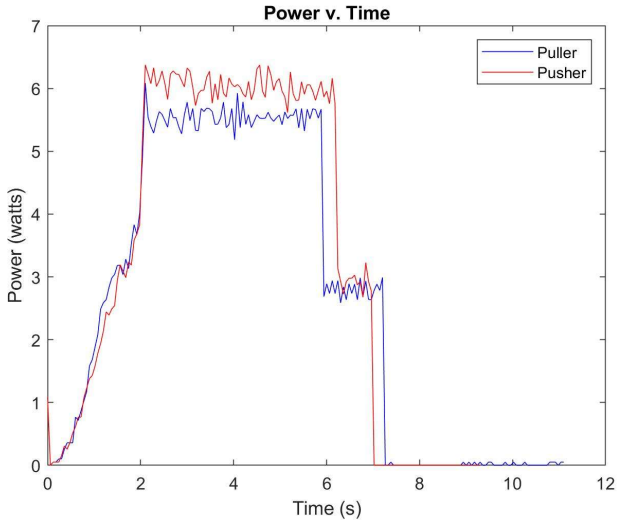
R&D 1: MOTOR PROPULSION

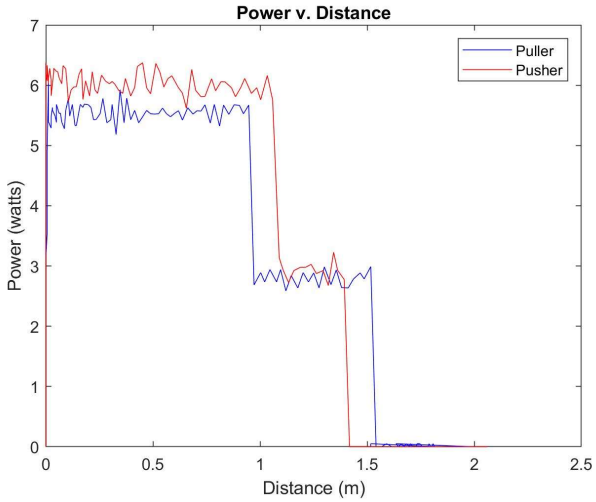
Data Collection

- Used MATLAB data analysis tool
- Found averages in Excel
- Created MATLAB plots
  - Distance v. Time
  - Power v. Distance
  - Power v. Time

R&D 1: MOTOR PROPULSION







R&D 1: MOTOR PROPULSION

Limitations

- Our AEV not designed well for one pusher, one puller motor
- Order of testing (puller, pusher, one of each) could be affected by battery power

Conclusions

- Which method travels same distance faster?
- Which method uses less power?

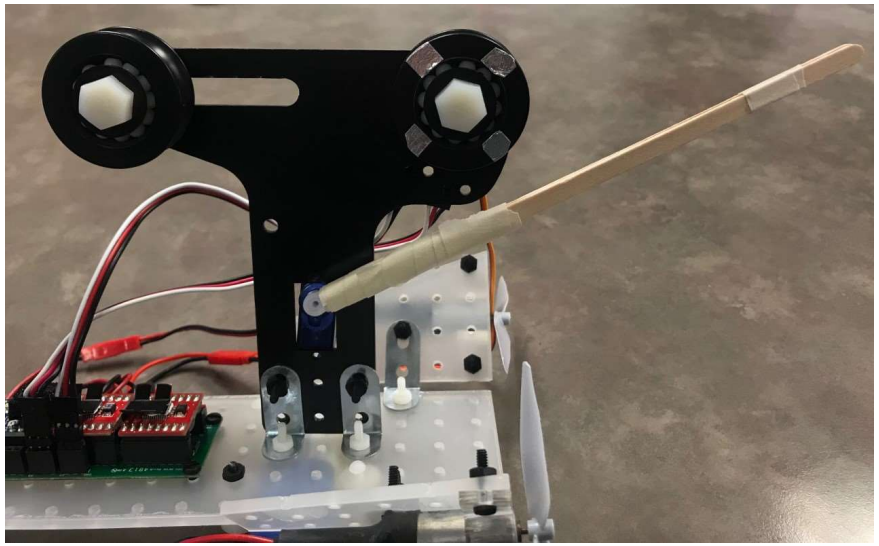
R&D 2: SERVO BRAKE

Why?

- To determine if using the servo is a viable braking option

How?

- Test with normal, coasting brakes
- Test with servo brake arm



R&D 2: SERVO BRAKE

Arduino Code

- Accelerate from 0% to 40% power in 2 seconds
- Run motors at 40% power for 99 marks
- Brake

NO BRAKE

```
// Accelerate all motors from 0% to 40% power in 2 seconds
celerate(4, 0, 40, 2);
// Run both motors at 40% power for 4ft (99 marks)
motorSpeed(4, 40);
goToRelativePosition(99);
// Brake both motors
brake(4);
```

SERVO BRAKE

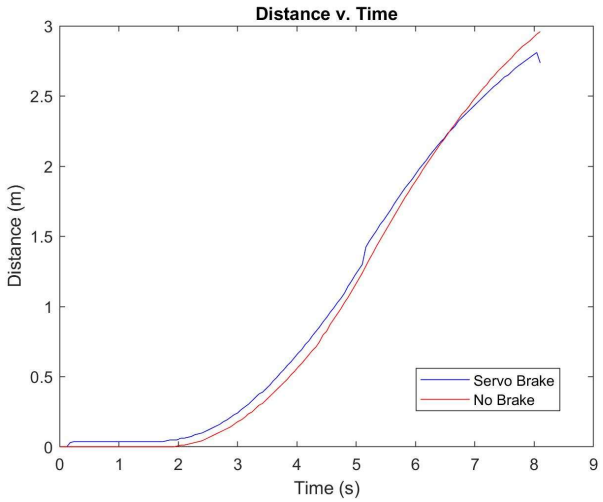
```
// Rotate servo
rotateServo(90);
// Accelerate all motors from 0% to 25% power in 2 seconds
celerate(4, 0, 25, 2);
// Run both motors at 25% power for 4ft (99 marks)
motorSpeed(4, 25);
goToAbsolutePosition(99);
// Rotate servo
rotateServo(0);
// Brake both motors
brake(4);
```

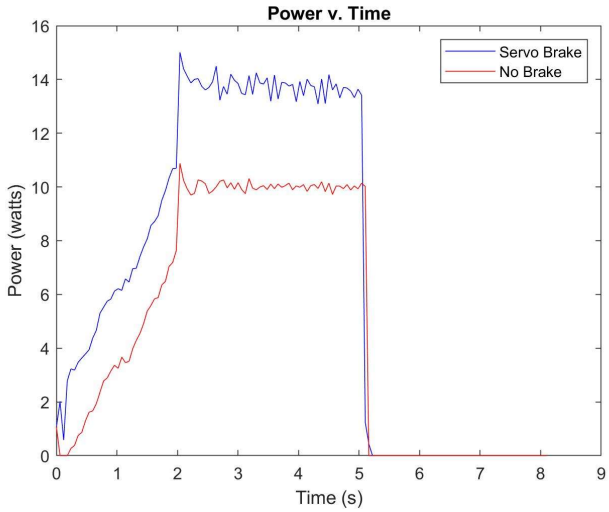
R&D 2: SERVO BRAKE

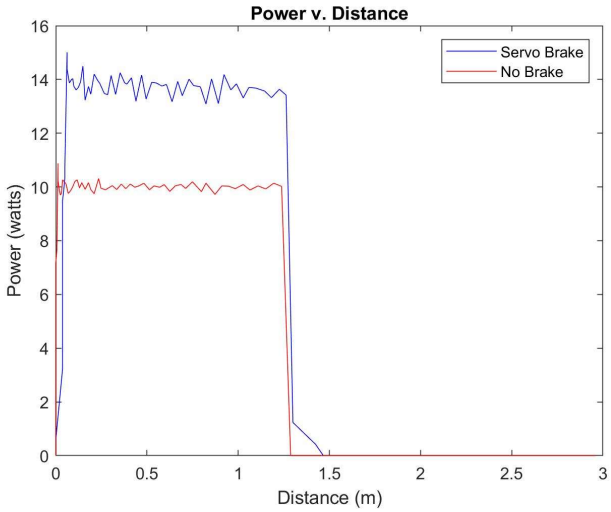
Data Collection

- Used MATLAB data analysis tool
- Found averages with Excel
- Created MATLAB plots
  - Distance v. Time
  - Power v. Distance
  - Power v. Time

R&D 2: SERVO BRAKE







---- Servo Brake

---- No Brake

R&D 2: SERVO BRAKE

Limitations

- Our brake arm was made of coffee stirrers and connected to servo with masking tape
- Servo learning curve
- Angle estimations

Conclusions

- Servo brake allows AEV to brake in a shorter distance
- Servo brake requires ~5 watts of additional power
- A sturdier servo brake arm might be worth the extra power cost

PERFORMANCE TEST PLANNING

Purpose

- Test 1: AEV travels up incline, stops at gate for 7 seconds, then proceed through gate
- Test 2: in addition to Test 1, connect with load, stop for 5 seconds, then exit loading zone
- Final: in addition to Test 2, return to gate, stop for 7 seconds, return to starting dock, within 2.5 minutes

- Process: write code, run tests, MATLAB plots, reevaluate
- Problems: battery voltage depletion, inconsistencies

QUESTIONS?

References:

- Ohio State Fundamentals of Engineering Program, "MCR & Deliverables" [AEV Documents]. Available: carmen.osu.edu for ENGR 1182.
- Ohio State Fundamentals of Engineering Program, "Technical Communications Guide" [Student Resources-2]. Available: carmen.osu.edu for ENGR 1182.
- Ohio State Fundamentals of Engineering Program, "Advanced R&D" [AEV Documents]. Available: carmen.osu.edu for ENGR 1182.
- Ohio State Fundamentals of Engineering Program, "User Manual – Motor" [AEV Documents]. Available: carmen.osu.edu for ENGR 1182.
- Ohio State Fundamentals of Engineering Program, "User Manual – Servo" [AEV Documents]. Available: carmen.osu.edu for ENGR 1182.

Conclusion

- Pusher method
- No Servo break