AEV Preliminary Design Report

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Executive Summary

The AEV project consisted of designing, building, and coding an autonomous energy vehicle (AEV) that would run on a monorail track and complete the assigned task. Other goals of this project were to design a vehicle that would focus on energy management, operational efficiency, and operational consistency. This project also developed project management and team working skills and taught more about the design process and project documentation. Each week, the team performed a different lab that all contributed towards the design, coding, building, and testing of the AEV. The assigned task was "Star Wars" themed, and the team was challenged to build an AEV that would start in the drop off area, glide on the monorail and stop in front of the first sensor for five seconds, continue on the path and navigate to the cargo area to pick up an "R2D2", stop for five seconds to verify all cargo is loaded, return back to the gate, trigger the other sensor, pause for seven seconds, and then continue back to the starting position and final drop off area. The AEV's mission was to transport R2D2 units following the destruction of the Death Star. An efficient system is needed because there is limited power on the remote planets.

During the first week of lab, the team explored the system hardware components and learned how to set up the AEV software as well as program basic commands in Arduino. Future labs involved performing tests to become familiar with the propulsion system efficiency as well as the programming for the external sensors, brainstorming and drafting AEV concept sketches, downloading data from the automatic control system in order to conduct analysis of the AEV after each run, using a concept scoring and screening matrix in order to analyze the various AEV models, running and collecting data from testing the AEV on a straight track, analyzing data in order to determine the amount of friction generated as well as the energy used, and designing and testing two different AEV designs using the same code to determine which design would run more efficiently. All of the labs gave the team valuable information on what the best AEV design would be and how the AEV could perform at top quality while completing the assigned task at minimal power.

Two final designs were originally created and tested to see which would run more efficiently. The concept screening and scoring matrix showed that design three, Connor's design, met most of the criteria and so both of the final designs were based off of this. Model two used slightly less power while giving the same results so it was chosen for the final AEV design. The team's final design included a base piece with parts pointing in, an arm coming straight up from that with two wheel attached with the battery on one side of the arm and the arduino on the other. It was determined from the various labs that a design with a lighter weight and running on 35 percent power would be most ideal and so this was incorporated into the final design. The team also learned that in order to overcome friction the AEV should run at a minimum of 25 percent power and that the 3030 propellor blades yielded the highest power and therefore should be used in the design. Various codes were tested using these conditions and the 3030 blades and the team is very close to completing the original mission goal.

In order to complete the assigned task the team needs to continue testing and tweaking the code in order for the AEV to run to perfection. The team will solidify the coded and run many more tests to account for any situation that may arise. The remaining labs will give the team time to run these tests.

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Introduction

The purpose of the Advanced Energy Vehicle project was to create the most cost and energy efficient vehicle for the rebel alliance to transfer R2-D2 units across the land to interceptor aircrafts of a remote planet where energy is scarce. The goal of the project was to design an Advanced Energy Vehicle (AEV) to complete the task of traveling on a track, stopping between two sensors for 7 seconds, continuing down the track, stopping to pick up an R2-D2 unit, waiting 5 seconds with the cargo attached, then to travel back to the gate, waiting for the arm to lift, and finally make it to the drop off area with the cargo intact. The Performance Design Test (PDR) is written to figure out the best model to use for the final test of the AEV. The various labs performed in class have allowed the group to test two vehicles and identify which model to use based off of the data collected from the tests and all previous labs. Aspects from the entire project have lead up to the PDR and are now being used to create a final project design.

The project began with the team building a simple AEV design. The AEV was crafted from a set of given materials, and the team had the option to make a custom laser cut part. Next, the team performed different tests in order to improve the energy efficiency and effectiveness of the design. Sensors were added in order to be able to use the command goToAbsolutePosition(d) and goToRelativePosition(d). These sensors could also be used for knowing when to change the AEV speed and reverse the wheel direction. The sensors were connected to the support arm. During one of the labs, a wind tunnel was used to collect information about RPMs and thrust. Using the wind tunnel data and data collected from the sensors, propulsion efficiency and the advanced ratio were calculated. By graphing these two sets of data it could be seen that the AEV is most efficient at 30 percent power. The next step in the creation of the AEV was to rethink the design. The members of the group all created their own designs and produced a concept sketch. These designs were then analyzed using concept screening and scoring. Within these tests, balance, weight, cost, aerodynamics, durability, flexibility, and style were all scored. The results then lead to the final two designs for the AEV which were then tested. Before continuing with the final designs, the sensors on the wheels were tested for accuracy. The data collected was used to calculate propeller force and friction force for the vehicle and using this information, the final design was picked. This report presents what Group L has completed up to Lab 9B of the AEV project.

Experimental Methodology

Two final designs for the AEV were tested on the track for the Performance Test 1. Group L created two designs seen in Figure 1 and 2 (Appendix). The designs both include one medium rectangle of plastic, T shape support arm, 16 pan slot screws, 16 machine screw nuts, four 90 degree brackets, an arduino, two hex bolts, two rotation sensor boards, a modified tee, two aluminum motor mount clips, two AEV motors, two 3 inch props, battery pack, a narrow battery pack clamp plate, pulley assembly, and a pulley assembly with reflective tape. The same code was written and used for both of the AEVs in order to test them and see which one should be chosen as the final design. The AEVs were put at the start of the track and ran using the same set of code. Data was collected from uploading information collected by the sensors. The sensors on the wheel obtain the data which is then uploaded into a matlab file to be calculated and made into graphs, showing power versus distance and power versus time, and data on excel spreadsheets. The data is obtained by connecting a USB cord to the corresponding part of the AEV and then opening up MATLAB and running an already created program. Using the collected data, the group was able to analyze the efficiency of the two designs. This information then lead to the decision to use design two for the second performance test. An image of this design can be seen below.

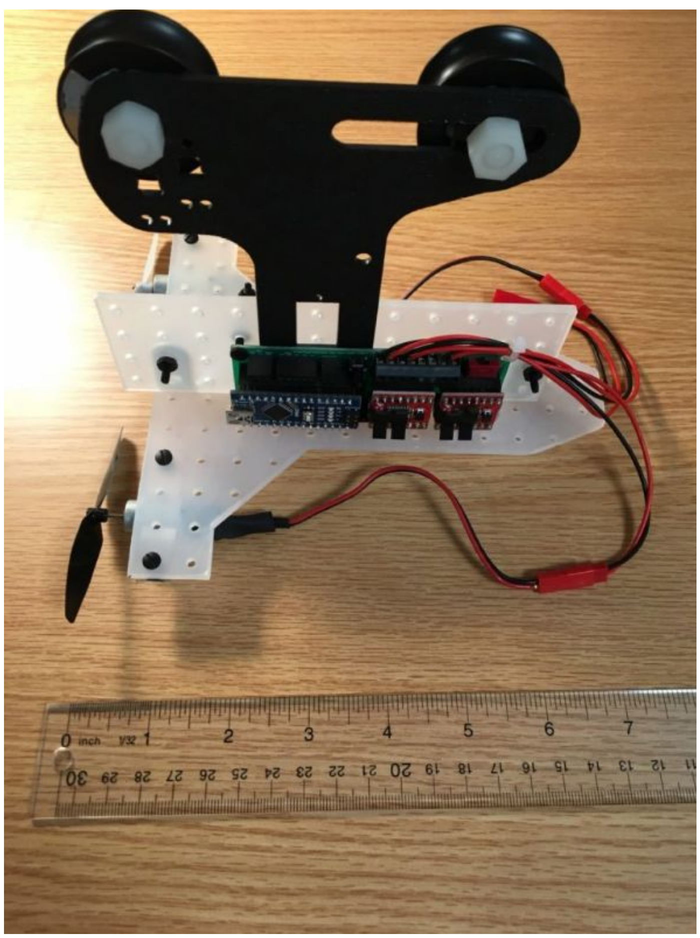


Figure 1: AEV Design Two Setup

Results

The two prototype designs that were tested during Performance Test 1 were both based on the same base model. The model was an evolution on a design created in Lab 4 with improvements to both the weight and the balance. In both of the designs the T-arm was used to attach the wheels to the body of the AEV. A medium sized rectangular piece was then attached to the arm so that its large sides were parallel to the flat part of the arm. A modified version of the T block was then attached perpendicular to the rectangle. The motors were attached to the bottom side of both sides of the top of the T block. The arduino also bolted to the side of the rectangular piece. The difference in the two designs comes from the location of the battery. In the first design, see Appendix Figure 5, the battery was placed in between the holder plate and the modified T block on the bottom of the AEV on the side opposite of the Arduino. In the other design, see Appendix Figure 2, the battery was bolted to the rectangular piece on the opposite side of the Arduino.

One important decision that the group decided on was which propeller to use. In the System Analysis 1 Lab, the group tested several propeller shapes and decided that the 3030 propeller was the most efficient and would be best suited for the AEV. A graph of the propulsion efficiency vs advance ratio is shown in Figure 2, below.

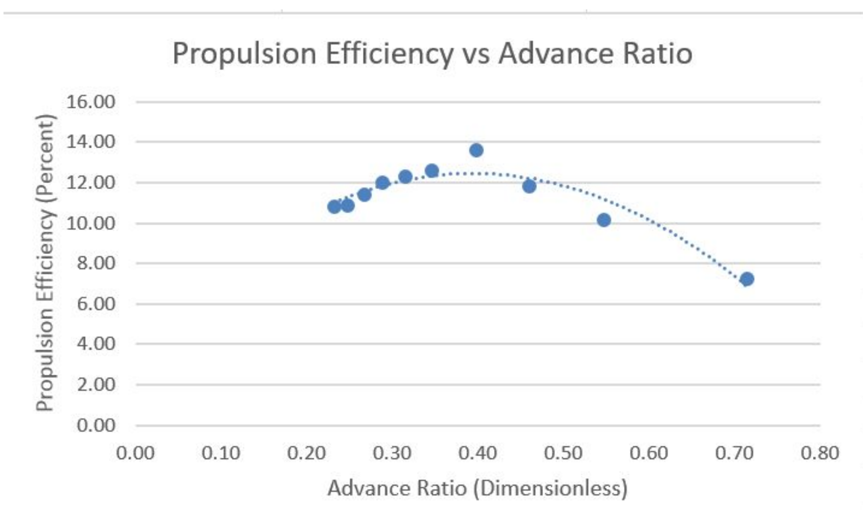


Figure 2: 3030 Propeller Propulsion Efficiency vs. Advance Ratio

From this graph there was one major takeaway: the most efficient motor speed to run the AEV at. Observing the graph puts the fourth data point at the maximum of the graph. This data point corresponds to the motor speed of 35% power. This is critical information for future programming of the AEV in order to minimize the energy consumption during the run on the track meaning that the program on the track should run at or as close to 35% power when possible in order to achieve the most efficient vehicle.

Table 1: AEV Concept Screening Matrix

	Reference	Design 1	Design 2	Design 3	Design 4
Criteria	Score	Score	Score	Score	Score
Balance	0	-	-	+	0
Weight	0	-	-	+	-
Cost	0	0	0	+	+
Aerodynamics	0	+	0	-	+
Durability	0	+	+	+	+
Flexibility	0	+	0	0	-
Style	0	+	+	0	+
Total +	0	4	2	4	4
Total 0	7	1	3	2	1
Total -	0	2	2	1	2
Net Score	0	2	0	3	2
Continue?		Yes	No	Yes	Combine

The concept screening matrix, shown above in Table 1, was used to help decide which concept designs from Lab 3 would be the most useful to continue to develop. As compared to the reference AEV design, Design 3, the one the prototypes were created from, showed the best combination on positive aspects to negative ones.

Table 2: AEV Concept Scoring Matrix

		Reference		Design 1		Design 2		Design 3		Design 4	
Criteria	Weight	Score	Weighted Score	score	Weighted Score	Score	Weighted Score	Score	Weighted Score	Score	Weighted Score
Balance	0.2	3	0.6	2	0.4	3	0.6	5	1	4	0.8
weight	0.2	3	0.6	3	0.6	1	0.2	4	0.8	4	0.8
Cost	0.1	2	0.2	3	0.3	3	0.3	4	0.4	3	0.3
Aerodynamics	0.15	3	0.45	4	0.6	2	0.3	3	0.45	3	0.45
Durability	0.15	2	0.3	3	0.45	4	0.6	3	0.45	3	0.45
Flexibility	0.15	3	0.45	3	0.45	2	0.3	4	0.6	2	0.3
Style	0.05	1	0.05	5	0.25	5	0.25	5	0.25	5	0.25
Total Score			2.65		3.05		2.55		3.95		3.35
Continue			No		No		No		Develop		No

In the concept scoring matrix, shown above in Table 2, Design 3 was again ranked higher than any other design based upon a weighted list of criteria. The only criteria where Design 3 was scored lower than another design was on durability, a characteristic which was improved upon after Lab 4.

While the two designs can be compared theoretically, the real, tangible differences could be clearly seen when the two designs were run on the track. Both designs the group was considering were tested on the track using the same code as a control. The code tested as a control was what the group developed for accomplishing the first part of the objective, from the starting point to the gate. One noticeable difference was that the second design, with the battery placed on the same piece as the arduino, coasted further than the first design. As seen in Figure 3, below, the second design was able to reach the number of marks in a lesser time. This decrease in time results in two important results. The first is that the AEV was able to travel an identical distance in a lesser time, meaning that the acceleration was greater than the other model. This leads to the inference that the net force on the AEV must be greater and that the frictional force must be lesser than the other model. The second result is that the energy consumed by the second design is less than that of the first because the area under the curve in Figure 3 is lesser. However, the difference between the two is not very significant but it still is an improvement. This slight difference in energy was expected by the group because of the only significant factor changed was the center of mass of the AEV.

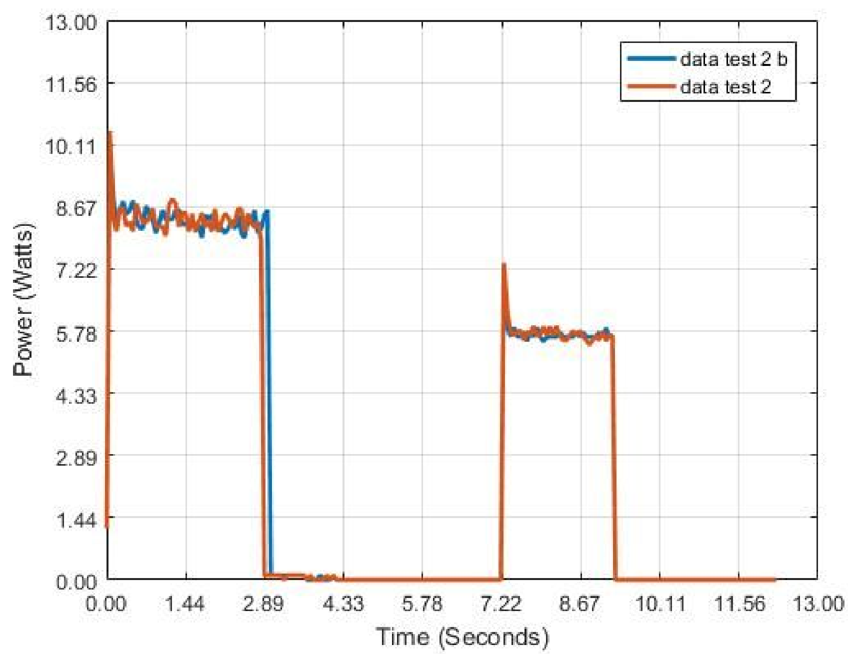


Figure 3: AEV Power vs Time

Reiterating what is displayed in the graph in a quantitative way, Table 3, below, shows the breakdown of energy consumed by the AEV by each phase of the test run's code. Phase 1 is the first plateau shape shown in Figure 4. It is where the largest portion of energy was consumed also where the AEV traveled the furthest. Here, the first design consumed over one more joule of energy than the second design. In Phase 2, the AEV's motor was not running and the vehicle was just coasting, which is why the energy consumption is so low. In this phase, model one actually consumed less energy than the second model. The motors were reversed for Phase 3 and powered as to stop the AEV before the gate. This phase consumed the second most amount of energy with the difference between the designs being miniscule. Lastly, as the AEV stopped in front of the gate, the motors were off and the energy consumption was 0 for both designs. Overall, the total energy consumed by the first design was only about 0.8 more than that of the second design.

Table 3: AEV Energy Phase Breakdown

Phase	Code	Energy Supplied	
		Model 1	Model 2
1	motorSpeed(4,30); goToAbsolutePosition(-200);	40.5943	39.66469
2	motorSpeed(4,0); goToAbsolutePosition(-370);	0.21355	0.4646
3	motorSpeed(4,25); goFor(1);	5.66437	5.70315
4	brake(4);	0	0
	Total:	46.47222	45.83244

This information is perhaps the most useful to the group in future testing runs because the different methods of programming the AEV can be compared by their energy consumption. This information is also useful because the shapes of each command's energy curve can be seen and the most efficient commands can be used. From there, the most efficient commands can be blended together with the most reliable and consistent commands in order to achieve the best code sequence to accomplish the AEV's mission.

Discussion

The purpose of this project was to create an advanced energy vehicle that, when programmed with a specific code, could complete a given task on a track as efficiently as possible. The first objective for the team was to become familiar with each part of the AEV and their functions. This allowed the team to come up with different and unique models for the AEV that could be tested. The second objective for this project was to observe how different function calls affected the performance of the AEV. Knowing what each specific function call does made it much easier for the team to modify the AEV's run without having to redo the entire code, increasing the efficiency of the team by reducing wasted time. After the team had a good grasp of how the AEV performed when given a task, it was time to test its efficiency.

Wind tunnel testing was used to determine which type of propeller, the 3030 or the 4545, would be most effective at pulling or pushing the AEV on the track. Through extensive testing using various voltage inputs, it was determined that the 3030 propellers would be the most efficient, producing much more pushing and pulling power than the 4545 propellers. This result was expected because the 3030 propellers had a greater surface area than the 4545 propellers, allowing for more movement when wind energy was applied. The 3030 propellers design also allowed it to be efficient when pushing and pulling the AEV. After determining which propeller was the most efficient, Figure 2 was made to determine the amount of power needed to make the AEV run while simultaneously wasting the least amount of energy. It was found that the propulsion efficiency peaked at an input power of about 35%. This means that if you apply more or less than 35% power to the motors, the efficiency of the vehicle will decrease. This value makes sense because it is greater than the minimum value to get the AEV to move, but not so high that it will fly off the track.

Next, the team was tasked with creating four original designs for the AEV, comparing them to a reference AEV using +, -, and 0's to represent whether or not the design would perform better, worse, or as well as the reference AEV for that specific criteria. As shown in Table 1 above, design 3 had the most + marks, meaning overall it, theoretically, would perform better than the other designs. Each criteria was then given a weight based on how important it was to the overall performance of the AEV and each design was given a score out of five for each criteria, shown in Table 2. Balance and weight were the highest weighted criteria while cost was the least weighted criteria. This is because the cost of the AEV doesn't really affect how the AEV runs. On the other hand, the balance and weight of the AEV are very important factors. If the AEV is unbalanced, it could potentially fall off the track. If the AEV weighs too much, then it won't be efficient. The weighted values were multiplied by the score each design was given and the totals for each design were compared. Theoretically, the higher the value the better the design would perform when compared to the others. After an AEV design was chosen, the team was finally able to write the code.

The team had to write a code that would have their AEV travel from one side of the track to the first sensor before the gate without tripping the seconds sensor. The AEV then had to wait at that gate for 7 seconds until the gate went down before proceeding forward to the other side of the track, picking up the cargo. Next, the vehicle had to wait again for 5 seconds until the cargo could be "loaded" and returned back to the first sensor right before the gate without tripping the second sensor. The vehicle then stopped for another few seconds for the gate to go down then travelled back to its original position. While the team was preparing this code, a slight modification to the AEV's design was implemented. The battery that was previously placed on the bottom of the AEV was now placed on the top, opposite of the arduino. Although this was a minor change, it appeared to improve the stability and the overall look of the AEV. Both designs were tested using the new code to see how the change affected the performance of the AEV. Although the change in performance was quite minimal, in Figure 3 it was shown to have a slight improvement over the old design.

One challenge that arose while testing the code occurred due to the misplacement of the count sensor. The count sensor was not properly placed onto the T-shape arm. Because of this, the count sensor wouldn't count the marks the AEV had travelled, making the motor continue to run after reaching its mark. This was easily fixed zip tying the sensor flat on the T-shape are directly under the wheel. Another potential source for error that could have affected the data collected during the AEV's run could be due to the uneven track. Since the track is made up of several metal rods joined together, they form a slight bump at these joined portions. This error could have resulted in a slight difference in the count sensor value, but not enough to greatly affect the distance travelled by the AEV.

Conclusions and Recommendations

The AEV project has taught the team how to design, build, and test a vehicle that runs on a monorail and completes the assigned task. Each week, the team performed a different lab that contributed towards the final design and coding of the AEV. It was determined as seen in Figure 3 that that a lightweight design that runs at around 35 percent power would be optimal. The team built the AEV based off of design three (as seen in Table 2) because this design had the highest score in the concept scoring and screening matrix. The team built the AEV using the 3030 propellers because they allowed for the greatest movement (Figure 3) and Table 3 showed which coding commands produced the best runs for the AEV. The team kept all of these factors in mind and used them to build the final AEV design as seen in Figure 5 found in the appendix. The final design was chosen because it incorporated all of the criteria listed above and ran smoothly because the battery balanced out the arduino.

Although most everything has gone very smoothly for the team so far, there have been a couple errors that needed to be resolved. The team has class in two different rooms and although the tracks have the same dimensions, different AEV data results were obtained for each track. In order to resolve this error, the team worked to develop two different sets of code so the AEV would run smoothly on either track. Additionally, the AEV does not always run consistently. Sometimes the AEV will work perfectly fine upon one run and then stop too far after the sensor for the next run. The team is working to resolve these issues by controlling all outside factors such as placement of the AEV at the beginning of the run.

The original mission was to design an efficient AEV to transport the R2D2 units across the monorail system to help rebuild the arm and prepare for a possible war. The team is very close to having this mission completed. A few tweaks still need to be made in the code so the AEV does not crash into the base loading station at the end. Additionally, the team needs to ensure that the code will run consistently with each trial. The team will continue changing the amount of tics and the power level at which the AEV runs in order to create the perfect code. The next few weeks of testing will give the team time to make these adjustments in order to successfully complete the mission.

The team has done a great job at completing all the assigned tasks on time. There have been no labs or tasks that the team was unable to finish. The team hopes to complete the project well before the assigned due date to allow extra time to test and perfect the AEV code. In the appendix Figure 5, one of the wheels does not appear on the AEV drawing. The wheel was on the original Solidworks model however it would not copy onto this document. This error was unable to be resolved even when trying to copy the file from various computers.

References

1. “The Ohio State University Advance Energy Vehicle Design Project” Lab Manual (2016, December 12) Retrieved from https://app.box.com/embed/preview/2gaj9nkdkxyhjwcntvh9ga9elwwzuurn?theme=dark&show_item_feed_actions=yes&show_parent_path=yes

Appendix

Table 4: Team Schedule

Performance Test 1	No.	Task	Start	Finish	Due Date	Kristin	Connor	Amanda	Alador	% Complete
	1	Design two different AEV models	3/10/2017	3/21/2017	3/22/2017	X	X	X	X	100
	2	Develop a code to test the two models	3/10/2017	3/20/2017	3/22/2017	X	X	X	X	100
	3	Test the two AEV models and collect data	3/10/2017	3/20/2017	3/22/2017	X	X	X	X	100
	4	Create SolidWorks models of the two designs	3/25/2017	3/26/2017	3/27/2017		X			100
	5	Analyze data and determine which AEV model is better	3/10/2017	3/20/2017	3/22/2017	X	X	X	X	100
Performance Test 2	**No.**	**Task**	**Start**	**Finish**	**Due Date**	**Kristin**	**Connor**	**Amanda**	**Alador**	**% Complete**
	1	Develop two AEV Codes to complete task	3/24/2017	3/27/2017	3/29/2017	X	X	X	X	30
	2	Tweak and edit the codes to run to perfection	3/24/2017	3/27/2017	3/29/2017	X	X	X	X	0
	3	Test the codes with the AEV	3/24/2017	3/27/2017	3/29/2017	X	X	X	X	0
	4	Collect and analze data from each code	3/24/2017	3/29/2017	3/29/2017	X	X	X	X	0
Performance Test 3	**No.**	**Task**	**Start**	**Finish**	**Due Date**	**Kristin**	**Connor**	**Amanda**	**Alador**	**% Complete**
	1	Test AEV with chosen model and code	4/3/2017	4/3/2017	4/10/2017	X	X	X	X	0
	2	Test AEV with lights off	4/3/2017	4/3/2017	4/10/2017	X	X	X	X	0
	3	Test AEV with fan on	4/3/2017	4/5/2017	4/10/2017	X	X	X	X	0
	4	Collect and analyze data from each run	4/3/2017	4/5/2017	4/10/2017	X		X		0
	5	Determine obstacles and plan to overcome them	4/2/2017	4/5/2017	4/10/2017	X	X	X	X	0
Performance Test 4	**No.**	**Task**	**Start**	**Finish**	**Due Date**	**Kristin**	**Connor**	**Amanda**	**Alador**	**% Complete**
	1	Read over code and check for errors	4/10/2017	4/10/2017	4/14/2017	X	X	X	X	0
	2	Find the mass of the AEV	4/10/2017	4/10/2017	4/14/2017	X	X	X	X	0
	3	Run the AEV and record time it takes to complete task	4/10/2017	4/10/2017	4/14/2017	X	X	X	X	0
	4	Analyze results and information	4/10/2017	4/10/2017	4/14/2017	X	X	X	X	0
	5	Possibly run the AEV a second time	4/10/2017	4/10/2017	4/14/2017	X	X	X	X	0
	6	Analyze results and fill out information sheet	4/10/2017	4/10/2017	4/14/2017	X	X	X	X	0

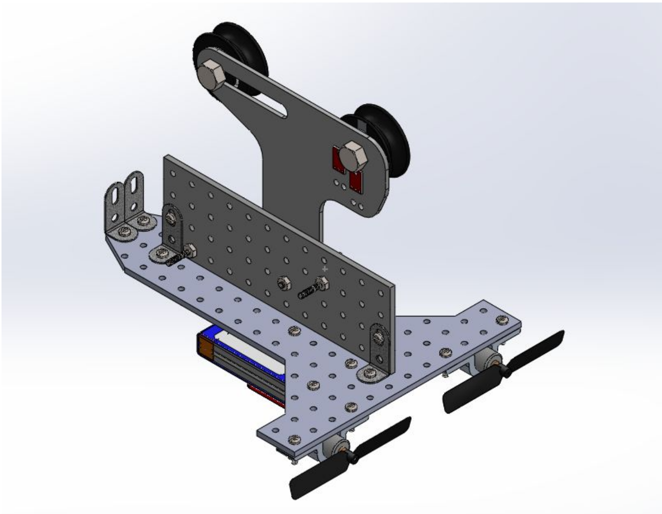


Figure 4: AEV Design 1 Isometric View

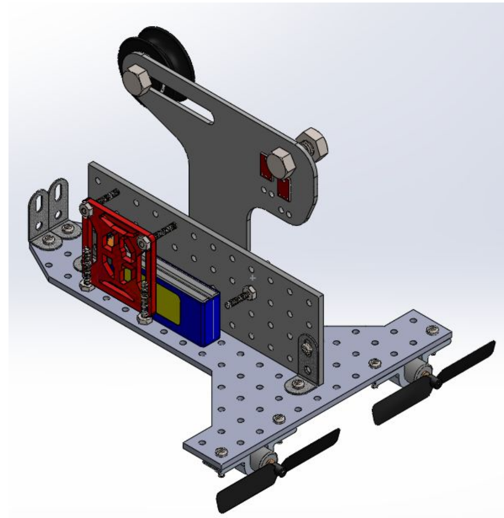


Figure 5: AEV Design 2 Isometric View

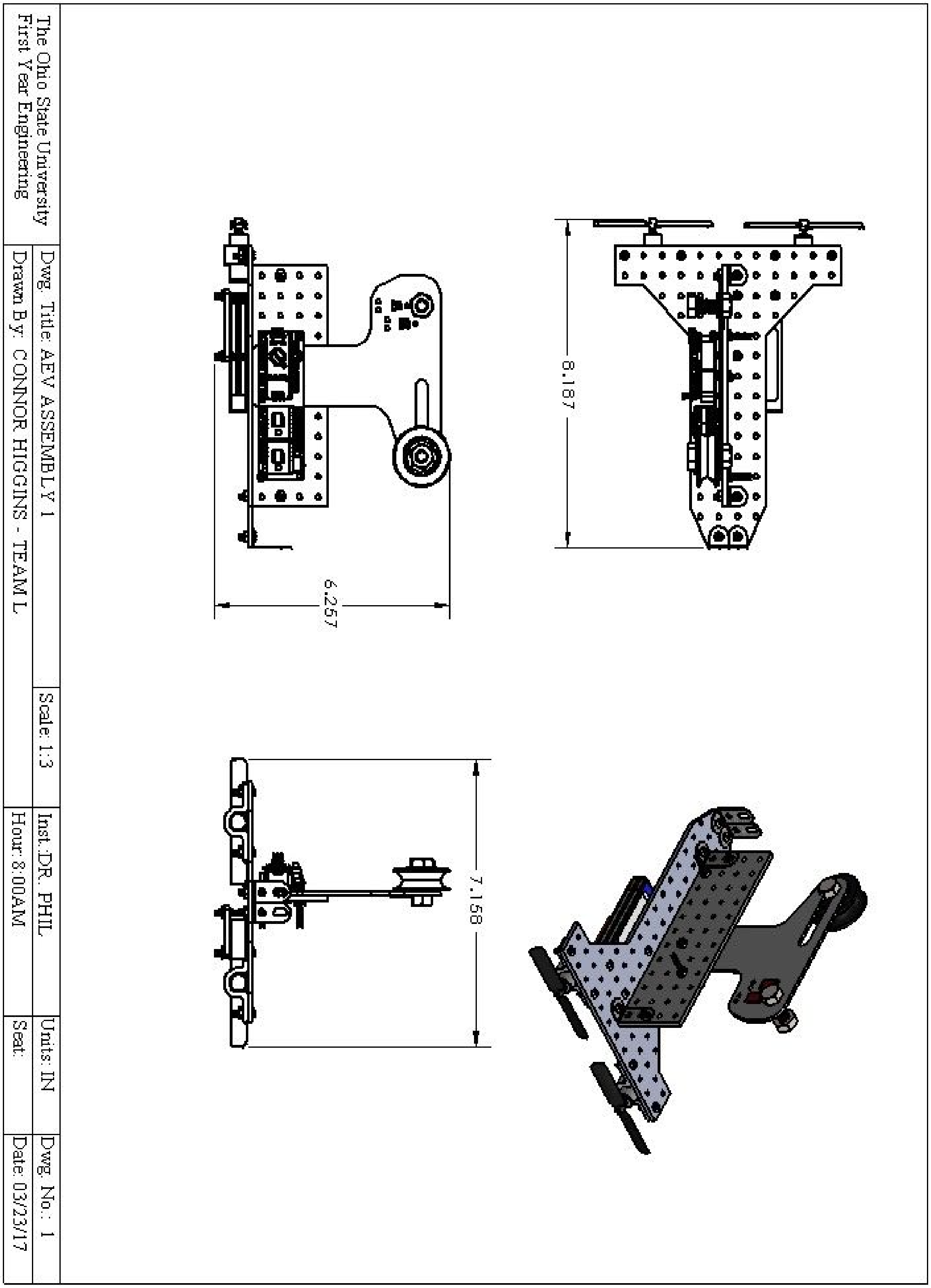
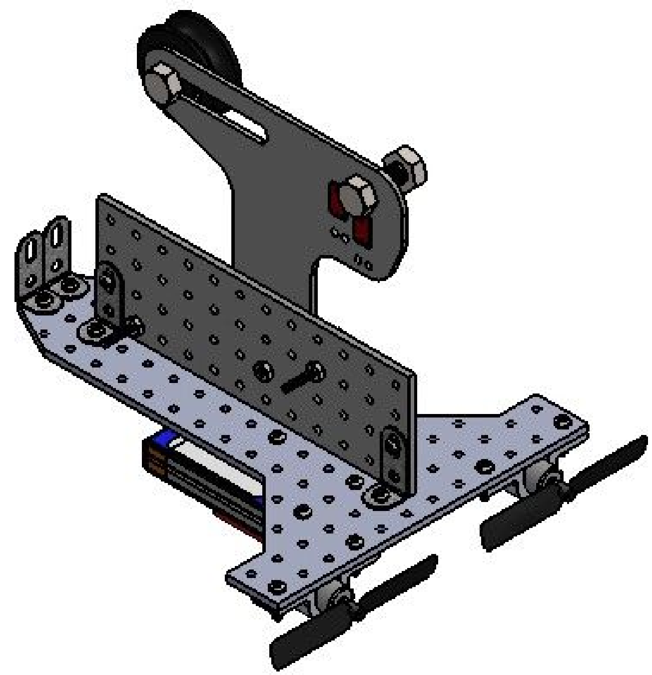


Figure _ : AEV Model 1 Page 1



ITEM NO.	PART NUMBER	QTY.
1	Medium Rectangle	1
2	Support Arm 1 2 Sensor Holes V2	1
3	pan slot head_ai	7
4	pan slot head_ai	5
5	pan slot head_ai	4
6	machine screw nut hex_ai	16
7	machine screw nut hex_ai	2
8	90-deg bracket	4
9	AEV Arduino Assembly	1
10	hex bolt_ai	2
11	Rotation Sensor Board	2
12	Modified Tee	1
13	Motor Mount Clip Aluminum	2
14	AEV Motor	2
15	Prop 3inch	2
16	Battery Pack	1
17	Battery Pack Clamp Plate Narrow	1
18	Pulley Assembly	1
19	Pulley Assembly w-reflective tape	1

ESTIMATED WEIGHT	260g
ESTIMATED COST	$159.30

The Ohio State University First Year Engineering	Dwg. Title: AEV ASSEMBLY 1	Scale: 1:2	Inst.:DR. PHIL	Units: IN	Dwg. No.: 2
	Drawn By: CONNOR HIGGINS - TEAM L		Hour:8:00AM	Seat:	Date: 03/23/17

Figure _: AEV Model 1 Page 2

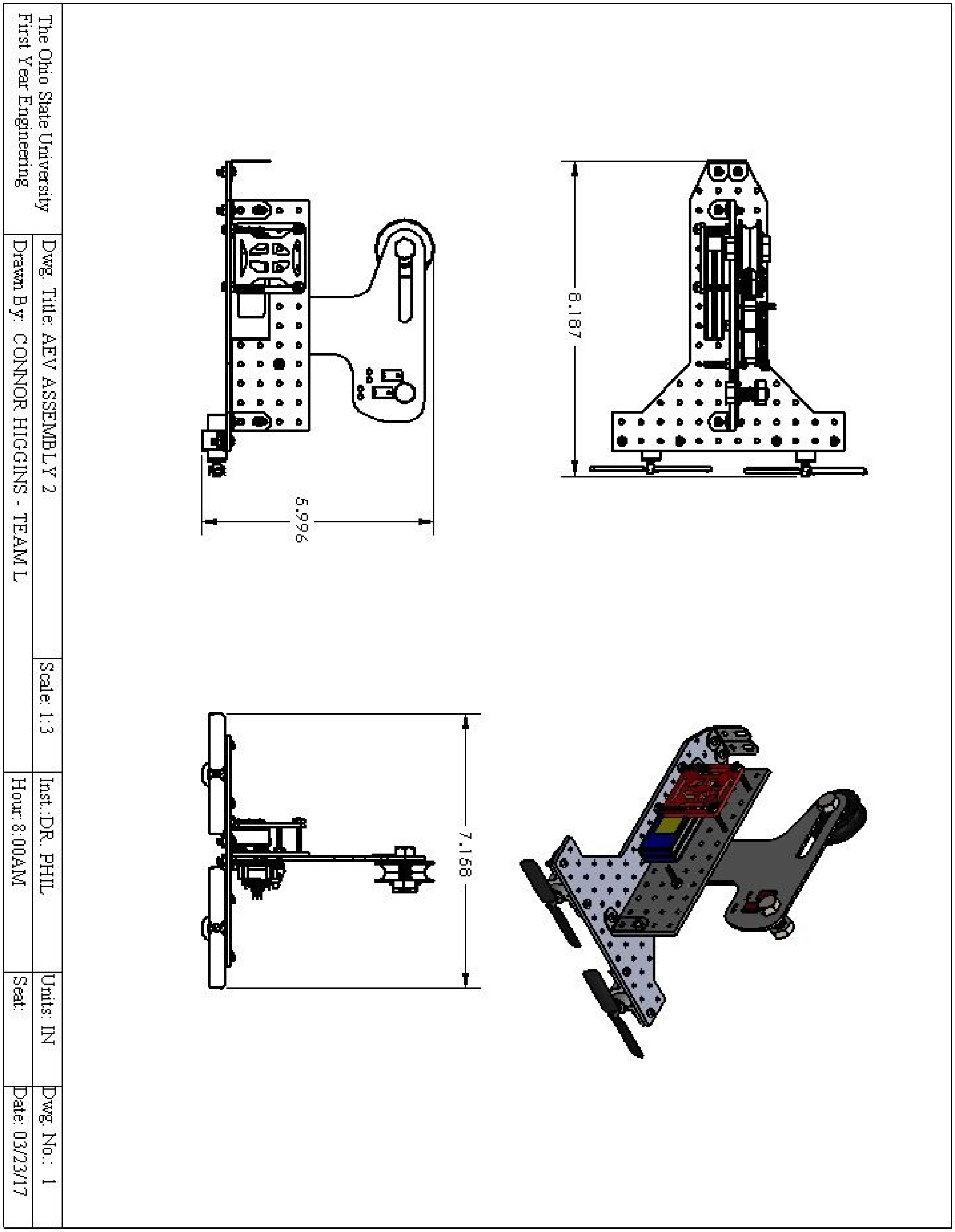
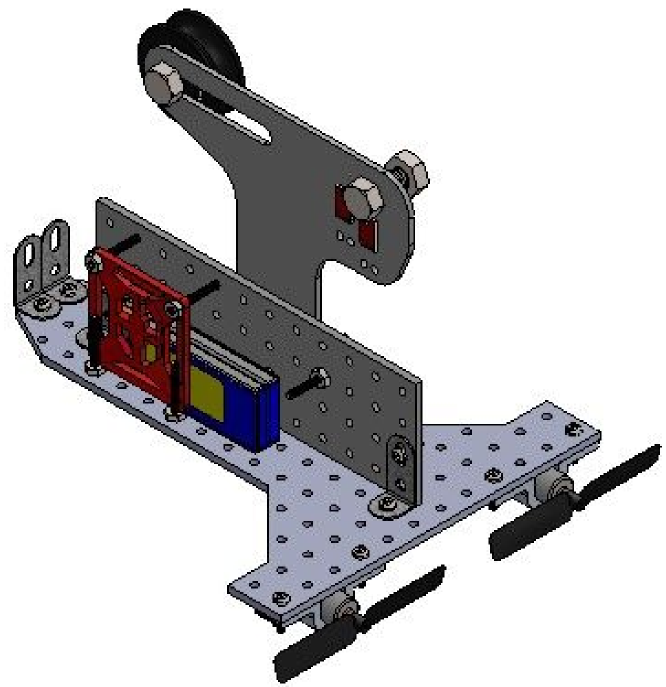


Figure _: AEV Model 2 Page 1



ITEM NO.	PART NUMBER	QTY.
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3	pan slot head_ai	7
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5	pan slot head_ai	4
6	machine screw nut hex_ai	17
7	machine screw nut hex_ai	2
8	90-deg bracket	4
9	AEV Arduino Assembly	1
10	hex bolt_ai	2
11	Rotation Sensor Board	2
12	Modified Tee	1
13	Motor Mount Clip Aluminum	2
14	AEV Motor	2
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16	Pulley Assembly	1
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	Drawn By: CONNOR HIGGINS - TEAM L		Hour: 8:00AM	Seat:	Date: 03/23/17

Figure _: AEV Model 2 Page 2

PDR Presentation Worksheet
Group L - Kristin Crowell, Connor Higgins, Amanda Killian, Alador Sisay
Instructor - Dr. Schlosser, GTA - Clayton Greenbaum 3/27/17

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1. How will you introduce yourselves and the topic? Why are we here today? i.e. grab audience attention, statistics, thought provoking question, brief story, etc.

The team will introduce themselves as "Team L" and each person will state their name. The beginning of the presentation will contain a hook where the attention of the audience is grabbed through facts and statistics from the AEV. The team will also provide the audience with a short story of how the team came together to build, test, and design the AEV.

2. How much, and what, background will you give to the project? (think: who is your audience)

The team will give a brief description of the given 'Star Wars' scenario to the audience and then briefly explain how the AEV was developed through the different labs. It will also be explained how the design for the AEV was created and how the AEV was designed to be the most efficient as possible.

3. What are the key topics your group has learned/discovered thus far? Don't just list the labs; what directly has impacted your thought process?

The AEV project has taught the team many things. First of all, the team has learned how to efficiently use time in lab to complete all the required components. The team has also learned how to react if something does not go exactly as planned. There have been a few scenarios where a part has failed, code has not worked, and the AEV does not run as planned. The team finds solutions to these problems and then goes above and beyond to make the AEV as best as possible. Finally, the team has learned how to explain what was performed in lab through technical writing pieces such as progress reports and executive summaries.

4. Identify the key goal(s) for the AEV project on which your group will focus (i.e.consistency, low weight, cost, energy, etc) and why:

Although many factors affect how efficiently the AEV will run, the team has decided to focus on using a minimal amount of power and having a smaller weight. This will cause there to be less friction allowing for optimal efficiency.

5. What is your plan (Project Management) going forward? (goals, timeline, responsibilities, etc) Is there a concise way to show this to your audience? What level of details are needed in this short presentation?

Every week, a team schedule is created. All of these tables will need to be put together and organized in order to make for a nice presentation when telling others about the project. This presentation should include details such as when and what was discussed in meetings, what tasks were completed each week, who completed what parts, and the goals the team had each week.

6. How will you divide the time of your presentation, both in speakers and topic? Does the time match-up with value/importance? A brief storyboard is very helpful with this.

Presentation material will be divided up evenly between all team members. Team members will discuss the parts that they wrote about in the progress reports. Amanda will discuss the situations from each week as well as what was accomplished in the weekly meetings. Connor will discuss the major results from each week. Alador will talk about how the team prepared for lab each week, and Kristin will discuss how the team planned their schedule for each week. All team members will work together to create a storyboard and will preplan thoughts to discuss in the presentation.

7. Define professionalism for your group. (think: how will you dress? How does the presentation format look? How will you carry yourselves and speak?)

Team L will present their AEV project in a professional manner. All team members will wear business dress (in Buckeye colors) and the presentation will be formal and well thought out. Team members will specific parts to share that have been well thought out and preplanned. The team will get together beforehand and practice the presentation so everything will run smoothly.