Situation (Weeks 9-11)

Weeks 9 through 11 were devoted to completing the three final R&D tests: Performance Test 1: Design Concept Comparison, Performance Test 2: Operational Objectives and Performance Test 3: Energy Optimization. During each Performance Test, Team R has focused on perfecting a different aspect of the overall AEV design in order to maximize the performance and efficiency of the final AEV.

Performance Test 1: Design Concept Comparison presented Team R with the task of comparing two AEV construction designs, and testing them both to ultimately decide which would be the final construction design of the AEV. This Performance Test was completed by first deciding which two designs would be taken to the final stage of testing. Team R ultimately decided to test two different propeller configurations, the two pull 3030 propeller configuration and the one push, one pull 3030 propeller configuration, which were deemed the most efficient and powerful propeller configurations from the advanced R&D testing. These two configurations were tested with very similar arduino codes, in order to determine which design produced the better results. The runs for both designs were analyzed and compared using the AEV performance analysis on MATLAB.

Performance Test 2:Operational Objectives was completed in a similar manner, but this test focused primarily on comparing two different sets of arduino codes on the same AEV design. The one push, one pull 3030 propeller configuration chosen in Performance Test 1 was tested using two different arduino codes, one operating on gofor time operators, and the second operating on relative distance codes. The runs for both arduino codes were analyzed and compared using the AEV performance analysis on MATLAB, which would tell which code allows to maximize the AEV's performance and energy efficiency.

Performance Test 3: Energy Optimization is the last step in designing the AEV for the final Performance Test. The Performance Test tasked Team R with combining the results from Performance Test 1 and 2 into a final AEV design, and making minor changes in the code and design to maximize the energy efficiency of the final AEV. Team R will have completed this task by conducting trial and error tests, making minor changes for each test and analyzing the run on the MATLAB analysis tool every time a change was made. These trial and error tests ultimately led Team R to the final, most efficient design for the AEV moving into the final testing stage of the project.

Week 9

Results & Analysis

Performance Test 1: Design Concept Comparison ultimately revealed that the one push, one pull 3030 propeller configuration design is the best design for the AEV, and will be the design the AEV uses in the final testing stages. Performance Test 1 pinned the one push, one pull 3030 propeller configuration against the two pull 3030 propeller configuration against each other with largely the same gofor time operational arduino codes. After trial and error testing to create a code that maximized the AEV performance for both designs, both designs were tested unbiasedly, and the results were analyzed in the MATLAB tool. The MATLAB graphs showed that the one push, one pull 3030 propeller configuration ultimately made for a more powerful, and more efficient run for the AEV, which is essential when moving forward in the testing. With this design, the AEV will be able to get down the track faster, and will be able to brake more efficiently. The additional power will also be essential in pulling the payload

back to the original dock in the final performance test. The one push, one pull 3030 propeller configuration also allowed for an easier connection to the payload for the future tests, as the two pull 3030 propeller configuration actually would not have provided a location for a metal connection bracket, as a propeller would be in the way of the payload. The one push, one pull 3030 propeller configuration provided a place for the metal bracket to be placed that would line up evenly and firmly connect to the magnet on the payload, which would be critical in the testing moving forward. Performance Test 1 proved that the one push, one pull 3030 propeller configuration is the most efficient, and overall the most ideal design for the AEV to have moving into further testing.

Week 10

Results & Analysis

This performance test, Performance Test 2, pits two ways of programming the AEV against each other. Using the one push, one pull 3030 propeller configuration from Performance Test 1, the team first programmed the AEV to travel from the starting point to the gate and then from the gate to the payload using the timed Arduino function call “goFor”. The team saw limited success with this method. Problems with this method included a major lack of consistency between runs and difficulty in fine tuning the program. Though the program may work perfectly for one or two runs, it would often stop much too short or go far too long into the gate. Despite the team’s best efforts to reduce error in starting position, the inconsistencies persisted throughout the week. However, the AEV did successfully complete Performance Test 2 during this time. Many different iterations of this code were tested due to the inconsistencies, mostly just small number tweaks. However, different approaches were used. Reductions or increases in power braking versus reductions or increases in the amount of time the motors ran at certain powers were the main two values that were changed. Part of the approach was also changed where a “celerate” function call was used to deliver lower amounts of power to the AEV instead of using full power all the way to the gate and then stopping. Due to continued issues with this code, the team has now begun development on a program utilizing the “goToAbsoluteDistance” and “goToRelativeDistance” Arduino calls in an attempt to limit the amount of variance from one test to the next and increase the overall precision of the AEV’s stopping.

Week 11

Results & Analysis

During the second committee meeting, the team discussed alternative techniques within the code to help the AEV perform as reliable and consistent as possible. Within the meeting for R&D consultants, other groups and Ms. Beyene suggested that instead of using time as the variable for starting and stopping the AEV, we should use absolute distance because it can be more consistent. Throughout the past couple of weeks the main problem with our AEV has been the code's consistency on the track. What is meant by this is the code would produce different results on the track, even when the code had not been changed at all. Also, the results varied greatly, for one test run the AEV could stop one or two inches short, but for the next run (without changing the code), it could crash into the gate. When we first began running the code with absolute distance, the group encountered many errors. First, we had

a test run that would go for 30 marks and the AEV would stop well short of the gate, but when the distance would be increased to 35 marks (2.4375 inches more), the AEV would travel much longer than the distance to the gate, providing more inconsistencies within the code. After consulting a TA, a couple errors within the design of the AEV were discovered as the main cause of the inconsistencies. The two problems with the AEV were the zip ties tying the reflectance sensors to the AEV were not tight enough, and there was a screw on the wheel side that through off the count for the AEV when the code was performed. To solve these problems, the zip ties were tied tighter to limit the reflectance sensors movement, and the screw was moved to the AEV side that did not have the wheel. After these changes were made, the code was much more consistent when using the code, and we were able to determine that those errors were the root of the AEV's problems.

Takeaways (Weeks 9-11)

After discussing within the group and with other groups, we have decided to entirely scrap our code, and build a new code using a different method. Throughout the process, the AEV's code would not perform consistent enough for us to rely on it when doing the performances tests. As a result, we have decided to use absolute distance as the variable for the code instead of time because of the insight given to us from the TA's and other groups we have spoken with. With the change in code, we hope the AEV will run much more consistently, and be able to rely on it more in the future than the previous code. When changing the code to using distance we realized that the design needs to be much more stable and will have to be checked on more in the future. We realized this when the code would not function properly for the first couple times, and it was a result of the reflectance sensors not being attached and secured properly, so the group will also have to keep an eye on the sensors throughout the rest of the process.

Situation (Weeks 12-13)

In the upcoming weeks of the AEV project process, Team R will begin to finalize the details on the AEV. Now that much research has been done to develop the AEV including the preliminary research and development topics as well as the advanced topics completed during the performance tests, this data can be used to optimize the energy being used on the AEV, the code being used to run the AEV, and the design of the AEV including the propeller configuration. Through this, the team will be able to calculate the best of all these factors. While finalizations are made on the AEV, the team will work to present these outcomes to their colleagues and the instructional staff through a final presentation, a website, and a critical design review report. The team will therefore be able to share their findings on how they finalized their most efficient and sustainable AEV for the Columbus community.

This needs to be completed in order for the team to have an AEV that fits the needs of the project. The AEV must be sustainable and efficient, and the final testing being done on the AEV will ensure that these goals are met. The presentation of findings must be included to ensure that other teams and companies can share information to ensure the best possible outcome is met.

The team will split up the work evenly for the reports. To do this, the team will meet ahead of time to split up the work and make it clear what member will do what in each assignment. Brian, as head programmer, will ensure that the codes used in the upcoming tests are efficient and will run the AEV the most smoothly. The team will assist by comparing the codes used in performance test 2. Alex, as head web developer, will make sure to keep all data up to date for the team's reference in future tests. As

head of CAD operations, Max will ensure that current designs of the AEV are saved and the design is changed as the physical model changes. Finally, Justin will make sure to make sure each factor of the AEV is optimized as the head of research and development. Through these aforementioned roles and assignments, Team R will compete the tasks outlined above and meet the goals below.

Team R has many goals in the upcoming weeks. Firstly, the team wants to have a successful third and final performance test. This will ensure that the AEV is up to par. Next, the team desires to create a successful website and reports to help their colleagues compare their findings with Team R's, therefore optimizing the use of data from all the AEVs. Lastly, the team hopes to create an AEV that fulfills the needs of the Columbus community set out in the first weeks of lab: to design advanced energy vehicles as part of a monorail project to transport people to and from these isolated urban areas to areas where they can work and purchase goods to fulfill their needs.

Schedule (Weeks 12-13)

- Lab Week 12
  - 12A (4/9)
    - ALL MEMBERS: Turn in Oral Presentation draft.
    - ALL MEMBERS: Perform Final Test Run #1
    - ALL MEMBERS: Make necessary adjustments if needed. If no adjustments are needed, complete the next testing runs.
  - 12B (4/11)
    - ALL MEMBERS: Continue Final Testing
    - ALL MEMBERS: Complete Final Test Run #2
    - ALL MEMBERS: Make necessary adjustments if needed. If no adjustments are needed, complete the next testing run.
  - 12C (4/12)
    - ALL MEMBERS: Continue Final Testing
    - ALL MEMBERS: Complete Final Test Run #3
- Lab Week 13
  - 13A (4/16)
    - ALL MEMBERS: Make efficient use of work day.
    - ALL MEMBERS: Assign roles for completion of Final Oral Presentation (due either 4/18 or 4/19), CDR (due 4/19) and Final Website (due 4/19)
    - ALL MEMBERS: Work diligently to complete all necessary assignments.
  - 13B (4/18)
    - ALL MEMBERS: If presentation is this day, turn in Final Oral Presentation by midnight before presentation, and complete Final Oral Presentation.
  - 13C (4/19)
    - ALL MEMBERS: Turn in CDR.
    - ALL MEMBERS: Turn in Final Website update.

- ALL MEMBERS: If presentation is this day, turn in Final Oral Presentation by midnight before presentation, and complete Final Oral Presentation.

Appendix A: Team Meeting Minutes

Meeting 1:

- Time of Meeting: 01/11/2018, 11:10 AM
- Location of Meeting: Hitchcock Hall 224
- Members Present: Alex Short, Brian Glowacki, Justin Beachy, Max Doucette
- Topics Discussed: Underpinnings of the AEV project and next steps.
- Upcoming Tasks: Make GroupMe, discuss times for meetings and outline rules for teamworking agreements, begin making the webpage. No specific roles have been assigned yet, so no one member is assigned to each task at this point.

Meeting 2:

- Time of Meeting: 01/18/2018, 11:10 AM
- Location of Meeting: Hitchcock Hall 224
- Members Present: Alex Short, Brian Glowacki, Justin Beachy, Max Doucette
- Topics Discussed: Begin preliminary testings of motors and becoming familiar with the AEV kit. Begin programming for scenario 1 for Preliminary R&D Lab. There were issues when trying to run the program. When the code was attempted to be run, a message was received that said, "problem uploading to board". The code was not being sent to the Arduino board properly. A new USB cable was received and the problem was not resolved. A new Arduino board was then provided and the program was properly uploaded and ran, however, the propellers would not move because there was too much resistance in the motors. More problems were encountered when the program was run a second time on the new board. The rest of the lab was spent troubleshooting the program and motors.
- Upcoming Tasks: All team members will review and properly prepare for Lab 03. Alex will update website and request help from team members as needed. The team members will meet to complete exercise 1.

Meeting 3:

- Time of Meeting: 01/25/2018, 11:10 AM
- Location of Meeting: Hitchcock Hall 224
- Members Present: Alex Short, Brian Glowacki, Justin Beachy, Max Doucette
- Topics Discussed: Team members worked to complete the first part of the lab. The Arduino program was still having issues running correctly. A TA was called over to assist, and a few settings were updated in the Arduino application. The application was reset again and the program ran successfully this time. The motors were set up and the program was run again and it worked fine. Next, the physical sample AEV was constructed. It was noticed that each screw and nut needed to be tightened down enough so that the jostling movement of the AEV would

not affect the functionality of the AEV. After constructing the AEV, the black wire connected to the board was ripped so a part of the ire was stuck in the port. A new board was provided. The red wire now was having issues being connected to the AEV, so the Arduino was fixed again. The rest of lab was used to clean up the area and the

- Upcoming Tasks: The team will work to keep the website updated. The team will each create an individual concept design and then meet to collaborate and decide which design to pursue.

Meeting 4:

- Time of Meeting: 01/28/2018, 6:00 PM
- Location of Meeting: Hitchcock Hall Basement Commons
- Members Present: Alex Short, Brian Glowacki, Justin Beachy, Max Doucette
- Topics Discussed: Initial Concept Designs and Next Steps for the design process
- Upcoming Tasks: Each team member will upload a photo of their initial concept design and put reasons why that design was not used (if applicable). Team members will discuss which design to pursue next meeting.

Meeting 5:

- Time of Meeting: 02/01/2018, 10:20 AM
- Location of Meeting: Hitchcock Hall 224
- Members Present: Alex Short, Brian Glowacki, Justin Beachy, Max Doucette
- Topics Discussed: Complete pR&D lab exercises 2, 4, and 5. AEV was constructed and Arduino was programmed. Exercise 2: Program ran successfully. Exercise 4: Max's design was constructed by the team.
- Upcoming Tasks: Each team member will assist in making the Progress Report, team members will communicate when to meet to complete pR&D.

Meeting 6:

- Time of Meeting: 02/05/2018, 5:20 PM
- Location of Meeting: Hitchcock Hall 224
- Members Present: Alex Short, Justin Beachy
- Topics Discussed: Completion of AEV model as well as pR&D lab exercises 4 and 5. During exercise 4, the code only ran for the first half of the exercise. The propellers would not reverse. The code was rewritten and loaded onto the Arduino. The design was tested on the test track and the data was downloaded onto into the AEV Analysis application.
- Upcoming Tasks: Team members will communicate when to meet to complete progress report as well as prepare for Thursday's advanced R&D lab. Alex will bring the lab kit Thursday. Max will review the team meeting minutes to ensure everything is looking good. Brian will upload his codes as well as the comments. Justin will get the updated plot from MATLAB uploaded into the website.

Meeting 7:

- Time of Meeting: 02/08/2018, 11:10 AM
- Location of Meeting: Hitchcock Hall 224

- Members Present: Alex Short, Justin Beachy. Max Doucette, Brian Glowacki
- Topics Discussed: Advanced R&D exercise 1 was begun. The team was assigned wind tunnel and propeller configuration. Propeller configuration was started with. The team decided to go with 1 2510 and 1 3130 propeller pushing. This configuration did not move the AEV very far.
- Upcoming Tasks: Alex will prepare the slides for Grant Proposal and print materials for committee meetings. Team members will meet to decide who will say what in the presentation in grant proposal as well as who will meet for what position in the committee meetings.

Meeting 8:

- Time of Meeting: 02/14/2018, 9:30 PM
- Location of Meeting: Thompson Library
- Members Present: Alex Short, Justin Beachy. Max Doucette, Brian Glowacki
- Topics Discussed: Grant Proposal, Committee Meetings, Schedule, Team Working Agreement
- Upcoming Tasks: All team members will plan to dress business casual in Thursday's lab and present Grant Proposal for AEV. Alex will handle Public Relations for Committee meeting. Max and Justin will handle Research and Development. Brian will handle human resources.

Meeting 9:

- Time of Meeting: 02/15/2018, 11:30 AM
- Location of Meeting: Thompson Library
- Members Present: Alex Short, Justin Beachy, Max Doucette, Brian Glowacki
- Topics Discussed: Grant proposal was given to the class to propose a cover for the front of AEV. Committee meetings for HR, PR, and R&D were completed. AEV Advanced R&D 1, Propeller Configuration was next. It was noticed that the weight distribution was not the greatest for the AEV, with a lot of weight in the back. It was decided not to change this until all 4 propeller configurations are done so that the variable of weight is not altered. The 2 push with 1 3130 and 1 2510 worked pretty well, which was the first configuration. However, the graphs for distance were not coming out right because of the reflectance sensors. Sensors were then fixed.
- Upcoming Tasks: Team members will plan to come to lab next week prepared to complete the Advanced R&D Lab 1.

Meeting 10:

- Time of Meeting: 02/22/2018, 11:10 AM
- Location of Meeting: Hitchcock Hall 224
- Members Present: Alex Short, Justin Beachy, Max Doucette, Brian Glowacki
- Topics Discussed: Team completed Advance R&D topic 1. It was found that the propeller configuration containing two 3130 propellers, one pushing and one pulling the AEV, was best for the project. The graphs for these are found under Advanced R&D. The team moved on to topic 2, which was wind tunnel testing.
- Upcoming Tasks: The team will complete the wind tunnel testing in the next lab. Alex will finish the website update after the team meets to analyze the wind tunnel data. The team will meet outside of class to complete the preparation for the Oral presentation. Since Alex will be out of

town for the scheduled presentation, the team will meet with the instructional staff at a scheduled time the following week of the class scheduled presentation.

Meeting 11:

- Time of Meeting: 03/04/2018, 11:10 AM
- Location of Meeting: Thompson Library
- Members Present: Alex Short, Justin Beachy, Max Doucette, Brian Glowacki
- Topics Discussed: Team prepared for rescheduled oral presentation. The team also delegated work for the second progress report.
- Upcoming Tasks: The team will complete the oral presentation for the instructional staff. The team will complete Progress Report 2, with Justin doing weeks 9-11 of the forward-looking summary, Max doing the situation and schedule for the forward-looking summary as well as weeks 12-13. Alex is doing the meeting minutes appendix as well as the weeks 7-8 for the backward-looking summary and backward-looking takeaways. Brian will do the backward-looking summary for weeks 5-8 as well as weeks 5 and 6.

Meeting 12:

- Time of Meeting: 03/08/2018
- Location of Meeting: Hitchcock Hall 224
- Members Present: Alex Short, Justin Beachy, Max Doucette, Brian Glowacki
- Topics Discussed: The team performed the first performance test. A propeller was broken pre-lab, so Justin Beachy repaired the AEV. Brian Glowacki wrote the code for the performance test. The code was to have the AEV go to the middle of the track, pause for 7 seconds, and then go again once the stop sign opened. The team had to reverse the direction of the wheels so that the AEV would work properly on the track they were to test on. One design tested was the original vertical design by Max Doucette. The other design that was tested was a similar design, but the wires were secured to avoid drag, as well as the battery and Arduino, moved to ensure a balanced axis parallel to the track.
- Upcoming Tasks: Team members will take a short break for a week and enjoy their time off. In the meantime, the members will prepare for various design ideas to test for the performance test and complete the tests by the end of lab 9c.

Meeting 13:

- Time of Meeting: 03/19/2018, 10:20 AM
- Location of Meeting: Hitchcock Hall 308
- Members Present: Alex Short, Brian Glowacki, Justin Beachy, Max Doucette
- Topics Discussed: The team continued with Performance Test 1. It was noted during performance test one that the timing had to be perfect for the power braking.
- Upcoming Tasks: Brian will fix the program in order to complete the performance test. The team will brainstorm possible configurations to use for the other design in the performance test.

Meeting 14:

- Time of Meeting: 03/21/2018, 10:20 AM

- Location of Meeting: Hitchcock Hall 308
- Members Present: Alex Short, Brian Glowacki, Justin Beachy, Max Doucette
- Topics Discussed: The team finished with Performance Test 1, design review concept, and discussed the CDR Draft. The amount of power as well as when this power was initiated was the main concern. Additionally, the team was required to rearrange some of the wiring components in order to accommodate to the second propeller configuration.
- Upcoming Tasks: The CDR Draft is due the 24th. Alex will work on the discussion, appendix, and table of contents. Brian will take the Executive summary and the description of the two concepts. Justin will work on the introduction, AR&D, and references. Max will take the run observations, screening and scoring, and experimental methodology.

Meeting 15:

- Time of Meeting: 03/22/2018, 11:10 AM
- Location of Meeting: Hitchcock Hall 242
- Members Present: Alex Short, Brian Glowacki, Justin Beachy, Max Doucette
- Topics Discussed: The team began with performance test 2. It was noticed that the code for the Arduino is not consistent with the test results. Sometimes, the AEV will hit the stop sign and other times it does not make it far enough. When picking up the load, it is also noticed that the AEV is coming in at too high of a velocity.
- Upcoming Tasks: The team will update the website and complete their tasks for the CDR draft by Saturday at 5 PM.

Meeting 16:

- Time of Meeting: 03/26/2018, 10:20 AM
- Location of Meeting: Hitchcock Hall 308
- Members Present: Alex Short, Brian Glowacki, Justin Beachy, Max Doucette
- Topics Discussed: Team R was tasked with completing another Performance Test in order to verify that the team's work was on track with the mission of the AEV. The AEV had to travel to the gate, wait 7 seconds, and then travel through the gate. It then needed to pick up a load on the other side. This Performance Test 2 focuses on perfecting the code used once the design was optimized. The team used the design utilizing a one-push-one-pull propeller configuration. It was noted during performance test two that the AEV stopped 5 inches earlier than the last test, using the same control program. The team was unsure why this was happening but assumed it needed to be re-calibrated due to variables such as the battery changing since the last test. Brian rewrote the code for the AEV and the test was re-run. Zip ties were also added to the sensors to help with consistency.
- Upcoming Tasks: Alex will update the website. The team will prepare for the second committee meeting and assign tasks when they are given by the instructional team.

Meeting 16:

- Time of Meeting: 03/26/2018, 10:20 AM
- Location of Meeting: Hitchcock Hall 308
- Members Present: Alex Short, Brian Glowacki, Justin Beachy, Max Doucette

- Topics Discussed: Team R was tasked with completing another Performance Test in order to verify that the team's work was on track with the mission of the AEV. The AEV had to travel to the gate, wait 7 seconds, and then travel through the gate. It then needed to pick up a load on the other side, wait 5 seconds, and then bring it back to the station. This Performance Test 2 focuses on perfecting the code used once the design was optimized. The team used the design utilizing a one-push-one-pull propeller configuration. It was noticed during the test that the AEV did work better than last time. Last time, the AEV seemed to stop early or late before the gate each time. When it was run this time, it worked fine. The problem now was that the AEV was coming into the loading station too quickly, so the AEV needed to be slowed down a bit. Once this was done, the AEV successfully was able to pick up the load and bring it back to the station. The rest of class was spent perfecting the code so that the AEV would stop in the right spot perfectly, and then the performance test was completed.
- Upcoming Tasks: Committee meeting 2 is tomorrow during lab time. Brian will take HR, Alex will take PR, and Justin and Max will take R&D. The team will look at the rubric prior to the lab to know what needs to be done for the meeting. The team will also prepare for the 3rd progress report as well as the final R&D (Energy Optimization).

Meeting 17:

- Time of Meeting: 03/29/2018, 11:10 AM
- Location of Meeting: Hitchcock Hall 308
- Members Present: Alex Short, Brian Glowacki, Justin Beachy, Max Doucette
- Topics Discussed: Team R was tasked with completing another Performance Test in order to verify that the team's work was on track with the mission of the AEV. The AEV had to travel to the gate, wait 7 seconds, and then travel through the gate. It then needed to pick up a load on the other side, wait 5 seconds, and then bring it back to the station. This Performance Test 3 focuses on perfecting the energy used in the AEV's run. The team used the design utilizing a one-push-one-pull propeller configuration. It was noticed during the test that the AEV did not work better than last time. Last time, the AEV was inconsistent, and again this occurred. With help from instructional staff, it was learned that a position function should be used for the code instead of using the goFor function.
- Upcoming Tasks: The team will begin progress report 3 and prepare for performance test 3. Alex will take the team meetings appendix and forward-looking summary and schedule. Brian will take the Arduino code appendix and week 9 summary. Max and Justin will do weeks 10 and 11 on the report.

Appendix B: Ardunio Function Calls

Performance Test 1

```
reverse(1);                 // sets motor one in reverse
motorSpeed(4, 40);          // sets both motors to speed 40
```

```
goFor(1.75);                // keeps above command for 1.75 seconds
celerate(4,40,10,1.84);     // decelerates both motors from 40 to 10 in 1.7 seconds
reverse(4);                 // sets both motors in reverse
motorSpeed(4, 50);          // sets both motors to 50 percent power
goFor(0.9);                 // keeps current command for 0.9 seconds
brake(4);                   // stop both motors
motorSpeed(4, 0);           // sets both motors to speed 0
goFor(7);                   // keeps above command for 7 seconds
reverse(4);                 // sets both motors in reverse
motorSpeed(4, 30);          // sets both motors to 30 speed
goFor(3);                   // keeps above command for 3 seconds
```

Performance Test 1 (both pull)

```
motorSpeed(4, 40);          // sets both motors to 40 speed
goFor(2.35);                // runs motors at initialized speed for 2.35 seconds
celerate(4,40,10,.4);       // decelerates motors from 40 speed to 10 in .4 seconds
reverse(4);                 // reverses both motors for power braking
motorSpeed(4, 50);          // sets both motors to 50 speed
goFor(1.3);                 // runs motor for 1.3 seconds
brake(4);                   // brakes both motors
motorSpeed(4, 0);           // sets motors to 0 speed so that the AEV waits at the gate
goFor(7);                   // AEV waits at gate for 7 seconds
reverse(4);                 // Reverses both motors to continue forward
motorSpeed(4, 30);          // sets motor speed to 30
goFor(3);                   // runs motors for 3 seconds
```

Performance Test 2

```
reverse(1);                 // sets motor one in reverse
motorSpeed(4, 40);          // sets both motors to speed 40
```

```
goFor(1.75);                // keeps above command for 1.75 seconds
celerate(4,40,10,1.78);     // decelerates both motors from 40 to 10 in 1.7 seconds
reverse(4);                 // sets both motors in reverse
motorSpeed(4, 50);          // sets both motors to 50 percent power
goFor(0.9);                 // keeps current command for 0.9 seconds
brake(4);                   // stop both motors
motorSpeed(4, 0);           // sets both motors to speed 0
goFor(7);                   // keeps above command for 7 seconds
reverse(4);                 // sets both motors in reverse
motorSpeed(4, 30);          // sets both motors to 30 speed
goFor(3);                   // keeps above command for 3 seconds
celerate(4,30,10,.85);      // decelerates both motors from 30 speed to 10 speed in .85 seconds
reverse(4);                 // reverses both motors
motorSpeed(4, 0);           // sets both motors to 0 speed so AEV coasts into payload
goFor(9.5);                 // has AEV motors idle for 9.5 seconds to allow for coasting into payload and
loading for 5 seconds
motorSpeed(4,50);           // sets both motors to 50 speed
goFor(4.9);                 // runs both motors for 4.9 seconds to leave loading zone
```